

**WHAT'S A  
POLAR BEAR  
DOING IN  
THE TROPICS?**



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by the  
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The Animal Concerns Research and Education Society (Acres) is a local charity, founded in 2001 by a group of Singaporeans. Acres aims to:

- Foster respect and compassion for all animals.
- Improve the living conditions and welfare of animals in captivity.
- Educate people on lifestyle choices which do not involve the abuse of animals and which are environment-friendly.

Our approach is **Scientific, Creative, Practical and Positive.**



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## EXECUTIVE SUMMARY

1. Polar bears are poor candidates for captivity, even in the best of circumstances. They are extremely wide-ranging, highly intelligent, cold weather carnivores, so they are extremely problematic to house and care for in captivity. In fact, many experts believe they are one of the species most ill suited to captivity.
2. Studies by researchers at Oxford University have indicated that the fact that polar bears have large home ranges in the wild may be the reason why they suffer problems in captivity such as stereotypical behaviour and high infant mortality. As stated in the report: “our findings indicate that the keeping of naturally wide-ranging carnivores should either be fundamentally improved or phased out”.<sup>1</sup>
3. Zoos in other countries e.g. the United Kingdom, Switzerland and Germany have stopped keeping polar bears on welfare grounds.<sup>2</sup> The polar bear specialist group of the World Conservation Union (IUCN) does not advocate captive breeding of polar bears.<sup>3</sup>
4. Wildlife Reserves Singapore, which owns Singapore Zoo, states that “We love our flora and fauna, and treat our animals in a dignified manner. We are always increasing our level of standards with changing times and are not easily satisfied with status quo”.<sup>4</sup> The Singapore Zoo should therefore consider scientific findings highlighting species (e.g. polar bears) that do not adapt well in captivity and phase out the keeping of those species.
5. Singapore Zoo may not meet the conditions it is legally obliged to adhere to. It is licensed by the Agri-Food and Veterinary Authority under the Animal and Birds (Pet Shop and Exhibition) Rules 2004: Permanent Animal Exhibitions. Under this license, the Singapore Zoo has to comply with various requirements, which include that the animal’s physical, physiological and psychological needs must be considered in order to assess whether or not the welfare needs of a particular group of animals are met.<sup>5</sup> Under the Animal and Birds (Pet Shop and Exhibition) Rules 2004 the Director-General may compound the relevant offence(s) committed by the licensee or revoke or suspend the license if the operator contravenes or fails to comply with any condition(s) of this license.<sup>5</sup>

6. Polar bears are adapted to the Arctic cold and cannot physiologically adapt to a Singapore's tropical climate. The polar bears at the Singapore Zoo are housed in an open-air enclosure and show clear signs that they are suffering from heat stress. Inuka and Sheba spent 36.0 per cent and 38.7 per cent of the time panting respectively. Inuka and Sheba also spent 23.6 per cent and 14.3 per cent of the time lying flat respectively.
7. Sheba was born in a German zoo and came to Singapore as a cub and Inuka was born in Singapore, therefore it is true that neither bear has experienced the conditions in the Arctic. However, this does not mean that the bears can somehow have physically 'adapted' to the climate in Singapore. They still possess all the physiological adaptations to life in the Arctic.
8. Singapore Zoo obviously recognises the fact that climate in Singapore is hot and it is uncomfortable to be outdoors in the heat as it offers air conditioned restaurants and six spacious air conditioned shelters purely for visitors to cool off as they walk around the zoo.
9. In 2005 there was much public debate in Singapore over the keeping of Arctic dogs in a tropical country following the death of an Alaskan Malamut who died after being left out in the sun by its owner. Former Singapore Zoo chief Bernard Harrison agreed that keeping the dogs here is "crazy". "They are simply not designed for this kind of weather" he said.<sup>6</sup>
10. The polar bear enclosure at Singapore Zoo is undersized, barren, poorly designed, does not accommodate any soft substrates and does little to satisfy the biological and behavioural needs of the bears. The polar bear enclosure only provides only approximately 0.0000005 per cent of the polar bear's natural home range.
11. Both Inuka and Sheba displayed a high level of inactivity, 42.5 per cent and 64.6 per cent respectively. Inuka and Sheba also displayed a high level of abnormal stereotypic behaviours, 64.5 per cent and 56.7 per cent of the active periods respectively.
12. The high levels of inactivity and abnormal stereotypic behaviours clearly indicate an abnormal animal-environment interaction<sup>7</sup>, almost certainly caused by a sub-optimal environment that does not satisfy the natural, species-specific behavioural needs of polar bears.



