

# *The State of the Ark:*

*A Review of Conditions  
at the Granby Zoo, 2001*

*by*

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## Executive Summary

In 2001, Quebec's Granby Zoo announced its intention to pursue \$47 million in provincial and federal funding for a major redevelopment initiative, including the construction of a \$12 million dolphin display facility. While the dolphinarium idea has been shelved indefinitely, the zoo is still pursuing funds for other work. This paper has been prepared in response to the Granby Zoo's redevelopment plans. It examines current conditions at the Granby Zoo and provides recommendations for improvement of their existing live animal exhibits. It also provides suggestions regarding the future direction of the zoo's live animal component.

The Granby Zoo, located approximately 40 minutes from the City of Montreal, is a traditional zoo that was established in 1953. Some of its featured animal exhibits are the AFRIKA pavilion, Reptile pavilion and the Cavern Des Debrouillards. The zoo also features several non-animal attractions, including a popular \$5.5 million water park called AMAZOO containing Quebec's largest wave pool and the Cunucunoma Adventure River ride.

The first impression one gets of the Granby Zoo is that its design and layout is haphazard and does not seem to follow any kind of taxonomic, climatic or zoogeographic organization. In fact, its layout and structure is similar to other older zoos that have added exhibits to their existing facilities as funds became available, resulting in a rather piecemeal kind of presentation and many substandard exhibits.

*The State of the Ark: A Review of Conditions at the Granby Zoo, 2001* focuses primarily on the zoo's animal housing and whether or not it meets an acceptable standard for modern zoos. This determination is based, in part, on the Five Freedoms of Animal Welfare which are listed below.

1. Freedom from thirst, hunger and malnutrition through ready access to fresh water and a diet to maintain full health and vigour.
2. Freedom from thermal and physical discomfort by providing an appropriate environment including shelter and a comfortable resting area.
3. Freedom from pain, injury and disease by prevention or rapid diagnosis and treatment.
4. Freedom to express normal behaviour by providing sufficient space, proper facilities and company of the animal's own kind.
5. Freedom from fear and distress by ensuring conditions and treatment that avoid mental suffering.

Satisfying the biological and behavioural needs of wildlife in captivity is critical to their welfare. If their needs cannot be satisfied, then they should not be kept. Unfortunately, the Granby Zoo fails to satisfy the needs of their animals in a number of instances. There are several reasons for this, including, but not limited to, poor enclosure design, lack of space, inappropriate substrates, unnatural environmental conditions, lack of privacy opportunities and lack of environmental enrichment. These deficiencies are, more or less, systemic problems that can be observed throughout the Granby Zoo.

This paper closes by providing several recommendations (both short and long-term) for future development of the Granby Zoo, and in particular, the live animal exhibit area. They are:

1. Develop a long-term institutional plan (including a site organizational plan) that provides a clear direction for change.
2. Place a moratorium on the development of new, animal-based, "flagship" attractions until existing animal housing problems have been resolved.
3. Develop and implement a program of enclosure upgrading based on the Five Freedoms of animal welfare.
4. Develop and implement an institutional environmental enrichment plan, incorporating both short and long-term goals, that is entirely integrated into the daily husbandry regime of all animals. The plan should be developed, implemented and evaluated by a committee of staff and should receive the appropriate level of material and financial support.

5. Develop and implement a formal exhibit-based educational program, including comprehensive, standardized graphics, for casual zoo visitors.
6. Furnish all exhibits containing primarily or exclusively hard substrate surfaces with soft substrate areas.
7. Rototill sections of all hardpan substrate surfaces to make them softer and landscape the ground surface in outdoor ungulate paddocks to make them more variable and interesting.
8. Equip all exhibits with shade and shelter structures and, where appropriate, “soft” rest areas.
9. Equip all exhibits with multiple privacy opportunities for all animals.
10. Immediately equip all exhibits with “basic” species-appropriate furnishings.
11. Relocate to more appropriate accommodation elsewhere all subtropical and tropical animal species (e.g., hippopotamus, white rhino) that require large outdoor paddocks.

## Introduction

This paper contains commentary on conditions at the Granby Zoo and recommendations for the future development of the facility. It is not meant to be a comprehensive review of animal care and accommodation, but instead, should be considered a “snapshot” image of conditions at the time of the inspection that illustrate problems that are more or less systemic throughout the facility. It should be noted that the Granby Zoo’s Reptile Pavilion was not included in this review.

I have based this paper primarily on observations made during a July 25, 2001 inspection of the Granby Zoo. Photographs and videotape of the conditions I observed were collected at that time. Additional information was obtained during two previous visits to the zoo in 1996 and 2000, as well as from media clippings, zoo literature and the zoo’s own website.

Comments about appropriate standards of captive wild animal husbandry and housing that are contained in this paper are based, in part, on a review of existing standards and guidelines for the keeping of wildlife in captivity that have been developed by, or are practiced by, zoo associations, individual zoological institutions and animal welfare organizations. Some of the standards that were reviewed while preparing this paper are general in nature, while others are more specific detailing individual species’ needs.

Information was also obtained from a variety of publications, attendance at conferences and workshops, as well as the author’s own experiences during the last 18 years reviewing and evaluating zoos throughout Canada.

## The Granby Zoo

The Granby Zoo, located at 525, rue St-Hubert, Granby, Quebec, approximately 40 minutes from the City of Montreal, is an accredited member of the Canadian Association of Zoos and Aquariums (CAZA). Reportedly 80% of Granby Zoo’s visitors originate from the Greater Montreal area.

The Granby Zoo is a traditional zoo, established in 1953, featuring more than 1,000 individual animals, representing approximately 225 species, in varied accommodation on a portion of its 40 hectare site. Some of the featured animal exhibits include the AFRIKA pavilion, Reptile pavilion, Feline pavilion, the Cavern and the Petting Zoo. An elevated train ride winds through a part of the zoo above a number of the animal exhibits.

The Granby Zoo also features several non-animal attractions, including a popular \$5.5 million, 10 ha water park called AMAZOO that features Quebec’s largest wave pool, the Cunucunoma Adventure River ride where visitors ride inflated tubes, engage in water games and utilize a large wading area.

The first impression one gets of the Granby Zoo is that its design and layout is haphazard and does not seem to follow any kind of taxonomic, climatic or zoogeographic organization. Visitors can walk from antiquated animal cages to uninspired, new landscape immersion exhibits to theme park attractions. Except in a few isolated instances, buildings and other structures have not been harmoniously integrated into the surrounding landscape. The Granby Zoo’s layout and physical structuring is similar to other older zoos that have added exhibits to their existing facilities as funds became available, resulting in a rather piecemeal kind of presentation.

The Granby Zoo is no stranger to controversy. Approximately 20 years ago a book by former Granby Zoo veterinarian Louise Beaudin criticized many aspects of the facility. In 1984, a *Sherbrooke Record* article entitled *Granby Zoo ready to sidestep wildlife treaties?* questioned the zoo’s placing of an order with a Cameroonian hunter for two young gorillas when it was well known that parents would have to be killed to obtain them. In 1987, the zoo again found itself in hot water when employees alerted SPCA investigator Louis McCann about possible elephant abuse. The *Montreal Gazette* reported that “Toutoune, an 8-year-old Indian elephant ... is on the mend from bruises inflicted when an untrained keeper tried to show her who was boss.” McCann said the incident “reflects the general lack of training for animal keepers at Granby Zoo.”

The latest controversy erupted in 2000 when the Granby Zoo announced their intention to seek \$47 million in federal and provincial funding for redevelopment of their facility, including \$12 million for the construction of a

dolphinarium. The zoo believed the addition of a dolphin attraction would be a significant revenue generation vehicle that would secure their future over the short to mid term. In late 2001, the zoo announced that they were temporarily shelving the plan for a dolphinarium.

Some critics of the Granby Zoo proposal argued that the facility needed to focus less on bringing in “charismatic” animal species and attractions that result in short term financial gain, and instead, should concentrate more on improving the quality of their existing exhibits and animal care.

## **Evaluating Zoos**

One might expect that an evaluation of a zoological institution would be based on a comparison with an ideal model. However, describing an ideal zoo is problematic because zoos vary quite considerably in format, size, quality and they've even changed their own descriptions, aims, objectives and entire raison d'être over the years.

This evolution has, in part, been a response to public pressure to move away from the menagerie-type zoo format where a multitude of different species are displayed in cages. It may also have been motivated by a desire on the part of some zoo directors and industry members to provide more appropriate accommodation for the animals in their facilities.

Over the years, these changes have resulted in a number of government agencies, zoo organizations and animal welfare groups developing their own guidelines, standards and assessment methodologies. One of the most useful tools for the assessment of zoo animal welfare are the 'Five Freedoms.'

### **The 'Five Freedoms'**

In 1965, the UK-based Bramble Commission reviewed the welfare of farm animals used in intensive agricultural operations. They formulated a set of minimal welfare standards that became known as the 'Five Freedoms.' Over the years these standards were revised by Dr. John Webster and others. The most recent revision by the UK Farm Animal Welfare Council occurred in 1993. They have been heavily referenced in the United Kingdom's Secretary of State's Standards of Modern Zoo Practice.

The 'Five Freedoms' provide a useful construct for the evaluation of animal welfare in a wide variety of situations.

The 'Five Freedoms' are

1. Freedom from thirst, hunger and malnutrition through ready access to fresh water and a diet to maintain full health and vigour.

This is a basic need of all animals in captivity that should involve consideration of the type of food provided, the frequency and method of presentation, as well as its nutritive quality. The provision of both food and water should take into account the animals' species-specific requirements.

2. Freedom from thermal and physical discomfort by providing an appropriate environment including shelter and a comfortable resting area.

Addressing this freedom requires consideration of several factors including, but not limited to, shelter from inclement weather conditions (i.e., rain, snow, wind); the provision of cool, shady areas and warm, sunny areas as needed; the provision of substrates of appropriate type and depth for animals that dig or burrow; the provision of trees, climbing apparatus and other materials that allow utilization of vertical space for animals that climb or fly.

3. Freedom from pain, injury and disease by prevention or rapid diagnosis and treatment.

Factors to consider in addressing this freedom include enclosure design; the provision of suitable furnishings; adequate space and appropriate social groupings to prevent inter-animal conflict, and appropriate sanitation, diet, and veterinary care to prevent or treat injury and disease.

4. Freedom to express normal behaviour by providing sufficient space, proper facilities and company of the animal's own kind.

This fourth 'freedom' is integral to the health and well-being of captive wild animals, as well as for achieving the interpretive goals of zoos, wildlife parks and other facilities. All captive animals must be able to engage in a significant portion of their natural behavioural regimes. They should be given an opportunity for choice and control, thereby allowing them to make a meaningful contribution to the quality of their own lives.

5. Freedom from fear and distress by ensuring conditions and treatment that avoid mental suffering.

This 'freedom' includes not only fear and distress caused by physical injury or intimidation from conspecifics due to overcrowding or abnormal social groupings, but also to threats from outside predators and pests. Frustration and boredom must also be addressed, as well as other kinds of chronic stressors, such as problematic auditory, olfactory and visual stimuli.

The 'Five Freedoms' are a useful assessment framework for inspections of zoos and other captive wildlife facilities.

Regardless of what kind of zoological facility is being assessed or what methodology is being used, it is important that the assessor understand what animal welfare is and that they possess a basic understanding of captive wildlife husbandry principles.

### **Animal Welfare**

Knowledge of the biology and behaviour of wild animals has increased exponentially during the past several decades. In some cases, this has facilitated a change in captive wild animal husbandry and housing practices. The antiquated notion that animals should live their lives according to pre-arranged schedules in sterile, easy-to-clean surroundings is slowly being rejected. In fact, most reputable professionals now recognize that "total institutionalized care" in which animals have no ability to make a meaningful contribution to the quality of their own lives is detrimental to animal well-being. This is particularly important concept to consider when assessing the welfare of wildlife in captivity.

Animal welfare involves more than just the satisfaction of physical needs or the absence of physical injury or disease. While physical functions and overall condition are an important aspect of welfare, an animal's welfare can be poor in the absence of obvious physical problems. For example, if an animal is frightened, bored, frustrated, anxious or subject to chronic stress, it may appear "normal" but not be experiencing a state of wellbeing.

While most zoo industry standards pay only token attention to the psychological needs of animals, these needs are nevertheless an important aspect of zoo animal welfare. In fact, examination of animal behaviour and behavioural responses to stress can be an effective way of determining the appropriateness of various husbandry practices.