13. Stereotypies in captive animals have been associated with poor welfare for five decades.<sup>8</sup> The expression of stereotypic behaviour is “the most common visible sign of psychological disorder in all species of zoo bears”.<sup>9</sup>
14. Obvious physical signs of distress in both bears are evident. Both have exhibited substantial fur loss and both appear to have lost a lot of lean muscle mass.<sup>10</sup>
15. Singapore Zoo does not meet the minimum requirements stated in the Province of Manitoba (Canada) *Polar Bear Protection Act 2003*. The Act includes a set of specific requirements regarding the keeping of polar bears in captivity.<sup>11</sup> These guidelines outline the minimum standards of care and husbandry that must be satisfied by those institutions seeking orphaned polar bears from Manitoba.
16. Singapore Zoo also fails to follow many of the recommendations in relation to enclosure and husbandry standards for polar bears made in guidelines on bear/polar bear husbandry written by zoological associations and animal welfare organizations.<sup>2,12,13,14,15,16,17</sup>
17. Acres has previously discussed the situation of the polar bears with Singapore Zoo and in 2004 presented a report to the zoo “Report on Polar Bears at the Singapore Zoological Gardens”, produced in collaboration with WSPA.<sup>18</sup>
18. Else Poulsen, an expert in the field of polar bear husbandry with over twenty five years of experience working in zoos, inspected the polar bear enclosure in 2005. She concluded “Inuka and Sheba are living in a wholly substandard environment and need to be removed from that environment.”<sup>10</sup>
19. Acres and WSPA have made a number of recommendations to the zoo to improve the polar bears well being.<sup>18</sup> Some have been implemented, however the majority have not, including providing air conditioning, providing soft substrates, providing an area where the bears can construct day beds and chilling the pool water.
20. As an interim measure, to mitigate at least some of the adverse effects of current conditions, Acres recommends that the zoo converts the outdoor enclosure to be fully air-conditioned, chills the pool water and makes improvements to the existing enclosure, such as providing soft substrates. The husbandry methods need to be modified and a more effective enrichment programme should be implemented to improve the bears’ well-being.

21. Acres does not support the construction of a new enclosure for the Singapore Zoo polar bears. It is not possible to construct an exhibit in Singapore that can accommodate polar bears in a way that satisfies their biological and behavioural needs and that can completely mitigate against the deleterious effects of Singapore's tropical climate.
22. When Sheba passes away, Acres urges that Inuka should be sent to a more appropriate facility and climate, perhaps a rehabilitation centre in Canada, as he still has many years ahead of him in which he can lead a better quality of life. Singapore Zoo should not acquire any more polar bears in the future on welfare grounds.
23. Without a polar bear exhibit, Singapore Zoo will surely not experience any reduction in visitor numbers, as it is doubtful that visitors come to the zoo only to see the polar bears. In fact, progressive steps taken by Singapore Zoo will garner more public support for it.

# CHAPTER 1

## INTRODUCTION

### 1.1 Campaign objectives



**Inuka, the male polar bear at Singapore Zoo.**

#### Short term

- To improve the welfare of the polar bears at Singapore Zoo.

#### Long term

- When Sheba (the female polar bear) passes away, to relocate Inuka (the male polar bear) to a facility where the local climate is more suitable and one that meets the standards listed in the Appendix as far as possible.
- To end the further import and keeping of polar bears in captivity in Singapore.