In general, animals that are housed in behaviourally impoverished environments show an overall decrease in interaction with their environment. This can be expressed in a variety of ways, such as sitting, lying down or sleeping more; overreaction to novel stimuli; or the development of aberrant behaviours, such as stereotypies (i.e., rocking, pacing, head weaving, tongue playing, etc.).

As the level of stimulation and environmental complexity decreases, most animals display a corresponding decrease in behavioural variability and an increase in behaviours directed at themselves (e.g., hair pulling) or their immediate surroundings (e.g., bar licking). They gradually close themselves off from their environment, rather than interacting with it, in an effort to cope with frustration, boredom and other chronic stressors.

Some animals withdraw to such an extent that they are almost completely unresponsive to outside stimuli – a state often described as “learned helplessness.” Some observers claim learned helplessness is similar to “habituation” but it is different in that it is usually associated with deleterious physiological effects.

In his book *Animal Welfare, A Cool Eye Towards Eden*, John Webster has the following to say about learned helplessness,

*... a loss of responsiveness to stimuli in animals, acquired after long periods in which they have been denied the opportunity to perform constructive behaviours designed to achieve pleasure (e.g. food) or avoid pain (e.g. electric shocks). This is sometimes described as an adaptive response, an interpretation which I find chilling. Learned helplessness defines the state of mind in which an animal has given up. I prefer to call it hopelessness.*

In *Stress and Animal Welfare*, Donald Broom and K.G. Johnson are very clear about the seriousness of behavioural impoverishment, “A profound lack of stimulation is something to which no vertebrate animal is likely to adapt.”

Satisfying the behavioural requirements of wildlife in captivity is essential to their welfare, yet it’s an area that has routinely been overlooked or ignored by many zoos. All captive animals must be given some control over their environment and an opportunity to make choices – in short, they must be allowed to make a meaningful contribution to the quality of their own lives.

### **Stereotypic Behaviour**

Stereotypic behaviour is a term that surfaces frequently when zoo animal welfare is discussed, so it is important to understand what it is. There have been various definitions of stereotypic behaviour, including:

*"Repeated, relatively invariant sequence of movements that has no obvious purpose."* (Broom)

*"The prolonged, obsessive performance of apparently purposeless activity."* (Webster)

*"It is a form of behaviour that occupies the animal for most of its periods of activity without any apparent normal stimulus bringing it into operation."* (Jordan and Ormrod)

The words "ritualized" and "clockwork-like" have been used to describe these behaviours.

The salient points are that the behaviours do not occur in the wild; they are repetitive; and they are apparently functionless. Most stereotypic behaviours occur when animals have failed to cope with or remove themselves from stressful situations.

Stereotyped behaviour should not be confused with displacement behaviour. Displacement behaviour usually occurs when an animal is frustrated in its aims (e.g., to obtain food or to win a confrontation). A displacement behaviour may be unrelated to its original aim (e.g., grooming, scratching or pacing) and its purpose would appear to be an attempt to reduce the feelings of conflict and frustration.

For example, a common displacement behaviour in humans occurs when two people have an argument and one of them goes for a walk, washes their car or engages in some other kind of activity to “cool down” or get their mind on something else. The cause of the activity (the displacement behaviour) was the argument but the activity itself may appear to have no relation to it. This same phenomenon occurs in captive wild animals. A chimpanzee frustrated in its attempt to acquire food may thump a stick on the ground or run rapidly around its enclosure to deal with the frustration.

Occasionally, some zoo owners try to characterize stereotypies in their animals as a positive mechanism for coping with stress. They argue that since endorphins are released in animals who are performing stereotypies, the release of these natural opiates makes the animal "happy" in its activity, as though on some kind of "high." The fact that endorphins are released when the body is under a stressful stimulus such as pain makes this line of thinking highly questionable.

The bottom line is that these behaviours are produced as a result of unsatisfactory environmental conditions and that some degree of mental suffering has occurred along the way and will continue to occur in the future.

### **Enclosures and space**

Enclosures must be designed with the biological and behavioural needs of the animals they are to contain in mind. Some factors that should be considered in the exhibit design phase include location, size, shape, colour, barrier type, enclosure infrastructure, permanent features (e.g., giant rocks, hillocks, berms, large trees), maintenance, and servicing. Each of these factors should be dictated by the species-specific requirements of the animals being displayed.

The physical environment provided to captive animals is directly linked to animal welfare because it is what the animal will interact with on a daily basis. Therefore, all enclosures must be designed to encourage species typical behaviours and movements.

Unfortunately, many zoos still construct relatively barren enclosures for animals that do little to address their needs. Many of them seem to be based on the oppressive cage models of years gone by -- feedlot-type, fenced paddocks for ungulates, tiled cells for small mammals and birds, and concrete grottos and islands for carnivores.

One of the most disturbing trends in modern zoos is the use of prodigious amounts of concrete, usually exhibited to the public as imitation rockwork, to confine animals and to mask anything and everything that the zoo might consider unsightly or unattractive. It's one of the most expensive design strategies in use today and, for the most part, unnecessary. Many of these concrete exhibits have no biological relevance whatsoever to the animals and are designed exclusively for the aesthetic benefit of the viewer.

A major design consideration is the type of barrier to be used. Bars, fences, netting and vertical wires can provide opportunities for climbing but may not be favored by architects and zoo planners who favor more natural looking displays. Glass and plastic barriers look artificial, can be very expensive and pose unique welfare problems for some animals, such as reptiles, who have difficulty understanding transparent boundaries and exhibit repetitive, often destructive interactions with them. Vertical walls, typically covered with spray-on concrete, are common, even though they can be expensive.

Many zoos favor dry and wet moats for large exhibits because they are considered aesthetically unobtrusive. However, moats have their drawbacks. They are extremely expensive, potentially hazardous to animals who inadvertently fall into them and they are nearly always constructed for the benefit of the viewer.

In certain circumstances, barriers can facilitate increased locomotor activity and exercise. In other cases, using one kind of barrier instead of another will allow for the construction of larger enclosures (assuming space is available). For example, exhibits using low cost electric fencing allow for the construction of much larger enclosures (at a fraction of the cost) for bears and other animals, than if more expensive, conventional barriers (e.g., walls, moats) are used. Ideally however, an animal's physical and behavioural requirements should dictate what type of barrier is used.

Providing appropriate space is a particularly important consideration and one that is surprisingly often ignored by zoos. The provision of space in some zoos seems to have no rhyme or reason, with very large animals being kept in grossly undersized enclosures, while very small animals are kept in very large enclosures.

A particularly disturbing trend in many zoos is the routine confinement of small mammals, birds and reptiles in grossly undersized 'jewel' cages or aquaria, with no apparent regard for their biology or behaviour. It should be recognized that most animals, even some that are very small, live in quite complex and expansive habitats in the wild, so there should be no arbitrarily decided upper limit on the amount of space that they can be provided with in captivity. Small animal species should be accommodated in as large an environment as possible.

While an animal's size does not necessarily determine the amount of space it should have, space allocation in many zoos seems to be based more on convenience and finances than on the biological and ethological requirements of the animals themselves.



All captive animals must be provided with space appropriate to their needs. In determining whether or not a specific amount of space is appropriate, several questions must be asked. First, how much space does the animal actually need to facilitate engagement in natural movement patterns and behaviours? Second, how much space does an animal need to feel secure; so that its fight or flight response isn't triggered or to escape from assault or the threat of assault by cagemates? Third, what are the consequences to the animal of not providing an appropriate amount of space?

Ideally, zoo architects and engineers should consider the most recent ecological and behavioural information from biological field studies and apply that knowledge in the initial design phase. According to Kenneth Polatowski in *Zoo Design, The Reality of Wild Illusions*, "Curators will be able to provide the best care for captive populations of animals when they have the ability to utilize ecological and behavioural data from biological studies and apply the lessons learned there in optimizing the captive environment." They need to know how much they will be compressing the natural living space of each animal into captive space. Success in satisfying animal needs will only be achieved when their biology and behaviour is understood.

During the last two decades, a growing number of zoos have been constructing what are known as "landscape immersion" habitats. These exhibits are typically a superficial replication of part of an animal's natural environment. Visitors follow pathways surrounded by lush vegetation (usually out of the animal's reach) and come across exhibits carefully framed by their surroundings. In some cases, these exhibits have merit, but the landscape immersion concept has been bastardized by the construction of increasingly substandard exhibits, such as the concrete gorilla grotto at the Buffalo Zoo, the new \$6 million indoor gorilla exhibit at the Toronto Zoo, and the Granby Zoo's uninspired AFRIKA pavilion. These new exhibits look nothing like the natural forest habitat of gorillas and most retain not even a hint of naturalness.

One of the best ways to see beyond the superficial veneer of acceptability that many landscape immersion exhibits project is to examine how animals are kept behind the scenes. Typically, conditions are more like tiled, public restrooms than natural habitats.

### **Substrates**

A critically important facet of appropriate wild animal husbandry is the provision of a suitable substrate. Animals have evolved specific morphological and behavioural traits that allow them to exist comfortably on, or in, particular kinds of substrates. If they are denied the opportunity to engage in 'normal' substrate-related activities, they can experience a range of deleterious consequences.

Many enclosures are constructed with concrete and/or 'gunite' (a molded concrete-like material) floors (and often walls) that superficially resemble rockwork. Zoos throughout the world make extensive use of these materials, often to the detriment of the animals themselves.

While hard surfaces are desirable from a management standpoint because they are relatively easy to clean and prevent animals from digging out of their enclosures, they are inherently boring and may predispose animals to sores and other problematic physical conditions.

As well, the textures experienced by the animals when moving on these surfaces typically bear little or no resemblance to textures found in nature. They're easy to clean and look somewhat 'real' but they're biologically irrelevant to the animals themselves. The numerous new concrete-based polar bear exhibits that can be found in an increasing number of zoos are good examples of this.

The rockwork in many of these exhibits is usually structured and painted so that it superficially resembles arctic pack ice. But unlike natural ice, its surface consistency tends to be uniform and alien to the bears. In the wild, polar bears experience a broad range of ice substrates, as well as a range of natural earth and rock substrates. In fact, polar bears, and all other bears for that matter, will construct nests, sometimes padded with vegetation, when given the opportunity. The molded, concrete, pack ice found in most polar bear exhibits is not biologically or behaviourally relevant to the bears.

For the most part, hard substrate enclosures are antithetical to good animal husbandry. They can be uncomfortable and/or physically damaging to the animals; they may increase the thermal load experienced by the animals by radiating heat in hot weather and cooling down rapidly in cold weather; they provide none of the behavioural opportunities that soft substrates do; and they hinder public education by presenting animals in a way that removes them from their natural ecological context.

Another inappropriate type of floor surface that is commonly encountered in zoos, especially in temporary caging, is wire or chainlink. Wire floors are generally used for convenience reasons, since they minimize the work involved in cleaning by allowing urine and feces to drop through the wire onto the ground below. They are not acceptable for the permanent housing of any animal species.

Wire floors can cause discomfort, pain, infection and injury, even when great care is taken to choose the most appropriate type and gauge of wire.

Wire floors also make heat regulation difficult, because air flows freely through the floor from below, as well as through any other barriers that are constructed of wire. In certain circumstances, they also make it difficult to provide proper bedding, since straw, wood chips and other materials may work their way through the wire, exacerbating the already problematic thermal situation.

Also of concern is the stress that can be caused by the wrong kind of floor surface. As mentioned earlier, animals have evolved specific morphological and behavioural traits that allow them to exist comfortably on particular kinds of substrates. Forcing animals to live on substrate types, such as wire, that are uncomfortable or physically damaging and that they are not equipped to cope with can cause considerable suffering.

Wire floors are inherently devoid of stimulation. They provide few, if any, of the behavioural opportunities, such as digging, rooting and surface foraging, that 'natural' substrates do.

All enclosures should be equipped with natural, 'soft' substrates that provide a range of behavioural opportunities. No animals should be permanently housed on hard or wire floor surfaces.

### **Environmental Conditions**

Animal welfare is based, in part, on an animals' ability to successfully adapt to changes in environmental conditions without suffering. So all captive animals should have conditions of temperature, humidity, light and ventilation compatible with their biology and behaviour. For endothermic animal species that regulate their own internal body temperature, the range of environmental conditions they can acclimate to is much broader than ectothermic species, who rely on outside conditions to regulate body temperatures.

Assessment of environmental conditions must be conducted from the animal's perspective. This is particularly important in exhibits housing ectothermic species, where even slight environmental changes can impact on physiological and behavioural functions. For example, low temperatures can slow down or eliminate the process of food digestion in reptiles, so they must be provided with appropriate thermal conditions.

If an animal is entirely terrestrial, it may not be useful to check the exhibit temperature by reading a thermometer located high on the wall of the exhibit. Temperatures and humidity levels in the upper half or on one side of an exhibit may be drastically different in the lower half or on the opposite side. Look at conditions from the level of the animal. What parts of the enclosure does the animal actually use? Are those areas preferred? Why?

Conditions of high temperature and humidity can be problematic in captivity. Many animals, particularly birds and mammals, have the ability to elevate internal heat production when they get cold, but they have greater difficulty cooling themselves down when they get excessively hot because they can only reduce heat production to a level compatible with continuation of their basic metabolic processes. This may not be sufficient to deal with conditions of high heat, so captive animals must be given the opportunity to thermoregulate by moving to cooler, shady areas such as forest cover, burrows, rock cavities, pools, etc. They must also be provided with potable water at all times.

Also problematic is the structuring of zoo husbandry practices around staff timetables. Doing so often ignores the need of animals to maintain a normal photoperiod. While this is less of a problem for animals housed in outdoor exhibits (unless they are out of their normal geographic range and their biology and behaviour is related to or dependent on normal photoperiod), it can be a real problem for animals housed inside. The activity budgets of animals in the wild are often influenced by the amount of light and dark they experience. While animals living in equatorial regions tend to have relatively constant hours of light and dark, this changes substantially as you move further from the equator. This should be a consideration when dealing with animals in captivity. Turning the lights on when staff arrive in the morning and shutting them off when they go home may not be an appropriate husbandry protocol for many species.

## **Privacy**

The psychological well-being of zoo animals must take precedence over the desire of visitors to see the animals every time they visit the zoo. Therefore all animals must be provided with the opportunity to remove themselves from the view of visitors, and if required, from their cagemates. Ideally, animals should not have to retreat to off-exhibit areas or interior accommodation to obtain privacy, but instead should be able to do so in the on-display areas.

Exhibiting animals in a way that does not afford them privacy can result in deleterious physiological and behavioural consequences. Animals that are forced to be on display may be subject to chronic stress that can rapidly reach unmanageable levels. This is made even worse when poor exhibit design allows visitors to look down on animals from elevated viewing stations or when visitors are allowed to view animals from all sides, essentially surrounding them.

Lack of privacy is particularly problematic when viewing stations allow visitors to get so close to the animals that their “fight or flight” response (the distance at which an animal would want to flee from or defend itself against a potential threat) is triggered. Violation of the “fight or flight” distance can result in high levels of stress and/or attempts to flee, often resulting in physical injury or, in extreme cases, death.

Privacy from conspecifics can also be an important consideration. Many animal species establish social hierarchies in captivity, where dominant individuals exercise first choice of food, preferred areas for resting, sunning, etc. For this reason, it is important that less dominant animals not only be able to avoid physical contact with dominant conspecifics, but that they be able to remove themselves from visual contact as well.

Privacy can also be important for species that delineate their territory through visual means. For example, snowy owls tend to establish territories visually, yet some zoos still place groups of them together in small cages where they are in clear sight of each other. This is inappropriate and stressful on the birds.

While most zoos have to be conscious of the fact that visitors come to see animals, they should not place visitor expectations above the privacy needs of the animals. In fact, not being able to see an animal every time you visit an exhibit may be more educational, and arguably more exciting (if you have to look, watch and wait) than seeing the animal sitting or lying -- frustrated and stressed -- in plain view.

The educational experience of visitors can be enhanced by explaining the reasons why animals must be able to remove themselves from their view or from the view of cagemates.

Privacy should always be a consideration during the initial exhibit design. The topography, fixed features and placement of viewer stations all require knowledge of the animals privacy needs.

In existing exhibits, the introduction of earth mounds, large rocks, brush piles, root balls, fences, walls, screening, shelter boxes and other materials may provide animals with appropriate opportunities to obtain privacy.

## **Environmental Enrichment**

A number of different, but very similar, definitions of 'environmental enrichment' are in use today. One of the most comprehensive can be found in the David Shepherdson paper, *Environmental Enrichment Programs in Zoos, Guiding the Next Step Forward*,

Environmental enrichment is a process for improving or enhancing zoo animal environments and care within the context of their inhabitant's behavioural biology and natural history. It is a dynamic process in which changes to structures and husbandry practices are made with the goal of increasing behavioural choices available to animals and drawing out their species-appropriate behaviours and abilities, thus enhancing animal welfare.

Environmental enrichment is often touted as the solution to a broad range of behavioural problems in zoo animals and sometimes as an amorphous goal of zoo managers. While it can be a useful strategy for raising the level of welfare in zoo animals, it should not be seen as a panacea. Environmental enrichment is a range of compensatory measures that attempt to deal with deficiencies inherent in animal housing and husbandry systems. It deals more with the symptoms of an existing problem than the root cause of the problem itself.

In a previous section of this paper, Broom and Johnson were quoted as saying, "A profound lack of stimulation is something to which no vertebrate animal is likely to adapt." It would be entirely appropriate to add the words "or should have to adapt." For this reason, all zoos should develop and implement environmental enrichment programs for all vertebrate species. A few zoos have gone even further by requiring enrichment programs for invertebrate species as well.

Satisfying the behavioural requirements of wild animals in captivity is essential to their welfare. Captivity imposes biological and behavioural constraints on animals that they may have no natural way of coping with. Since the nature of their confinement often offers few opportunities for coping, especially when compared to the range of options that would typically be available to them if they were in a wild setting, they must be given as enriched and complex an environment as possible. All captive animals must be given some control over their environment and an opportunity to make choices; in other words, they must be allowed to make a meaningful contribution to the quality of their own lives.

Since the environments that most zoo animals currently experience are not going to change overnight, it is essential that environmental enrichment be viewed as a critical component of daily management that increases animal choice, control and welfare. Under no circumstances, should it be considered as something to get to when time or finances allow.

In addition, it is critical that the process of environmental enrichment be viewed as a dynamic process that requires thought, effort, evaluation and revision. Under no circumstances, should it be considered as something that can be accomplished by occasionally throwing a ball or tire into a cage. The sporadic introduction of novel items into enclosures may encourage brief sessions of activity, but the novelty of those items will quickly fade as familiarity with them grows. Keeping animals occupied and stimulated can, at the best of times, be a challenging prospect.

While environmental enrichment can take many forms, for the purposes of this report, I'll divide it into three basic categories: fixed exhibit features; non-fixed features and novel objects; and olfactory, auditory and food-related enrichment strategies.

Structural enhancement through the provision of appropriate fixed exhibit features, such as a contoured surface topography, giant rocks, mature trees, streams, pools and other items must be carefully considered during the initial exhibit design phase, since the likelihood of those features being changed after construction of the exhibit is minimal. Of course, it goes without saying that the biology and behaviour of the species to be confined must be a major factor in all decisions regarding which fixed features to incorporate into an exhibit.

One often overlooked aspect of enclosure design is the use of vertical space. Incorporating appropriate design features and structures that allow utilization of the vertical dimension will increase opportunities for locomotor activity and exercise, even for animals that are predominantly terrestrial in nature.

There's an almost endless array of non-fixed features and novel objects that can be incorporated into environmental enrichment programs. In fact, this category is restricted only by the imagination of animal caretakers and management teams.

Numerous publications are now available outlining enrichment items and strategies for a range of animal species. Organizations such as the Association of British Wild Animal Keepers produce books about enrichment. In addition, monthly magazines like *The Shape of Enrichment* outline new enrichment items and techniques, and numerous zoos have compiled their own lists of enrichment items and devices that they're pleased to distribute to interested parties.

Some examples of non-fixed features and novel objects that can be utilized in enrichment programs are small trees, branches, logs, log piles, small rock piles, brush mounds, root balls, moveable sand/bark/mulch pits, other novel substrates, nesting boxes, pipes, tubes, visual baffles, shade structures, moveable climbing apparatus, platforms, hammocks, bungee cords, rope ladders, hanging rings, scratching posts, pools, streams, sprinklers, water jets, rafts, brushes, puzzle feeders, boomer balls, nylabones, traffic cones, wooden rings, cardboard boxes, etc. Most of these are things that animals can use and manipulate.

Many animals can also benefit from auditory and olfactory stimulation. The addition of particular sounds from conspecifics, as well as other species, has been used as an enrichment strategy for several kinds of primates, while the introduction of novel scents has been a successful method of stimulation for several bear species.

Food-related enrichment strategies are a particularly important facet of enrichment programming. For many species, food acquisition activity represents a significant percentage of their daily routine. In fact, the process of acquiring food is extremely important for nearly all animals, with most species having evolved specific morphological and behavioural traits that favour food acquisition over other kinds of activity.

Study of the activity budgets of wild animals provides a basis for comparison with captive animals. Food acquisition activity can comprise 50% or more of a wild animal's daily activity, so it's important that expression of species-typical food-related behaviours in captive animals be encouraged and facilitated by animal caretakers.

Historically, zoos have fed their animals infrequently, often once or twice a day according to a fixed schedule. This virtual elimination of food acquisition activity left animals bored and inactive. Thankfully, this practice is beginning to change. Increasingly, staggered feeding schedules, the introduction of live food items, hiding of food items, painting food treats such as jam or honey in hard to reach locations to encourage stretching and climbing, whole carcass feeds for carnivores, the provision of multiple foraging opportunities for ungulates and other strategies that make animals search and work for their food are being employed.

Making animals work for their food may sound rather harsh, but it was discovered quite some time ago that captive animals, if given the choice, would often rather work for their food, than accept identical, free food offered without any work involved. They preferred to be doing something.

The idea that animals should be fed on a fixed timetable with no variation as part of a regime of 'total institutionalized care' should be considered an anachronistic method of animal husbandry that is no longer acceptable.

### **Safety and Security**

Zoological facilities should always operate in a manner that ensures the safety of animals, staff, visitors and persons living adjacent to zoo property.

All enclosures should be designed with enough space and complexity that animals will not be preoccupied with escape. Contented animals that are able to engage in a range of behaviours are less problematic in this regard.

All barriers (including gates and doors) must be constructed with the physical abilities of the animals in mind. Walls must be high enough that animals cannot jump over them, moats must be wide enough that animals cannot jump across them and fences must be strong enough that animals can't push them over.

Extra attention must be given to gates and doorways. They should fit snugly against fences and walls, leaving no gaps in between and they should not bend or warp when locked. Doors and gates should always open inwards and sliding barriers should be built so that animals cannot lift them off their hinges or tracks.

Enclosures should ideally be equipped with double door entry systems that allow staff to enter through one door, closing it behind them, before opening the second door into the exhibit. This prevents the inadvertent escape of animals who may 'sneak' past the person entering the exhibit. While this system is advisable for all enclosures, it is absolutely essential for exhibits housing potentially dangerous animals.

As well, all enclosures housing potentially dangerous animals must be equipped with secondary containment areas, where animals can be secured during routine enclosure maintenance, cleaning or for veterinary purposes. This area should be secured by a sliding door that can be safely operated from outside of the exhibit.

All enclosures should be locked, regardless of species. Not only does this prevent animal escapes, particularly with intelligent animals that can learn to open doors and gates, but it may prevent entry into exhibits by trespassers, vandals and thieves.

An essential component of any zoo security strategy is a perimeter fence around the facility. In fact, some zoo associations make perimeter fencing a mandatory requirement for accreditation. Perimeter fencing should ideally be 2 meters in height, topped with barbed wire and the base of the fence should be buried into the ground to a depth of at least 1 meter or affixed to a concrete curb or base. Not only will a perimeter fence discourage escaped animals from leaving the zoo grounds, it will also discourage unwanted entry by human trespassers and feral animals. Large trees that overhang the fence should be trimmed to ensure that they do not fall, thereby creating openings that animals could escape through.

Night lighting should be considered in key areas as an aid to security personnel.

Emergency protocols to deal with animal escape, keeper or visitor injury, natural disasters and other problematic situations must be developed and implemented. Drugs to immobilize potentially dangerous, escaped animals and firearms to prevent loss of life should be on site and in good working order. All staff should be familiar with emergency plans and protocols, which should, ideally, be laid out in an emergency procedures manual that all staff are required to review.

## **Education**

If zoos are to fulfill their stated mandate of conveying educational messages about animals and wildlife conservation to the public, their animal exhibits must provide the means to do so. Sadly, the majority of zoo visitors (85-90%) do not participate in organized zoo education programs, so the primary vehicle for education of casual visitors in virtually all zoological facilities is still the viewing of caged animals. For this reason, outdated and/or poorly designed exhibits where animals display aberrant behaviours in ugly conditions are educationally counterproductive.