## 1.2 Introduction to Singapore Zoo and their polar bears

### 1.2.1 Singapore Zoo

Opened in 1973 and an establishment of Wildlife Reserves Singapore, Singapore Zoo's mission is to inspire an appreciation of nature through exciting and meaningful wildlife experiences. It has a vision of being the foremost institution in the world. Wildlife Reserves Singapore further states that "We love our flora and fauna, and treat our animals in a dignified manner.<sup>4</sup> We are always increasing our level of standards with changing times and are not easily satisfied with status quo".<sup>4</sup>

Indeed, Singapore Zoo should strive to maintain a high standard of animal welfare and to consider scientific findings highlighting species that do not adapt well in captivity (e.g. polar bears). By doing so, they will be able to maintain and enhance their reputation and continue to attract large numbers of Singaporeans and foreign visitors.

In recent years, Singapore Zoo's decision to end of the chimpanzee photography sessions and the circus-style animal shows has been welcomed by both local and international wildlife protection/animal welfare organisations. This is clearly a step in the right direction and will contribute to Singapore Zoo's continued success.

Hopefully, these progressive steps that Singapore Zoo takes, will also in turn encourage other Southeast Asian Zoos to improve the welfare of their animals.

Singapore Zoo has the financial capability of maintaining a high standard of animal welfare. For the financial year of 2004/2005, Wildlife Reserves Singapore had a surplus of thirteen million dollars.<sup>4</sup>

### 1.2.2 Singapore Zoo polar bears



**Left: Inuka.; Right: Sheba.**

There are two adult polar bears currently housed at Singapore Zoo:

- Sheba, a twenty-eight year old female.
- Inuka, her fifteen year old male offspring.

Sheba arrived at the zoo in 1978 as a two year old cub from Cologne Zoo in Germany. Inuka was born in 1990 at Singapore Zoo.

Another polar bear, who has since died, was previously housed in the same enclosure.

Sheba and Inuka are currently living in an open air enclosure that was built over twenty years ago. There are a number of significant welfare concerns for both Sheba and Inuka and obvious behavioural and physical signs of distress have been observed for both bears. These problems have been observed in the scientific study presented in this report and has also been highlighted in a report submitted to the zoo in 2004 by Acres and WSPA.<sup>18</sup>



**Above: Polar bear enclosure.**  
**Below: Seated viewing area at the polar bear enclosure.**



### 1.3 Introduction to polar bears (*Ursus maritimus*)



Young polar bear.

Polar bears are the largest non-aquatic carnivore alive in the world today. Adult males may weigh from about 350 to over 650 kilograms whilst females normally weigh 150-250 kilograms.<sup>19</sup>

Polar bears are found throughout the ice-covered waters of the circumpolar Arctic.<sup>19</sup> Scientists have identified twelve subpopulations among an estimated 40,000 polar bears that range the frozen waters of the United States, Canada, Denmark, Norway and Russia.<sup>20</sup>

In the wild, the changing seasons strongly influence the behaviour of polar bears, with the seasonal influences on wild bears closely related to climatic conditions and availability of food.<sup>21</sup> With the changing seasons come changes in distribution, activity levels, hunting activity, mating behaviour and reproductive behaviour.

Polar bears are primarily carnivorous, feeding mainly on seals. Their diet is supplemented with seaweed, clams, crabs, and fish collected while the

animal is diving. They also eat carrion, such as dead whales, washed ashore on Arctic coastlines.<sup>22</sup>

Although polar bears are not migratory animals, their seasonal movements in some areas may be considerable. Polar bears on the pelagic drift ice in the Barents Sea undertake extensive annual migrations following the seasonal changes in sea ice, yielding annual range sizes of 250,000 square kilometres.<sup>23</sup> One marked polar bear was found to have crossed the Arctic, covering 3,200 kilometres in one year.<sup>22</sup> In one day, polar bears can travel eighty kilometres or more.<sup>24</sup> In an average lifetime, a polar bear may traverse 260,000 square kilometres.<sup>22</sup>

Polar bears are good swimmers and are able to swim 100 to 120 kilometres, and maybe even farther, without landing.<sup>25</sup> Their webbed paws propel them through the water at speeds of up to six and a half kilometres per hour. While diving, polar bears can remain underwater for up to two minutes.<sup>25</sup> Scientists logged one non-stop swim by a polar bear of 200 miles.<sup>20</sup>