In theory, visitors should leave zoos with a feeling of respect for animals and an awareness of the factors that are causing their destruction in the wild. Since the attention of casual visitors must usually be captured during the first few seconds of viewing an exhibit, it is important that animals be accommodated in a way that satisfies their needs – that allows them to behave in a somewhat natural fashion in surroundings that are similar in form and function to those that their counterparts in the wild experience – thereby increasing the chance that they will appear “normal” and interesting to viewers. Visitor impact is directly linked to the way zoo animals are presented, so exhibit quality must be high.

In addition, if zoos are to be truly educational, they should develop and deliver a range of educational programs for visitors. They include, but are not limited to, interpretive labels and graphics on enclosures; newsletters, guidebooks,

brochures and other publications; audio-visual displays; information stations; guided and self-guided tours; meet-the-keeper sessions; lectures and demonstrations.

In many zoos, interpretive graphics are often poorly designed and inaccurate, while others offer vague, completely meaningless whimpers about endangered species. Other types of educational programming are often just as deficient or absent altogether. Unfortunately, many zoos relegate educational programming to the backburner, making it something they get to if time and finances allow, if they get to it at all.

Other zoos make education something separate and distinct from the live animal collection, creating wonderful educational exhibits far removed from the animals themselves. Education should be integrated into every aspect of zoo operations, not kept separate from everything else.

### **Canadian Association of Zoos and Aquariums Accreditation**

Zoo organizations claim that their peer-review accreditation programs are useful tools for maintaining and improving animal husbandry and housing practices in member facilities. While accreditation may serve the interests of those zoos that apply to be accredited, the system itself often does little to ensure adequate husbandry and housing practices or to allay the concerns of those outside of the industry.

The Granby Zoo is an accredited member of the Canadian Association of Zoos and Aquariums (CAZA), a non-profit zoo industry organization established in 1975 to promote the interests of its members.

In the mid-1980s CAZA established an accreditation program. All voting CAZA member institutions, including the Granby Zoo are now required to be accredited by the association's commission. Accreditation involves an application and questionnaire and an announced on-site inspection by a team of three Fellow members, one of whom must be a zoo veterinarian. According to a CAZA brochure, "The accreditation system is the keystone for the professional development of our institutional members."

In a session at the October 2000 Zoocheck Canada/ World Society for the Protection of Animals *Wildlife in Captivity: Assessment and Enforcement* workshop in Toronto, a CAZA representative indicated that the association's accreditation process is "designed to be used as an evaluation of people looking for membership in our association." The session then detailed the *C.A.Z.A. Standards Of Animal Care And Housing* (1994) and pointed out that they serve as guidelines for trained and experienced zoo professionals. It is presumed that the standards are used as a guideline for the accreditation process.

Unfortunately, the CAZA standards are very brief; many of the words and terms used are not defined; most of the content is extremely generalized and subject to a considerable degree of interpretation; and the standards do not contain specific recommendations for the housing and husbandry of particular species.

To a large extent, interpretation of the standards is subject to the expertise, experience and bias of each member of the accreditation inspection team. As well, accreditation inspections only provide a one-day snapshot of each facility - essentially what was happening on the day of the inspection.

These substantial weaknesses in the system undermine the veracity of the CAZA accreditation process. In this author's view, the award of accredited status to a zoo does not ensure adequate or humane animal husbandry and housing practices and should not be used as a benchmark for evaluations. Other, more comprehensive, regulatory schemes, that are much better for evaluation purposes, can be found in various jurisdictions around the world.

## Commentary on Specific Exhibits

The following section highlights specific problems in several Granby Zoo exhibits. Many of the concerns expressed in this section are representative of problems that are systemic throughout the facility. This should not be considered a comprehensive review of animal husbandry and housing conditions. Instead, it should be viewed as a snapshot image of conditions based primarily on observation of the physical facility during the time of the inspection.

### Common Porcupine (*Erethizon dorsatum*)

**Species Description:** Common porcupines are robust, quill covered, vegetarian animals that primarily inhabit coniferous and deciduous forests in North America. They have relatively small heads, short ears, legs and tail, and large claws that assist in climbing. They tend to be solitary in nature, although they will sometimes den together in rock crevices, shallow caves, hollow logs and trees, especially during severe winter weather. During the winter they consume evergreen needles and the cambium layer and inner bark of trees, but their diet changes to buds, twigs, leaves, flowers, berries, nuts, roots and other material during the summer when additional food sources are available. They establish regular runways through ground cover and snow between den sites and feeding areas.

**Exhibit Description:** Two Common porcupines were observed in an extremely small, simulated cave exhibit in the Caverne Des Debrouillards building. The room containing these animals was very dim with the only illumination coming from an overhead skylight. The enclosure substrate was entirely hard, the walls were dark, molded gunite from floor to ceiling and the skylight area was encased in gunite so that it resembled a cave opening. The use of available vertical space was poor. A branch and a short wooden ladder were the only furnishings in the enclosure, so climbing opportunities were negligible. The room did not appear to offer the porcupines any opportunity to obtain privacy.

**Comments:** The space provided in this exhibit is grossly inadequate. The animals are only able to move a few steps in either direction before hitting the walls of their enclosure. While wild porcupines do not have excessively large ranges, they may travel distances from 100 to 1,500 m on a daily basis, so compressing their environment to the extent that the Granby Zoo has is problematic. As well, the space lacks sufficient complexity.

Also, while common porcupines may occasionally seek shelter in shallow caves, they do not inhabit them on a permanent basis, so the portrayal of these animals as cave dwellers may be misleading to visitors.

While porcupines are excellent climbers and can often be seen in trees, sometimes as high as 20 m, they are primarily terrestrial spending most of their time on generally soft forest substrates. The hard substrates that they are forced to live on is inappropriate. It should be covered with several inches of earth substrate until these animals can be moved to more appropriate accommodation elsewhere.

Despite the extremely small size of this exhibit, the utilizable space could be increased somewhat by providing appropriate climbing materials. It should immediately be equipped with vertically and horizontally positioned branchwork of varying sizes (1.5 to 8 cm diameter) to facilitate climbing. Branches will probably be chewed apart so they will have to be replaced regularly. The current branch and wooden ladder should be removed.

The dim lighting may be problematic. While porcupines tend to be nocturnal, they can be active during the day as well. If the exhibit is not on a reverse light cycle, it should be. These animals should experience a normal photoperiod cycle and not be kept perpetually in twilight or darkness.

The exhibit was also behaviourally impoverished because it lacked any kind of meaningful environmental enrichment. Introducing shrub and tree branches, hollow logs with intact bark, high wooden platforms placed at various points on the walls, climbing apparatus and other items would substantially improve this exhibit in the short term.

While improvements can be made, it is doubtful that this exhibit could be brought up to an acceptable standard for porcupines. It is grossly undersized, devoid of naturalness and it does little to satisfy the needs of these animals.



Ideally, the two animals in this exhibit should be moved to more appropriate accommodation in another part of the zoo.

**Tiger** (*Panthera tigris*), **Jaguar** (*Panthera onca*), **Cougar** (*Puma concolor*), **Ocelot** (*Leopardus pardalis*) & **Sand Cat** (*Felis margarita*)

***Species Descriptions:***

**Tiger:** The world's eight species of tigers are confined to pockets of India, China and Southeast Asia, where they frequent a range of habitat types, including tropical rainforest, snowy coniferous and deciduous forests and mangrove swamps. Weighing from 65 to 320 kg, tigers are superbly adapted to stalk and ambush large prey. Females inhabit a range as small as 20 square km, while the range of males can be larger than 100 square km. They are usually nocturnal but can be active during the day.

**Jaguar:** The jaguar is the new world's largest cat that can weigh up to 120 kilograms. They are found in a variety of habitat types, including dense jungle, tropical scrub forest, savannah and grasslands, from the southern United States to Argentina. They tend to be solitary animals that prey on deer, capybara, peccaries, tapirs, monkeys, skunks, porcupines, armadillos, birds, fish, frogs, turtles and small alligators. Jaguars are territorial and inhabit a range that can vary, depending upon food availability, from as little as a few square kilometers to hundreds of square kilometers.

**Cougar:** The cougar is the New World's second largest cat (65 – 103 kg.) that can be found from northern British Columbia to southern Argentina. It frequents a diversity of habitat types, including tropical and temperate forests, swamps, grasslands and deserts. They're athletic and hunt a range of prey species, including moose, elk, caribou, beaver, porcupine, wild pig, opossum, raccoon, rabbits, rats, and even insects. They space themselves out and typically cover a large territory ranging in size from 12 – 200 or more square kilometers.

**Ocelot:** The ocelot is a relatively small spotted cat, typically weighing from 11 - 16 kilograms, that can be found in tropical and sub-tropical forest, savannah and scrub lands from the southern United States to Brazil and northern Argentina. They consume small mammals, birds, reptiles, insects and occasionally some grass or fruit. They tend to be solitary, nocturnal and territorial. Studies show that they sometimes cross their entire home range every two to four days in search of food.

**Sand Cat:** This small wild cat, usually weighing only 2 - 2.5 kilograms, inhabits desert regions of Africa, Central Asia and Pakistan. They are superbly adapted to arid environments having long dense hairs covering the soles of their feet to protect them from the hot sand and to make moving easier, a thick coat to protect them from the desert heat and cold and the ability to go without drinking for long periods of time. Sand cats are primarily nocturnal and subsist by hunting rodents, hares, small birds, reptiles and insects.

***[Note: Three felid species (African lion, snow leopard and leopard) displayed at Granby Zoo are not described.]***

**Exhibit Description:** The big cat complex consists of an irregularly shaped building with several outdoor display cages, three circular outside pens housing snow leopard (not described above), tiger and African lion (not described above), and a number of indoor exhibits that can be viewed from a central visitor gallery. The majority of the displays are grossly, undersized square or rectangular cages or rooms with concrete or tiled substrates that are reminiscent of the sterile, ugly cages of 19<sup>th</sup> century animal houses.

A row of rectangular outdoor exhibits adjoining the Big Cat building face out onto the visitor walkway. The concrete base of this row is raised up several feet above the level of the walkway, presumably to facilitate better viewing of the animals by visitors. The exhibits vary in size from slightly less than 37 sq. meters to upwards of 56 sq. meters in area. In two cases, access doorways between the units had been left open to allow the animals to move from one cage to another. The ceiling height was approximately 3 ½ m and was uniform from one end of the row to the other. There has been no attempt to exploit the available vertical space. Shade was provided by an alcove in the back wall, by vines that have been allowed to grow over part of the enclosure structure, or presumably, by the

shadow of the cat building itself at certain times of the day. While vertical wooden planks covered some of the rear walls of the units, no attempt had been made to hide the straight lines and sharp corners of the building in others.

The interior quality of these outdoor cages varied somewhat. The leopard display consisted of two units with barren concrete floors and a few large branches, all of them smooth and completely stripped of bark. There were few natural features in the leopard exhibit and no environmental enrichment items were observed. Neither unit provided any privacy whatsoever.

The cougar had access to two units. The first contained an earth substrate with considerable natural foliage, while the second unit was vastly different with a barren concrete floor, several denuded branches and a few rocks. There was little opportunity for privacy on either side.

One cougar and a leopard were observed methodically pacing back and forth in a repetitive fashion.

The three circular outdoor pens were much larger than the rectangular units described above. All of them were constructed of steel mesh on metal support posts, with the snow leopard pen, measuring approximately 12.5 m across, being the smallest and the only one covered by a roof. The unit is attached to the cat building, so the back wall of the exhibit consists of the building's concrete wall, while the other two thirds consist of the steel mesh barrier adjacent to the visitor walkway.

A large rock and earth mound was situated on one side of the snow leopard exhibit while some smaller rocks and a tree branch were situated on the other side. Most of the exhibit floor was covered with grass and weeds. There were no high perching areas and privacy opportunities were limited.

The tiger and lion pens were slightly larger in size but their topography was not as variable. They were essentially grassy areas with a jumble of denuded logs piled in the middle. Privacy opportunities were limited.

The indoor enclosures were deficient in all respects. Most of them were square or rectangular rooms with a single glass wall facing onto the central visitor gallery.

The indoor unit abutting the outdoor tiger pen contained a single tiger who was observed lying on the floor. Presumably, this unit would have at one time served as indoor accommodation for the tigers housed outside as its back wall appeared to be made of sliding glass panels (painted black) that would allow access to the outdoor pen. The unit itself was small, ugly and barren consisting of a brightly lit room with a smooth, hard, tiled floor surface and concrete block walls painted with a mural of clouds. The display contained a single raised wooden platform and a few logs almost completely stripped of bark. The animal was not able to remove itself from public view.