Polar bears are generally solitary in the wild, although large congregations do occur in certain areas, usually at significant sources of food, at certain times of the year.<sup>25</sup>



## 1.4 Welfare of wild animals in captivity



**Captive polar bears at a Japanese zoo**

The captive environment presents a vastly different environment to what animals have been adapted to. Compared to the dynamic and complex nature of the natural environment, the captive one is frequently more static. Physical factors such as temperature, humidity, structural features, and the type, quantity, and availability of food are typically more predictable in a captive environment.<sup>26</sup> As a result of this predictability, captive environments frequently offer less stimulation and opportunity for choice than natural environments.<sup>26</sup>

Like their counterparts in the wild, captive animals need to engage in a variety of instinctive behaviours such as seeking shelter, nest sites, mates and food resources; avoiding predators and parasites; defending territories; and exploring new spaces.<sup>27</sup> However, most captives are, to a large degree, restricted or prevented from engaging in these behaviours.<sup>27</sup>

The behaviour of wild animals in captivity may also be under human control,<sup>28</sup> in contrast to the wild, where decisions are made based on the individual's own choices. This ability of the animal to have some control

over its environment appears to be crucial in stress reduction and therefore reduce the risk of associated health problems.<sup>29</sup>

Bears in captivity are highly susceptible to the development of abnormal behaviours, in particular stereotypies<sup>30,31,32</sup> and excessive inactivity.<sup>33</sup> Typical stereotypies behaviours displayed by bears include pacing, repetitive swimming, weaving, head-swaying and oral forms such as tongue-flicking and teeth grating.<sup>30</sup>

Suboptimal and restrictive captive conditions often result in the development of stereotypies,<sup>34</sup> which typically arise when an animal's environment lacks appropriate stimulation.<sup>35</sup> Stereotypies are behaviour patterns that are invariant in style, performed repetitively, and appear to have no function. They are of concern because they may indicate poor welfare, and are sometimes detrimental to health.<sup>30</sup>

Suboptimal conditions can also result in frustration and increased levels of stress, leading to development of aberrant behaviours such as hyperaggression, hypersexuality, lethargy and other problematic conditions.<sup>27</sup> Captive conditions also decrease the level of the animals' general reactivity and markedly change their behaviour.<sup>13</sup>

Most progressive zoos now recognize that confining animals in boring, behaviourally impoverished enclosures that fail to satisfy their species-specific needs is no longer acceptable.<sup>27</sup>

Each animal species has evolved adaptations to survive in their own particular natural environment. It is thus extremely important that zoo designers, zoo management and animal care staff allow for a free expression and utilization of these adaptations in captivity.<sup>27</sup> Progressive enrichment strategies should be implemented to encourage animals to take control of their own lives by providing an environment that allows them choice and control.

## **1.5 Welfare concerns for polar bears in captivity: International scientific studies**

Polar bears are poor candidates for captivity, even in the best circumstances. Captive polar bears are notorious for their tendency to exhibit repetitious stereotypic behaviours. These behaviours include head-swinging, pacing, tongue-flicking, and circular or to-and-fro patterns of swimming.<sup>36</sup> Other abnormal behaviours that have been described include head twisting and head weaving. Polar bears are particularly well known for pacing<sup>13</sup> and probably the most universal movement observed in almost any zoo in the world by polar bears is the expression of “head-body turns”. According to WSPA, this movement is often seen as part of pacing stereotypies, but may also be expressed as part of swimming stereotypies.<sup>2</sup>

### **1.5.1 British zoos studies**

Studies undertaken at British Zoos in the 1980s and 1990s documented and examined in detail the abnormal and stereotypic behaviours displayed by the polar bears there.<sup>36,37,38</sup>

In one survey carried out in British zoos between 1989 and 1991, all polar bears in these zoos showed stereotyped behaviours at one time or another, with the most common being that of pacing to-and-fro.<sup>36</sup> In this survey, zoo polar bears were recorded spending an average of thirty-three per cent of their day engaged in stereotyped behaviours. One polar bear spent sixty per cent of its time engaged in stereotyped behaviour.<sup>36</sup> In a separate study, abnormal behaviour was seen to be displayed by all polar bears in five British zoos.<sup>38</sup>

With captive polar bears, stereotypic behaviour is particularly resistant to change.<sup>36</sup> It is not only wild caught polar bears that are susceptible to developing these abnormal behaviours in captivity. Captive born individuals appear just as prone to development of abnormal behaviours, including stereotypic behaviours.<sup>38</sup>

Captive polar bears are also prone to other forms of abnormal behaviour. Polar bears have also been recorded displaying pronounced inactivity or apathy, for example sitting “trance-like” in one squatting position for hours at a time, staring at a wall.<sup>38</sup> It has been suggested that the original cause of this pointless squatting behaviour was boredom, this boredom then led to a form of ennui, then the bear became mentally moribund.<sup>38</sup> It has long been recognised that cerebral degeneration is a common feature amongst opportunist species kept in captivity.<sup>38</sup> Apathy in captive animals has been recorded by numerous scientists including Hediger (1950, 1955),<sup>39,40</sup> Meyer-Holzapfel (1968)<sup>41</sup> and Morris (1964)<sup>42</sup>.

Following his investigations into the welfare of captive polar bears, Stefan Omrod (1992) concluded “It is self-evident that polar bears have extreme difficulty in adjusting to the conditions of captivity. This is especially clear when one examines the widespread incidence of aberrant behaviour.” “The welfare of polar bears is not good. I believe that many suffered and may still be suffering, to some degree, in the process of adapting to their captive environment”.<sup>38</sup>

### 1.5.2 Oxford University report

A 2003 report by researchers Dr. Georgia Mason and Dr. Ros Clubb at Oxford University strongly indicated that a particular lifestyle in the wild confers vulnerability to welfare problems in captivity.<sup>1</sup> It appeared that home-range size and the daily distance travelled was the predicting factor in how well a species adapts to captivity. They suggested that problems including poor health and a tendency to pace are directly related to the size of the animal's home range in the wild. These problems were suggested to stem from constraints imposed on their natural behaviour.<sup>1</sup>

One of their key findings was that among the carnivores, naturally wide-ranging species show the most evidence of stress and/or psychological dysfunction in captivity.<sup>1</sup> The direct relationship of home range size to abnormal behaviour and high infant mortality in captivity existed independent of factors like the size and design of the enclosure and feeding schedules.<sup>1</sup>

It is unclear why natural home-range size is so important. "It could be that some carnivores roam because they are very sensitive to changing prey densities, or some species find roaming pleasurable, so they roam," Dr. Mason said. "They might be designed in such a way that roaming makes their central nervous system develop properly".<sup>43</sup>

**The typical zoo enclosure for a polar bear is one-millionth the size of its home range in the wild, which can reach 31,000 square miles, the authors said.<sup>1</sup> Some captive polar bears spend twenty five per cent of their day in what scientists call stereotypic pacing, and infant mortality for captive animals is around sixty five per cent.<sup>1</sup>**

The researchers based their findings on an analysis of some 1,200 journal articles covering four decades of observations of animals in the wild and at 500 zoos worldwide.<sup>43</sup>

The study revealed those species that are inherently likely to fare badly in zoos and other establishments. **One of the conclusions of the report was that polar bears and other wide-ranging carnivores do so poorly in captivity that zoos should either drastically improve their conditions or stop keeping them altogether. As stated in the report: "our findings indicate that the keeping of naturally wide-ranging carnivores should either be fundamentally improved or phased out".<sup>1</sup>**



## **CHAPTER 2**

### **LEGISLATION: INTERNATIONAL AND LOCAL**

This chapter provides a list of legislation which Singapore Zoo seemingly fails to adhere to. Further details are provided in Chapter 5.

#### **2.1 Singapore legislation<sup>5</sup>**

The Singapore Zoo is licensed by the Agri-Food and Veterinary Authority (AVA) under the Animal and Birds (Pet Shop and Exhibition) Rules 2004: Permanent Animal Exhibitions. AVA issues a permanent animal exhibition license to the zoo.