While somewhat smaller, the unit housing the sand cats was similar. A single, brightly lit room with smooth tiled floors and plain white walls. One stump and a few barkless branches were the only large objects present. A single cardboard box, one small ball, a cloth suspended by a string from one of the diagonally placed logs and a plastic children's wading pool were also observed. Two wooden sleeping boxes were situated on the floor at the front of the exhibit.

The jaguar unit was grossly undersized measuring approximately 9 m by 5 m. It featured a molded gunite floor, simulated Mayan temple walls (made of gunite) and a few branches and ropes. The unit was brightly lit and contained a single animal that was observed lying on a platform. It did not appear as though the cat had an opportunity to remove itself from public view.

There were two units housing ocelots. One was a small tiled room similar to the adjacent unit housing sand cats, while the other was a larger end unit with tiled floors, similar to the indoor tiger area. It contained a number of vertical branches (denuded of bark), a single ramp, a few ropes and a raised sleeping box. A small mound of molded gunite rockwork was situated in one corner of the exhibit. A single ocelot was observed pacing in a repetitive fashion.

**Comments:** Most of the enclosures in the big cat complex are spatially inadequate. Except for the two largest outdoor pens (which are not particularly sizable by modern zoo standards), all are grossly undersized and do not encourage free expression of natural behaviours and movements. Ideally, the number of animals should be reduced and the separate display units joined together to form larger, more complex spaces.

In all cases, the use of vertical space was negligible and could be drastically improved by the introduction of ramps, platforms, climbing structures, aerial walkways and other furnishings. Not only would this increase the utilizable enclosure space and encourage the animals to get more physical exercise, it may also help mitigate the effects of environment-related stress.

All indoor units and most of the rectangular outdoor units featured hard, tiled or concrete substrates. These floor surfaces should be modified to include soft substrate areas. In some cases (indoor units), this would simply involve covering the floor of the exhibit with the appropriate substrate material or sectioning off a portion of the floor and covering that section. While there is more labour involved in keeping "natural" floor surfaces clean, the benefit to the animals outweigh any inconvenience they may cause.

Most of the exhibits provide little, if any, opportunity for the animals to remove themselves from public view. In some cases, simply opening access to off exhibit areas may be a temporary solution to this problem. Ideally though, all animals should be provided with privacy in their on-exhibit areas. This may be a relatively easy process in those units housing small cats (the sand cat and ocelot units are already equipped with wooden sleeping boxes in their on-exhibit areas), but may prove difficult in the existing large cat units, primarily because they are so small. Nevertheless, this problem should be addressed. Outfitting each unit with a variety of furnishings such as rock piles, hollow logs, concrete pipes and brush piles would provide the cats with opportunities to obtain privacy.

The bright lighting observed in the sand cat unit and one of the ocelot units was inappropriate. These animals are nocturnal and should be exhibited in subdued lighting or on a reverse light cycle.

Except for an occasional item or two in several of the units, environmental enrichment was absent. A formal program of environmental enrichment must be developed and implemented. A first step should be the introduction of furnishings into each unit, such climbing apparatus, high perches, branches, hollow logs, branches with intact bark intact, concrete pipes, living plants, etc.

Other ways of providing stimulation include, but are not limited to, whole carcass feedings (with intact head and skin), hiding food treats to encourage exploratory and hunting behaviours, adding scents for olfactory stimulation, providing durable play objects such as nylabones and boomer balls, and creating "working-for-reward" activities, such as suspending meat treats from bungee cords to encourage jumping and leaping.

The enclosures in the big cat complex are antiquated in design and need to be refurbished or replaced. In the short term, reducing the number of cats, amalgamating a number of the existing units and increasing their interior complexity would be a useful first step in addressing the current situation.

### **Fennec Fox** (*Vulpes zerda*)

**Species Description:** The smallest of the foxes, the Fennec fox is a skillful predator that lives in groups of up to ten individuals in Saharan regions of northern Africa. They are superbly adapted to life in the desert, being primarily nocturnal and subterranean, having heavily-furred feet to facilitate walking on sand and possessing the ability to go for long periods without drinking. Rodents, lizards and insects are their most popular prey items.

**Exhibit Description:** Two Fennec foxes were observed in an undersized, barren enclosure, consisting of a small room with concrete walls and a glass front allowing visitors to view the animals from the interior gallery of the big cat building. One half of the exhibit was filled with a large imitation rock outcrop, while the other side contained a similar, smaller feature that appeared to be hiding a food or watering area. There were no soft substrate areas anywhere in the exhibit.

An indentation along the length of the back wall, about halfway between the floor and ceiling, provided a shelf for the animals to use. The only other feature was a large branch, mostly denuded of bark, propped up against the simulated rock outcrop. There was minimal use of vertical space. The walls were painted with desert murals and there appeared to be no natural sunlight, even though the exhibit was illuminated rather brightly. The front portion of the exhibit did not provide any privacy opportunities. However, it's possible the animals could obtain some privacy by sitting on the shelf at the rear of the exhibit behind the upper portion of the rock outcrop.. No environmental enrichment of any kind was observed. The two foxes were observed sleeping on the top of the rock outcrop in plain view.

**Comments:** This enclosure is extremely small, allowing the animals to move only a few paces in either direction before encountering a wall. Since Fennec foxes are active, nocturnal predators, they require relatively large spaces, so these foxes would be better moved to more appropriate accommodation elsewhere. The lack of space is severely problematic. An increase in utilizable space could be achieved by incorporating climbing structures and aerial walkways into the exhibit.

The exhibit is entirely hard, consisting primarily of a molded, gunite floor and walls. Fennec foxes spend a great deal of time underground and moving about on soft substrates such as sand and dry earth, so the floor of this exhibit should be covered with an appropriate substrate material that is soft and provides opportunities for digging.

Environmental enrichment was severely lacking. As well as introducing and changing cage furnishings, such as logs, rocks, branches and other items (which would also provide privacy opportunities) on a periodic basis, activity could be encouraged by the feeding of live prey (crickets, mealworms) and the introduction of novel scents. Other items that might also be suitable for enrichment purposes include dog chew toys, small tires, kong toys, nylabones, pine cones, leaf piles and balls.

The fact that the exhibit was brightly lit was also problematic. These animals should be subject to a reverse light cycle allowing visitors to see that they are nocturnal animals.

Overall, this enclosure is grossly undersized and inadequate. The space and complexity available to these animals needs to be drastically increased.

#### **Asiatic Black Bear** (*Ursus thibetanus*)

**Species Description:** Asiatic black bears are large, primarily solitary carnivores that can be found in a variety of habitat types in Afghanistan, Pakistan, India, Burma, northeastern China, parts of Russia and on Taiwan and several Japanese islands. Their preferred habitat is forest with a thick understory and a proliferation of food sources. Black bears are excellent climbers, swimmers and possess a very strong sense of smell. They consume grasses, shrub and tree-borne fruits, berries, nuts, roots, insects, frogs, birds, bird eggs, small mammals, carrion and any other food items they can find. In northern regions, black bears hibernate during the winter by subsisting on body-fat accumulated during the fall season.

**Exhibit Description:** One black bear was observed in a wire, geodesic dome structure, reportedly constructed during the 1950s. This enclosure previously housed at least two polar bears. The entire base of the exhibit interior is constructed of concrete. A kidney-shaped pool embedded in the foreground floor and a silo-type structure at the rear of the exhibit are its only permanent features. A concrete walkway rises in a circular fashion from the front of the tower base around its perimeter before stopping just above its starting point. A single vertical tree trunk, almost completely denuded of bark, is situated at the front of the tower, presumably to allow the bear to climb up to the concrete walkway or down from it to the floor. The use of the vertical space in the exhibit was extremely poor.

There were no privacy opportunities in the on-display area. Visitors can easily view almost all of the exhibit interior. I was unable to view the furthest side of the tower, so there may have been access to some form of interior retreat inside its base.

The enclosure was devoid of environmental enrichment of any kind. The bear was observed pacing repetitively along one section of the enclosure barrier and displayed a ritualistic head turn when shifting direction.

**Comments:** In her 1994 report *The Welfare and Management of Bears in Zoological Gardens*, behavioural scientist Alison Ames describes the essential components of an appropriate bear husbandry and housing regime:

- *Captive bears should be provided with objects for manipulation and play.*
- *Bears should be provided with a wide variety of objects so that they have more choice and control in their captive environment and the moveable objects should be exchanged on a regular basis to provide some novelty and stimulate exploratory and play behaviours.*
- *Bears should be provided with climbing frames to enable them to exhibit their skills and interest in an arboreal habitat.*
- *It seems clear that a greater emphasis should be put on the third dimension when designing exhibits for bears.*
- *Bears should be provided with nesting material in the form of straw, wood-wool, branches or leaves which can stimulate play and lead to a decrease in abnormal behaviour.*
- *Visual barriers should be provided as bears are not naturally sociable animals and they allow the animals to avoid one another and be out of each others' sight.*
- *New enclosures should be designed to incorporate two separate paddocks so that individuals can be separated when necessary. The paddocks should contain large overgrown areas where the bears can perform a wide behavioural repertoire.*
- *Environmental enrichment should be a priority for day-to-day husbandry.*
- *In designing new facilities for bears, zoo must aim to provide them with individual security, sufficient complexity to carry out a wide range of normal behaviour, opportunities to achieve objectives and finally some degree of novelty. Play facilities alone are not adequate, bears must also be made to work for tangible rewards.*

Current trends in captive bear housing favor the creation of very large, complex, naturalistic paddocks, so the Granby Zoo enclosure seems particularly dated. In fact, it is grossly deficient in all respects and is not appropriate housing for any bear species.

Ideally, the Granby Zoo should construct a naturalistic, multi-acre enclosure on another part of the zoo site that will satisfy the animal's biological and behavioural requirements. If this kind of enclosure is not possible, due to limited space availability, the bear should be relocated to more appropriate accommodation elsewhere.

In the meantime, the Granby Zoo should make a number of changes to the existing exhibit. The concrete floor should be modified to include substantial soft substrate areas. This could be accomplished by constructing a 20 cm high concrete rim around portions of the current concrete base and filling these sections with earth and sand, similar to a child's sandbox, or by removing sections of the floor entirely exposing the earth below. In addition, the pool could be substantially reduced in size or drained entirely and filled with earth. Not only would this provide a sizable soft area in the current exhibit, it would allow food items to be buried quite deep in the earth.

A changeable, wooden climbing structure should be erected in the center of the exhibit to make use of the available vertical space. This structure should include several ramps, platforms and possibly a bear hammock. The vertical branch currently in front of the tower should be replaced with a new branch with bark intact.

Since bears tend to be solitary, visual baffles in the on-exhibit area should be provided for privacy. The addition of rock piles, logs, log fences, root balls, concrete pipes, wooden A-frame or teepee structures, brush piles and other items will provide hiding places and stimulation. As well, the bear should have a den box or off-exhibit area it can retreat to. This should be provided with bedding material in the form of straw, wood wool or soft branches for nest building and play.

Portions of the enclosure barrier abutting the visitor walkway should be screened with camouflage netting to reduce the amount of viewing space available to visitors. The netting should not extend higher than 2 m, so the bear still has the opportunity to view outside the exhibit when perched on the tower ramp or any climbing structures that may be added to the exhibit at a later date.

As part of a larger institutional environmental enrichment initiative, a plan should be developed and implemented to increase the level of stimulation experienced by the bear. Natural items such as branches, brush piles, Christmas tree mounds, rotting logs and stumps, pine cones and other items should be introduced on a regular basis.

Artificial items, such as boomer balls, nylabones, bowling pins, plastic buckets, traffic cones, cardboard boxes, beer kegs, fire hoses, phone books, tires, sleds, feed tubs, ice blocks, crushed ice mounds and old animal furs should also be added on a periodic basis to encourage play behaviours and manipulation. Hoses or sprinklers could be mounted on the side wall of the enclosure as added stimulation.

Since bears are intelligent, active, opportunistic carnivores, they should be made to work for a least part of their daily feed ration. Food should be hidden throughout the exhibit to encourage foraging and exploratory behaviours. Food items can be hidden in hollow logs, under rocks and logs or buried in the earth. Seeds, nuts, raisins, dry vegetable pieces, crushed dog biscuits, dog chow and grains can be scattered throughout the enclosure. Peanut butter, jam and liquid baby food can be painted on walls, branches and climbing structures to encourage the bear to climb and stretch to reach. Favourite food items can also be frozen inside blocks of ice or stuffed into tubes forcing the bear to manipulate the objects to acquire the food.

Old furs, animal carcasses, large bones and articles from other animal enclosures can be introduced to provide olfactory stimulation.

### **Hippopotamus** (*Hippopotamus amphibious*)

**Species Description:** One of the world's largest and heaviest terrestrial animals (some individuals can weigh up to 9,000 pounds), the Hippopotamus is found throughout sub-Saharan Africa. They have bulky bodies, huge, tusk-like, canine teeth and numerous adaptations, such as protruding eyes and nostrils, that favour life in an aquatic environment. Their preferred habitat is deep river water with extensive reed beds and grasslands nearby. As strict vegetarians, they forage for grasses along riverbanks, sometimes moving many kilometers through the water in a single day. They also forage substantial distances inland looking for food, usually at night. While some hippos may occur singly, they tend to live in groups of up to 30 animals, with the core of these groups being mothers with young.

**Exhibit Description:** Two hippos (mother and young) were observed in a grossly undersized, open pen contained by a shallow, dry moat, fencing on one side and the wall of a large service building at the rear. The moat was approximately 1 meter deep, with a molded concrete wall sloping up toward the animal pen at an angle of approximately 45 degrees. At the top of the moat was a single strand hot-wire meant to keep the hippos from descending to its narrow, grassy floor.

The bulk of the exhibit consists of a flat, hardpan, substrate area surrounding a comparatively large shallow, concrete pool (approximately 5 adult hippo body lengths long), deep enough in the middle for the animals to completely submerge. A fairly wide, very noticeable pathway has been worn around the perimeter of the pool, while the rest of the exhibit floor had an extremely sparse, closely-cropped grass and weed cover.

The animals are in plain site at all times as the exhibit is entirely flat and open. No visual baffles have been provided to give the animals privacy and no shade structures were in place. No environmental enrichment of any kind was observed.

**Comments:** The small size, flat, barren, ground surface, open exposure and shallow pool make this exhibit one of the most unimaginative and boring at the Granby Zoo. It does little, if anything, to encourage species-typical behaviours. The fact that Granby Zoo maintains hippos at all is also concerning, since hippos are not cold tolerant and would have to be kept inside for a considerable period of time each year.

In the wild, hippos routinely leave the water at dusk and spend the night grazing, sometimes many kilometers from water, returning at dawn. They usually spread out alone, except for females with calves, and can eat up to 70 kilograms of grass each night. Because the Granby Zoo hippo exhibit is so small (the hippos can only move a short distance before they encounter a moat, fence or wall), there is little or no opportunity to graze in a natural way.

A much larger, grassy paddock with contoured surface topography is required.

The pool in the hippo enclosure is extremely small. While the animals are able to submerge, they cannot move more than a few steps in either direction before they emerge from the water again. In the wild, hippos spend approximately 50% of their time submerged in shallow rivers and lakes, sometimes moving considerable distances underwater each day. Much of the biology and behaviour of hippos is focused more on existence in an aquatic environment than it is for life in a terrestrial environment. This fact seems to have been almost completely ignored by the Granby Zoo. Their hippo pool does little to encourage species-typical behaviours and should be replaced with a substantially larger, more complex swimming area, preferably multiple pools, including a large pond and mud wallows.

There appeared to have been no attempt to environmentally enrich the hippo enclosure. Ideally, a substantial increase in overall space, including pasture areas for grazing and an expanded water area would be the appropriate enrichment vehicles. Utilizing standard enrichment strategies, such as adding novel items into the exhibit, might provide some relief in the short term but it won't alleviate the underlying cause of the problem which is the inadequacy of the enclosure itself.

In the on-exhibit area the hippos should also be provided with visual baffles that give them an opportunity to remove themselves from public view and shade structures that provide cool areas for resting.

Until new accommodation can be provided, the Granby Zoo should consider a number of enrichment strategies to provide some novelty and variation for the hippos. They include, but are not limited to vertical furniture (rubbing/scratching posts), rock piles for belly scratching, sprinklers, water jets, misters, sturdy objects securely hung from above that can be pushed, large balls and logs that can be pushed along the ground, floating objects that can be pushed around the pool, sod strips, earth piles, mud wallows and novel feeding methods. Conspecific vocalizations can also be used for enrichment.

In the wild, hippos are social creatures, usually found in groups of up to 30 animals. Ideally in captivity, they should be housed in their appropriate social groupings, not singly or in pairs. The single mother with calf that I observed is inappropriate. Other zoos, such as Europe's Noorder Dierenpark, maintain more natural-sized hippo herds.

The Granby Zoo hippo enclosure is grossly inadequate. Ideally, because of the inappropriate climate, the animals should be moved to more appropriate accommodation elsewhere. At a minimum, a new, more appropriate enclosure should be constructed.

#### **White Rhinoceros (*Ceratherium simum*)**

**Species Description:** The White Rhinoceros is a large herbivorous grazing animal that is now restricted to protected game preserves and parks in several African countries. Their preferred habitat is open woodland and grassland with brush. They are powerfully built with short legs and a long head with a wide mouth that they swing from side to side while grazing. Groups of up to 14 rhinos have been observed, but smaller ones are more the norm. Dominant bulls tend to maintain a somewhat solitary existence. They generally stay within their home range for their entire lives; typically an area from 1.5 – 11 square kilometers in size.

**Exhibit Description:** One White rhino was observed in a flat, hardpan substrate enclosure estimated at slightly more than .75 ha in size. Most of the enclosure floor was bare, except for some modest grass and weed growth along the fenceline, around rocks and trees. Several areas were quite muddy because of standing water that had not yet drained away or evaporated. The enclosure was ringed by fencing made of vertically-placed, rustic, log struts. The only enclosure features were a few large rocks, a couple of mature trees (dying because the bark had been rubbed off their trunks) and a wooden "rubbing" frame. The few living trees in the enclosure had been hot-wired to prevent damage by the rhino. Visitors are able to observe the entire enclosure from two viewing stations and there appears to be little, if any, opportunity for the animal to remove itself from public view. No environmental enrichment was noted in the enclosure.

**Comments:** Some of the comments contained in the previous section on hippos also apply, in whole or in part, to the white rhino enclosure. While somewhat more spacious than the hippo exhibit, the enclosure is still undersized, drab, relatively barren and does little to encourage species-typical behaviours.

In the wild white rhinos typically inhabit ranges from 60 – 260 ha where they will graze for up to 12 hours each day, so it's important that they be housed in large enclosures that allow them to move and graze in a natural fashion. The Granby Zoo exhibit does not provide opportunities to do so.

White rhinos are a somewhat social species with relatively high densities (12.5 per 5 sq. km.) being found in some protected areas in the wild. Females and juveniles associate in small groups, while adult males tend to be more or less solitary. I was unable to determine whether or not the single rhinoceros I observed was a male or female. If it was a female, it should be kept with other animals. Some zoos maintain white rhinos in single male, multi female herds, mixed in with other ungulate species as space allows.

Until a more appropriate, grassed paddock enclosure can be constructed, several strategies can be employed to increase the level of stimulation available to the rhino. They include, but are not limited to, multiple rubbing/scratching posts at varying heights, rock piles for belly scratching, sprinklers, water jets, misters, sturdy objects securely hung from above for jousting, large balls and logs that can be pushed along the ground, sod strips, earth piles, dry and wet wallows, olfactory stimulation through the application of scents to furniture, bulk feed spatially well distributed and novel feeding methods.

#### **Asian Elephant (*Elephas maximus*)**

**Species Description:** The distinctive trunk, ears and immense size of elephants make them one of the most recognizable animals in the world. Asian elephants are found in parts of India and Southeast Asia, including Sumatra and Borneo, usually in jungle situated next to open, grassy areas. As vegetarians, they consume large quantities of grass, bark, roots, leaves, stems and fruit. They spend a considerable portion of each day finding and eating food, rarely foraging in one area for more than a few days, but tend to rest during the hottest temperatures. Asian elephants are highly social, forming stable herds of 20 or more female relatives, led by an elder matriarch. Their home range is typically a minimum of 30 sq. km in size, but may be much larger.

**Exhibit Description:** Two female Asian elephants were observed in a barren, undersized paddock opposite the zoo's main entrance. The enclosure consisted of a relatively flat, hardpan substrate and lacked significant features. The only items observed were one chained tire and a vertical log structure with canopy. Most of the pen was devoid of vegetation and there did not appear to be any opportunity for privacy. The visitor walkway ran along the length of the front of the exhibit. I was unable to view the interior accommodation.

**Comments:** Elephants are among the most difficult species to house properly in captivity. They are extremely intelligent, socially complex animals that can live for up to 90 years. For this reason, they require very large, complex spaces, appropriate social groupings, and a significant amount of psychological stimulation. The Granby Zoo's undersized, tedious enclosure does not provide the space or complexity that elephants require. The enclosure is reminiscent of old-style elephant enclosures found in zoos throughout the world.

The Granby Zoo should take steps to relocate both elephants to more suitable accommodation elsewhere. The current social environment and housing conditions, particularly during Quebec's cold winter months, are not acceptable.

Until the elephants can be moved, a number of strategies can be employed by the Granby Zoo to provide physical and psychological stimulation. Providing large sections of trees that can be eaten, stomped on and played with will provide hours of activity. Introducing play objects, such as tires, plastic barrels, boomer balls, beer barrels filled with treats that the elephants have to shake to get out, earth mounds filled with food treats, self-activated sprinklers and water jets may encourage activity. Even unusual, novel items, such as giant mirrors that allow elephants to look at themselves or giving them materials to paint with have proven successful in providing stimulation.



## **Lowland Gorilla (*Gorilla gorilla*)**

**Species Description:** Lowland gorillas are the world's largest primates, reaching up to 1.8 meters in height and nearly 225 kg. in weight. They have broad chests, muscular bodies, large, strong hands and feet and blackish hair. Found in the tropical rainforests of midwest Africa, these entirely herbivorous animals live in peaceful groups consisting of one adult male, several adult females, as well as juvenile and infant young. A family group will typically remain in a territory from 9 – 14 square miles in size.

**Exhibit Description:** One male and two female Lowland gorillas were observed in an extremely small, very poor "landscape immersion" exhibit in the AFRIKA Pavilion. A great deal of the exhibit consisted of molded gunite made to resemble rock outcrops. The gunite rose to a height of approximately 3 ½ - 4 meters at the back of the exhibit and approximately 3 ½ meters at the side. Containers, housing several plant species, were located at the top of the gunite on the side walls, presumably to create an impression of "naturalness." Above the gunite on both the side and back walls, the concrete brick wall of the room was in plain view. Some of it had been painted over with a mural.

The gunite floor of the exhibit was tiered allowing the animals to move from the floor level to a level a couple of meters higher. On one side of the exhibit, a gunite mound extended to a height of approximately 3 ½ - 4 meters. The animals could climb to the top of this mound. Straw and/or wood wool was present on the floor of the exhibit, and in several areas, appeared to be several inches deep.

A small, tiered waterfall ran from the top of the mound to the floor below and then over the floor and out of the exhibit. A number of thick, primarily vertical tree trunks and branches (mostly denuded of bark) were placed throughout the exhibit. A section of fire hose was suspended between two of the trunks and two feeding tubes were hanging from branches.

There appeared to be little opportunity to obtain privacy and two of the animals sat with their backs to the viewing windows. This exhibit is reminiscent of the Buffalo Zoo's infamous gorilla "grotto," an abominable cave-like enclosure that in no way, shape or form resembles the natural habitat of gorillas.

**Comments:** This exhibit, like the AFRIKA Pavilion's other primate exhibits, is very poor. The simulated rock outcrops make the display look more like a cave than a forest, presenting the animals in a completely unnatural context. It appears as though most of the funds spent on this exhibit went to superficial, cosmetic features (rock cliffs, waterfall) that have little relevance to the apes themselves. It may have served the animals better for the Granby Zoo to have built a far more complex, interesting, but artificial looking exhibit.

The vertical tree branches placed throughout the exhibit should be replaced with new branches with intact bark. The existing smooth branches are inherently boring and are probably less attractive for climbing because of their smoothness. Ideally, a large, moveable, wooden climbing structure should be constructed in the exhibit and a variety of branches of varying sizes with intact leaves and bark should be introduced and replaced as needed. Additional fire hoses, as well as rope ladders and climbing apparatus could expand the usable vertical space.

The enclosure substrate is entirely hard, except for areas where deep litter has been provided. Additional areas of deep litter should be provided and "sandboxes" should be created by sectioning off portions of the floor and covering them with appropriate substrate materials.