Under this license, the Singapore Zoo has to comply with the following conditions which are relevant to the keeping of polar bears at the Singapore Zoo. **This report provides clear evidence that the Singapore Zoo probably does not comply with the conditions with regard to their captive polar bears.**

Under the Animal and Birds (Pet Shop and Exhibition) Rules 2004, the Director-General may compound the relevant offence(s) committed by the licensee or revoke or suspend the license if the operator contravenes or fails to comply with any condition(s) of this license.

#### **Permanent Animal Exhibitions**

##### **Principles of Managing the Animals**

5 The licensee must be able to show that provision has been made to meet all requirements for the welfare of all animals in the collection. The animal's physical, physiological and psychological needs must be considered in order to assess whether or not the welfare needs of a particular animal or group of animals are met. Assessment of these needs must be based on an understanding of the species in the context of both its natural history and captive husbandry.

6 The licensee should keep the animals in an environment that is conducive to their well-being, to allow them to display their natural range of activities and behaviours.

7 The animals must not be subjected to any situation (such as overcrowding, conflict situations, etc) which could result in their suffering from chronic stress. Likewise, the animals must not be subjected to excessive public attention such as patting, riding, etc.

### Accommodation

20 All animal accommodation must provide the basic physical and psychological needs of the species.

21 There must be sufficient space available for the animal to exercise and rest as well as afford protection from rain, sun and strong winds.

22 Accommodation must be built to an acceptable design and the building materials durable.

24 The holding area is for short-term holding of animals. It must allow the animal to stand, sit and lie comfortably.

25 The licensee must provide evidence that the animal accommodation is designed to meet or exceed the biological requirements of the species.

Under the Animals and Birds Act, there are also certain guidelines relating to performing animals.

### Animal Performances

#### Conditions

2 The animals must not be forced to perform acts considered unnatural for the animal.

## **2.2 Canadian legislation**

The Wild Life Act of the Province of Newfoundland and Labrador includes specific requirements for the keeping of polar bears, including minimum permissible enclosure size, den requirements, exercising equipment requirements and pool requirements.<sup>44</sup>

The Province of Manitoba has a robust legislative and policy framework in place for the protection of polar bears. Recognising polar bears as a species with special requirements, a set of specific requirements in relation to the keeping of polar bears in captivity was included in The Polar Bear Protection Act, which was made law by the Government of Manitoba, Canada in 2003.<sup>11</sup>

These guidelines outline the minimum standards of care and husbandry that must be followed by those institutions housing polar bears. These strict guidelines must also be met by any zoos wishing to acquire a polar bear from Manitoba, which is the province that is the primary source of orphan polar bears.



## CHAPTER 3

# WELFARE CONCERNS FOR POLAR BEARS IN A TROPICAL CLIMATE

### 3.1 Detailed behavioural study: Effects of heat stress

#### 3.1.1 Methods

The polar bears at Singapore Zoo have no substrates in which to dig day beds, have no snow to lie in, have no ice cold water to plunge in and have no control over their offered diet. Therefore, the only ways they can attempt to cool down when outdoors is by panting, by adopting a posture in which some heat will be dissipated from their body (i.e. lying spread-eagled on the ground with thighs spread wide) and seeking out whatever shade is available.

This study documents the panting and lying flat behaviours. A preliminary study was conducted in August 2005. The preliminary study provided an opportunity for the observers to familiarise themselves with the behavioural repertoire of the animals, as well as refining the observation protocol.

Since data on behavioural states rather than events were collected and the subjects were sampled using a few behavioural categories, the polar bears were observed in their enclosures using instantaneous and scan animal sampling.<sup>45</sup> Scans were made every two minutes to determine which of the behaviour categories (defined in Table 3.1 and 3.2) each individual was engaged in. The sampling interval of two minutes was chosen after the preliminary study, since it gave the closest account of their behaviour.

*Ad libitum* sampling was also used to record novel or intriguing behaviours and actions.