Over the past ten years, a great deal has been published on the topic of primate enrichment, so I won't discuss it in detail here. Instead, I'll just mention a few ways of enriching gorilla enclosures. Possible enrichment strategies include, but are not limited to, browse, log feeders, hammocks, boomer balls, traffic cones, tires, rubber boots, cardboard boxes, newspapers, magazines, phone books, sod strips, popsicles, food treats frozen in blocks of ice, shredded ice, radio and television.

Some zoo managers refuse to incorporate television and other "artificial" items into their enrichment programming claiming they aren't natural and will detract from the overall viewer experience. They seem to overlook the fact that captivity itself is inherently unnatural, so anything that positively affects animal wellbeing in captivity should be

utilized. As well, the use of radio and television can be restricted to non-visitor hours or to areas of the enclosure not observable from the public gallery. Because their exhibit is so unnatural, the Granby Zoo should consider all strategies for enrichment.

In addition, scatter feeding and hiding food items on a daily basis will increase foraging and exploratory behaviour.

Overall, the “concrete” gorilla exhibit is undersized, “hard” and boring. Eventually, it should be replaced with a larger more natural exhibit, or the animals should be moved to more appropriate accommodation elsewhere.

### **Andean Condor (*Vultur gryphus*)**

**Species Description:** While diminishing in numbers, the Andean condor, the world’s largest bird of prey, can still be found in several mountainous regions of South America. Since they are predominantly scavengers, they prefer open areas that enhance their chances of locating dead and dying animals as they soar high on thermals for up to 150 km each day. Juvenile and unpaired adults may roost together in groups, while breeding birds will roost in pairs. Occasionally, large groups will gather at feeding sites.

**Exhibit Description:** A single Andean condor was observed in a rectangular, chainlink enclosure abutting a wooden, two story building. The entire floor surface of the enclosure was relatively flat and grass covered. A large natural tree branch, completely denuded of bark, ran lengthwise along the middle of the enclosure approximately 3 meters off the ground. Two shorter, but similar, bare branches were located at a lower level in the front portion of the enclosure, closest to the visitor walkway. There were no privacy opportunities available in the on-display area, so the condor would have to enter its wooden, box located high on the back wall of the exhibit to remove itself from public view.

**Comments:** Andean condors are soaring birds that spend a great deal of time in the air. Typically, in captivity, the space provided to these birds is so small they are only able to flap their wings a couple of times as they jump from one perch to another. Because they can’t fly, they spend a great deal of time sitting, so the type and placement of perches they’re provided with is extremely important.

The Granby Zoo enclosure contains a single, long perch running along the length of the exhibit about halfway between the floor and ceiling, as well as a couple of lower perches. There are no perches that would allow the bird to retreat to the maximum distance possible in the exhibit from visitors.

The ability of the public to view birds of prey at close range can be stressful in ways that are difficult to recognize. Many animals feel threatened through direct viewing. In the wild, birds will take flight and retreat to a high vantage point when they feel threatened. Since captive birds of prey don’t typically have the ability to move substantive distances from the people viewing them, they must be provided with the ability to remove themselves from public view at the furthest distance they can. A higher perch, or series of perches, some equipped with visual baffles, nearer the back wall of the enclosure and perches high in the back corners may provide more secure perching locations.

In addition, natural perches should be placed at varying heights as close to the side, front and back of each cage wall as possible, but not so close as to cause plumage damage to perched birds who may rub wing tips or tail up against the wire. This placement will facilitate exercise through horizontal movement from one side of the cage to the other, even if flight is not possible.

Perching options for the condor at the Granby Zoo are extremely limited and need to be upgraded. Condors are heavy birds with long toes and relatively weak feet. While they stand on flat surfaces and large branches in the wild, these surfaces comprise a range of different sizes, textures and locations. They also spend a considerable portion of each day flying, so their feet are not in constant contact with any surface.

The existing perch sites are hard and static. Standing for long periods on the wrong types of surfaces can lead to problematic foot conditions, so a number of different natural perches of varying diameter should be provided. Existing smooth perch sites should be removed or covered with thick, coarse astro-turf to make them soft.

While there hasn't been a great deal of work in the development of enrichment strategies for condors, introducing novel items, providing enclosure furnishings such as springy branch work and ladders, and experimenting with different kinds of feeding, such as whole carcass feeds, may encourage activity.

## General Commentary

### 1. Enclosures and Space

The layout of the enclosures within the Granby Zoo appeared haphazard. The institution does not seem to be cohesively organized into any kind of taxonomic, climatic or zoogeographic pattern. While some animals are displayed according to taxonomic grouping (e.g., Reptile Pavilion, Big Cat Complex), others are arranged zoogeographically (e.g., AFRIKA Pavilion), while still others are housed according to the type of environment they inhabit (e.g., the Caverne Des Debrouillards). A few species (e.g., Andean condor, harbour seals) are housed in enclosures situated randomly throughout the facility. Except in a few isolated instances, enclosures and service buildings have not been harmoniously integrated into the surrounding landscape. This piecemeal arrangement is probably the result of the Granby Zoo adding new exhibits to their existing facility as funds became available during their nearly 50 years of operation.

The majority of Granby Zoo's enclosures seem to have been designed and constructed by traditional architects and construction tradespeople who had little or no background in biological or ethological disciplines and who therefore did not recognize and understand the importance of designing exhibits with environmental variability and features appropriate to the species-specific requirements of the animals being exhibited. As a result, the exhibits tend to be small, barren and "hard."

While many of Granby Zoo's enclosures are functional from a safety, maintenance and animal viewing perspective, they do little to address the biological and ethological needs of the animals. In captivity, animals should be allowed to live as much as possible according to their evolved natural history. So it is critically important that zoo architects, management and animal care staff do everything possible to facilitate the free expression of a broad range of natural behaviours and locomotor activity. The large mammal enclosures, big cat complex, black bear cage and many other Granby Zoo exhibits are indicative of a design-type that should no longer be considered acceptable. They contain and display animals, but they do not provide them with a suitable living environment. They are, for the most part, unimaginative and tedious.

The provision of appropriate space is a major consideration in designing enclosures so that they address animal needs. Unfortunately, many of Granby Zoo's enclosures are grossly undersized and do little to satisfy the spatial requirements of the animals they contain. Species, such as elephants and bears, that would normally travel considerable distances on a daily basis in the wild or who may engage in prolonged periods of hunting or foraging, are able to walk or trot only a few body lengths distance to the other side of their enclosure, before having to turn around and come back. The Asian elephants, white rhino, hippopotamus, big cats, black bear, lowland gorilla and many other species were confined in undersized enclosures that did little to encourage species typical behaviours and movements.

The new AFRIKA Pavilion, reportedly constructed at a cost of \$6 million dollars, was particularly disturbing in this regard. While I thought all of the exhibits in this area, including those housing mandrill and colubus monkey, were quite poor, the Pavilion's flagship exhibit housing Lowland gorillas was particularly bad. Not only was it extremely small, it did not possess even a hint of naturalness. In fact, this exhibit no more resembled a gorilla's natural forest environment than a cave does.

I was also concerned about the Caverne Des Debrouillards display. This complex of "jewel" exhibits and aquariums feature a variety of invertebrate and vertebrate species, including the cave cricket, axolotl, Taiwan beauty snake, Cuban boa, Tokay gecko, bats, common porcupine and raccoon, in small glass-fronted enclosures. Visitors enter through one door and follow a path through a simulated limestone cavern before exiting through another door.

Probably the most egregious design flaw in this complex of exhibits is the amount of usable space allocated to many of the animals. In some cases, the small amount of space provided virtually eliminated the animal's ability to function in a normal fashion and to engage in a range of natural behaviours. Many specimens seem to have been reduced to nothing more than living museum pieces. If the goal of this exhibit is to convey information about the animals within the context of their natural ecology, then the Caverne Des Debrouillards is an unmitigated failure.

In some cases, the severe space restriction also precludes any opportunity for the animals to remove themselves from public view. Since the physiological and behavioural effects of confinement and display are not clearly understood for many species, particularly invertebrates, fish, amphibians and reptiles, zoo architects and managers should apply the “precautionary principle.” In the absence of formal scientific investigations, they should not assume that species lower on the phylogenetic scale require smaller and less complex environments to maintain wellbeing. Instead, they should assume the opposite, that all animals require both space and complexity. Every effort must be made to provide each animal with the largest, most complex and stimulating environment possible, including areas for them to obtain privacy. This is not the case in the Caverne Des Debroillards.

In many of Granby Zoo’s exhibits, lack of space is problematic in other ways. For example, the small amount of space makes it difficult to maintain living plants (grasses, bushes, trees) in some of the animal exhibits. The large mammal and ungulate pens feature hardpan or bare earth substrates with very little vegetation. This is probably due to grazing/browsing pressure by the animals or destruction by trampling since the animals have nowhere else to go. Ground vegetation can be successfully maintained in large mammal and ungulate enclosures if they have enough space. Grassy substrates are more behaviourally stimulating than bare earth.

The small size of some of the primate enclosures (gorilla, mandrill) make it difficult to include living plants as a permanent display feature. Many primates rip, pull and break living vegetation in their enclosures, so maintenance of living plants in enclosures requires a large amount of space with a substantive number of plants or continual replacement of those that are damaged. The Granby Zoo’s relatively small enclosures cannot sustain enough living vegetation to compensate for losses caused by destructive animals. Other zoos, where primates are housed in sizeable enclosures, are able to maintain a variety of living plants in the on-exhibit areas.

A long-term institutional plan that addresses enclosure design and space allocation should be developed. Part of this should include a systematic plan to upgrade and/or replace existing animal accommodation. Serious consideration should be given to reducing the size of the live collection, keeping only those species outlined in the new institutional plan that can be accommodated appropriately. A major reorganization and downsizing of the live collection should also result in larger, more complex exhibits and greater attention for the animals that remain. Improved conditions should also facilitate increased engagement in natural behaviours, a decrease in the display of abnormal activities and a more engaging, educational experience for visitors.

In the meantime, the process of downsizing should begin through attrition and, where appropriate, the transfer of animals to more appropriate accommodation elsewhere. A gradual reduction in the number of live animals should, in some cases, allow existing enclosures to be expanded. For example, if the number of animals in the big cat complex were to be substantially reduced, many of the existing cages could be amalgamated into larger, more complex exhibits.

As well, vacated exhibits (especially those now occupied by large animals) could be adapted for the display of smaller species that are currently kept in inadequate accommodation.

The Granby Zoo also makes very poor use of the vertical space in enclosures. A few of the zoo’s exhibits contain ropes, branches and platforms but they tend to be few and far between and only provide limited access to the third dimension. Facilitating use of vertical space can substantially increase an animal’s utilizable living area, even for species that are primarily terrestrial (fennec fox). This will definitely make things more interesting for the animals, as well as for the visitors watching them. As part of a comprehensive refurbishment plan, the Granby Zoo should develop and implement a strategy for increasing vertical space usage. This can be accomplished through the introduction of items such as ropes, hoses, hammocks, swings, ladders, ramps, platforms, tree branches, wooden climbing structures, monkey bars, high perches and platforms.

## **2. Substrates**

Captive animals should not be housed permanently on hard substrates or wire floors. While these surfaces may be desirable from a management point of view because they are easy to clean, they may predispose animals to sores and other problematic physical conditions. They are also inherently boring, and do not provide any of the behavioural opportunities available to animals housed on natural, soft substrates.

A significant number of enclosures at the Granby Zoo were not equipped with appropriate substrate materials. The large mammal enclosures (Asian elephant, white rhinoceros, hippopotamus) contained tedious, hardpan substrates with little vegetative cover. Many of the ungulates were housed in barren, earth-based pens, an inherently boring situation as well, especially for those species that in nature would normally spend a considerable portion of each day grazing or browsing on grassy terrain.

A diverse range of species (gorilla, leopard, caracal, fennec fox, black bear, porcupine) were housed on inappropriate, hard substrates that provided almost no stimulation and may be physically uncomfortable. This situation is particularly problematic for species that engage in a great deal of ground-related activity (black bear) or that spend a considerable amount of time underground (fennec fox).

Clearly, many of the enclosure substrates at the Granby Zoo are inappropriate. Over the long term, all of these should be replaced with surfaces that satisfy the biological and behavioural requirements of the animals. The boring, hardpan surfaces and earth paddocks currently provided for large mammals and ungulates must be changed to softer, more behaviourally-enhanced grassy surfaces. As well, the tedious interior topography of the exhibits must be changed to a more complex, contoured style of landscaping, incorporating mounds, bermes, rock piles and other features.

The hard, tiled and concrete substrates provided in many of the enclosures (big cats, mandrill, porcupine) are also entirely inappropriate and must be changed completely. Until they are, all exhibits with hard floor surfaces should be provided with “soft” substrate areas. This can be easily accomplished by covering the existing enclosure substrate with several inches of an appropriate material or by covering smaller, sectioned off portions of the exhibit floor.

Those animals that root and dig more than a few inches into the earth (black bears) or who naturally frequent burrows (fennec fox) should be provided with deep earth pits that allow them to engage in these activities. Providing novel substrates, such as permanent or temporary bark, mulch and sand pits (sometimes as simple as providing a large garden planter filled to the brim) should be considered as well. They can be useful additions to an organized environmental enrichment program, especially when used for hiding food items.

In addition to providing permanent soft substrates, primates and many other species can be provided with a deep litter (a layer of straw, wood chips or wood wool) covering the entire floor surface of their enclosures. When combined with scatter feeding of food items, a range of foraging activities that keep the animals occupied for considerable periods of time can be encouraged. They also facilitate play behaviours and nest building. I only observed a few exhibits (part of the lowland gorilla enclosure) with deep litter.

### **3. Privacy**

Providing opportunities for animals to remove themselves from public view or the view of cagemates is a critical component of appropriate animal housing and husbandry. Lack of privacy can cause considerable stress, particularly when animals are viewed from above or when visitors are allowed to get too close. Species that establish social hierarchies or territories in captivity must also be provided with privacy opportunities so that subordinate individuals can remove themselves from physical and/or visual contact with more aggressive, dominant cagemates.

A significant number of animals at the Granby Zoo did not appear to have any opportunity to obtain privacy. The Asian elephant, white rhino, hippopotamus, several cat species, Asiatic black bear, common porcupine and numerous others did not seem able to remove themselves from public view in their on-exhibit areas. In fact, it appeared as though many of them were subject to shut-out (a common practice whereby animals are denied access to off-exhibit areas, usually with the express intention of forcing them to be on display) as they did not seem to have access to off-display areas.

The Granby Zoo should act immediately to ensure that all animals can remove themselves from public view or, where necessary, from the view of cagemates. While the creation of new, more appropriately designed enclosures is the long-term solution, a number of tactics can be employed in the short term to address this need.

Simply allowing animals free access to their off-exhibit accommodation is an easy way of providing privacy. It is not however a long-term solution to the problem, because animals should be able to remove themselves from public view in their on-exhibit area. As a first step though, it's quick, easy and requires minimal effort on the part of zoo staff. All of Granby Zoo's animals should have free access to off-exhibit areas.

Providing a range of enclosure furnishings that animals can hide in, under or behind is another obvious way of providing privacy. Large rocks, rock piles, large logs, root balls, hollow logs, deep litter, long grasses, shrubs, browse piles, living trees, high sheltered perches, artificial visual baffles, fences, stone walls, camouflage screen and large pipes that animals can enter are just a few of the many items that can be added to enclosures to create privacy opportunities. The Granby Zoo's many barren enclosures should be outfitted with items that create privacy opportunities.

Another way of increasing privacy for captive animals is to restrict viewing opportunities by visitors. This can be accomplished by closing off visitor viewing stations or screening over sections of enclosures that are normally visible. In concert with other measures, this can be a useful measure to employ at the Granby Zoo. For example, a significant portion of the black bear dome could be screened allowing visitor viewing from only one or two stations.

#### **4. Environmental enrichment**

Like their counterparts in the wild, captive animals need to engage in a range of instinctive and learned behaviours, such as seeking shelter, nest sites, mates, and food resources; avoiding predators and parasites; defending territories; and exploring new spaces to maintain psychological health and well-being. Most captive animals are, to a large degree, restricted or prevented from expressing a significant portion of their natural behavioural regime. This can result in frustration, boredom and increased levels of stress resulting in an increase in abnormal behaviours, such as inactivity and stereotypies (these behaviours are not usually the first sign that something is wrong but the end result of a destructive husbandry process), as well as an overall decrease in environmental interaction as the animal attempts to cope by withdrawing into itself.

For their own health and well-being captive wild animals must be encouraged to engage in a range of natural activity. If an animal spends a significant portion of each day foraging for food in the wild, the restriction or loss of that activity must be compensated for. If the natural activity cannot be replicated in the captive situation, the animal must be encouraged to engage in other activities to replace it. Compensation may, in part, be accomplished through a program of environmental enrichment. However, it's important to remember that environmental enrichment is a compensatory mechanism that addresses deficiencies inherent in husbandry and housing systems that would otherwise be dealt with through natural means.

Very little environmental enrichment was evident at the Granby Zoo. Most enclosures were uninspired, tedious and barren. A few contained modest quantities of live vegetation, floor litter or novel items, but the majority were almost completely devoid of meaningful stimulation. There was no evidence of any kind of organized environmental enrichment program.

A significant number of animals were inactive (e.g., cougar, sand cat, gorilla, white rhino, American bison), while others were displaying what appeared to be stereotypic behaviours (e.g., jaguar, ocelot, Asiatic black bear).

An institution-wide environmental enrichment action plan, incorporating both short and long-term goals, should be developed and implemented. Environmental enrichment must be considered, by both staff and management, as an essential component of the daily animal husbandry regime. It should be developed, implemented and regularly evaluated by a committee of staff and should not be left as the responsibility of one person or to individual keepers or curators to implement as they see fit. The program must be fully supported, both financially and materially, by Granby Zoo management.

An almost limitless range of strategies and tactics can be employed to environmentally enrich captive animal environments. As part of their action plan, the Granby Zoo should consider a range of enrichment vehicles for each

enclosure including, but not limited to, the introduction of appropriate furnishings; novel objects for animals to use and manipulate; olfactory, auditory and visual stimulation; and a multi-faceted feeding program.

While an aggressive, properly designed and implemented program of environmental enrichment should be viewed as essential because it will substantially increase the quality of life experienced by Granby's animals, it should not be considered the answer to their problems. Over the long-term, new enclosures that are designed and constructed according to each animal's species-specific needs are required.

## **5. Education**

Like most other zoological institutions that have a considerable volume of visitor traffic, the Granby Zoo has some potential to become a vehicle for public education. Unfortunately, its current value in this regard, particularly for casual zoo visitors, is negligible.

The fact that the Granby Zoo has not organized its live collection into a coordinated presentation format based on taxonomic, climatic or zoogeographic characteristics, or a unified combination thereof, makes the goal of educating casual zoo visitors very difficult to achieve. Ideally, a site organizational theme, developed in conjunction with an overall zoo plan, would provide a focus for conveying certain kinds of messages. Carefully designed pedestrian circulation routes through the zoo would allow storylines, meant to facilitate conveyance of information to visitors, to be developed. At the Granby Zoo, the pathways leading up to, through and away from the AFRIKA Pavilion adhere to this concept, but there is little else in the zoo that does. Visitors currently move from one exhibit to another to amusement park rides to the aquatic park with no apparent theme connecting them. This is a very confusing format that is not conducive to the educational process.

The live animal displays are also problematic from an educational perspective. While some animals are exhibited in semi-natural enclosures (Bennett's wallaby in a large grassy paddock), many are still housed in biologically irrelevant, educationally counterproductive displays (Asian elephant, Hippopotamus, American bison, Common porcupine) that have little, if any, interpretive value to visitors.

My reason for saying this is that the design of a considerable portion of the current animal accommodation makes it impossible for animals to express a full range of species-typical movements and behaviours. In addition, an overall lack of physical and behavioural stimulation within the enclosures has resulted in high levels of inactivity (animals sitting, lying or sleeping a great deal of the time) and, in some cases, the development of abnormal stereotypic behaviours (tiger pacing, bear pacing). Finally, with few exceptions, the animals are not presented in a way that provides visitors with any idea of their natural ecological context. Instead, they are exhibited as individual specimens in largely ugly, artificial surroundings in which they are able to do little that could be considered "natural."

Presentable, engaging, educational graphics providing, at the very least, the animal's name, scientific name, distribution, habitat, behaviour and status in the wild should be available at every exhibit. Additional signage providing information about taxonomy and biology, wildlife conservation issues, local, national and international environmental concerns and other subjects should also be developed.

The Granby Zoo's educational potential remains unfulfilled at present. There is a paucity of information about the animals for casual zoo visitors, and even less about their plight in the wild. The zoo should develop an educational master plan, incorporating increased use of exhibit graphics, participatory non-animal displays, organized interpretive sessions and other recognized, low-cost educational strategies aimed at casual zoo visitors. The plan should integrate educational programming into every aspect of the zoo's operations and should be implemented by a committee made up of staff from all of the zoo's departments, as well as members of the public.

The animal exhibits themselves must also be drastically improved if they are to have any educational value at all. So many of the exhibits are in such an impoverished condition that only miseducation and a devaluation of wildlife in the eyes of visitors is likely to occur. Captive animals must be able to express a range of species-typical behaviours and movements. Unfortunately, this is not the case at the Granby Zoo.



## **Conclusions – The Five Freedoms**

The Granby Zoo seems to be moving in several different directions at the same time. On the one hand, the development of AMAZOO indicates a move toward a more family-oriented kind of amusement park, with a somewhat decreased emphasis on the display of live animals. On the other hand, the relatively new and expensive AFRIKA Pavilion and the now defunct proposal to construct a dolphinarium indicate that the Granby Zoo hopes to expand its live animal component.

It seems obvious to this author that the addition of high profile attractions, such as AMAZOO, the AFRIKA Pavilion, and possibly a dolphinarium at some future point, are attempts to attract paying customers. In all likelihood, these attractions would provide only short-term respite from the problems at hand. The Granby Zoo is an aging, menagerie-style animal collection that lacks any kind of cohesive institutional organization. The existing animal exhibits are, for the most part, poorly designed, undersized and boring.

A look back at the Five Freedoms of Animal Welfare, outlined earlier in this paper, clearly indicates that the Granby Zoo must substantially upgrade its animal husbandry and housing. At its most basic level, the first Freedom regarding thirst, hunger and malnutrition appears to be satisfied. However, I saw little evidence that food items were presented in a way that facilitated natural foraging behaviors and consumption patterns. This shortfall must be addressed.

The second Freedom requiring animals to be free from thermal and physical discomfort through the provision of an appropriate environment, including shelter and a comfortable resting area, doesn't appear to be satisfied in several cases. Numerous animals were observed without access to appropriate substrates (black bear, porcupine, gorilla), comfortable rest areas (black bear, jaguar) and several enclosures appeared to lack adequate protection from the elements, such as shade structures in the on-exhibit areas (hippo). Numerous other environmental conditions (humidity, photoperiod, temperature and ventilation) could not be assessed during this investigation because it would have required access to off-exhibit areas.

Freedom from pain, injury and disease by prevention or rapid diagnosis and treatment could not be determined. However, some factors that may lead to pain, injury or disease, such as inappropriate accommodation and lack of privacy clearly need to be addressed.

The fourth Freedom requiring animals to be free to express normal behavior by providing sufficient space, proper facilities and company of the animals own kind is definitely not being satisfied. The small, physically and behaviourally impoverished spaces provided to many of Granby's animals, as well as the lack of compensatory environmental enrichment, are serious deficiencies in this zoo that must be addressed.

The final Freedom, that animals be free from fear and distress by ensuring conditions and treatment that avoid mental suffering may not be satisfied in many cases. The high level of inactivity and the display of stereotypic behaviours clearly indicate that aspects of housing and husbandry are problematic.

## **Recommendations**

1. Develop a long-term institutional plan (including a site organizational plan) that provides a clear direction for change.
2. Place a moratorium on the development of new, animal-based, "flagship" attractions until existing animal housing problems have been resolved.
3. Develop and implement a program of enclosure upgrading based on the Five Freedoms of animal welfare.
4. Develop and implement an institutional environmental enrichment plan, incorporating both short and long-term goals, that is entirely integrated into the daily husbandry regime of all animals. The plan

should be developed, implemented and evaluated by a committee of staff and should receive the appropriate level of material and financial support.

5. Develop and implement a formal exhibit-based educational program, including comprehensive, standardized graphics, for casual zoo visitors.
6. Furnish all exhibits containing primarily or exclusively hard substrate surfaces with soft substrate areas.
7. Rototill all hardpan substrate surfaces to make them softer and landscape the ground surface in outdoor ungulate paddocks to make them more variable.
8. Equip all exhibits with shade and shelter structures and, where appropriate, “soft” rest areas.
9. Equip all exhibits with multiple privacy opportunities.
10. Immediately equip all exhibits with “basic” species-appropriate furnishings.
11. Relocate to more appropriate accommodation elsewhere all subtropical and tropical animal species (e.g., hippopotamus, white rhino) that require large outdoor paddocks.