Following the preliminary study, observations were made from September until December 2005 between the hours of approximately 1000 and 1730 for a total of seven days. Observations were made for 3150 minutes with a total of 1575 sample points.

**Table 3.1 Categories of behaviours used for study on panting**

<b>Activities</b>	<b>Definition</b>
Panting	Breathing with rapid, shallow breaths. Mouth is open, tongue may hang out of mouth
Others	Any behaviour other than panting or unable to view behaviour clearly

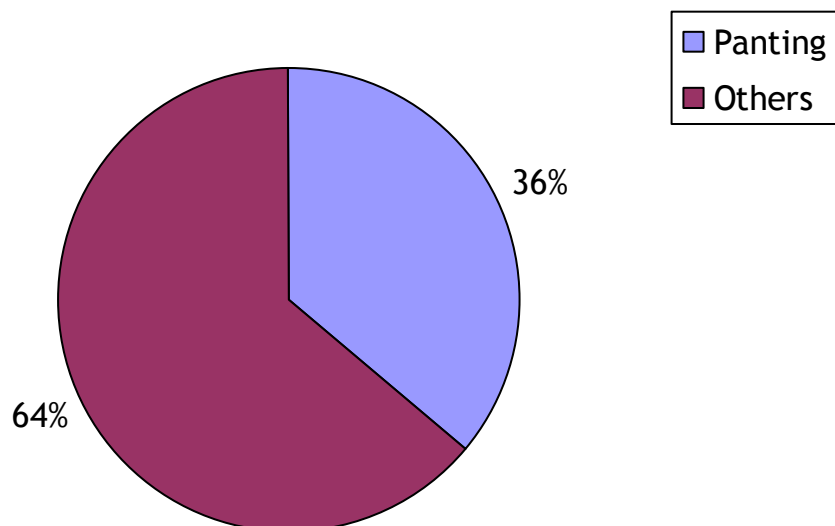
**Table 3.2 Categories of behaviours used for study on lying flat**

<b>Activities</b>	<b>Definition</b>
Lying flat	Lying on belly with armpits and inner thighs in contact with the floor
Others	Any behaviour other than lying flat on the floor or unable to view behaviour clearly

### 3.1.2 Results

**TABLE 3.3 Panting behaviour profile of Inuka**

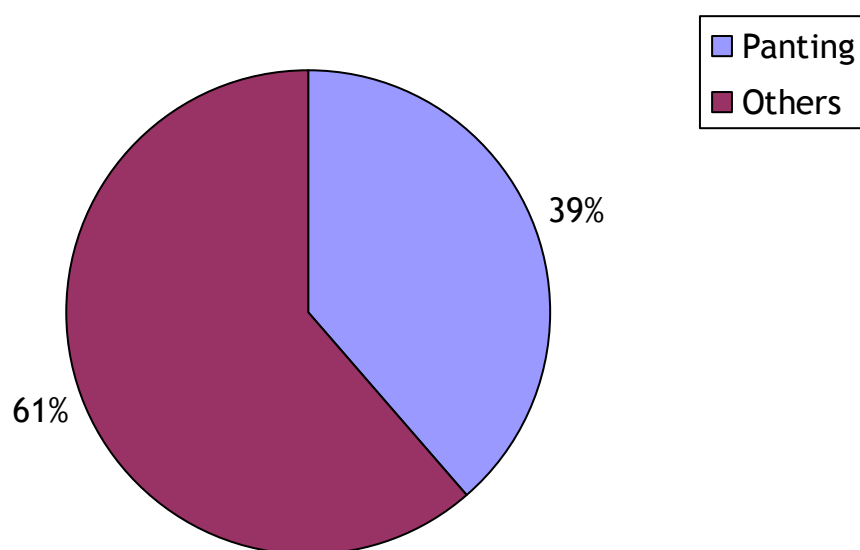
Activities	No. of sample points	Percentage
Panting	567	36.0
Others	1008	64.0



Percentage of occurrence of panting behaviours of Inuka.

**TABLE 3.4 Panting behaviour profile of Sheba**

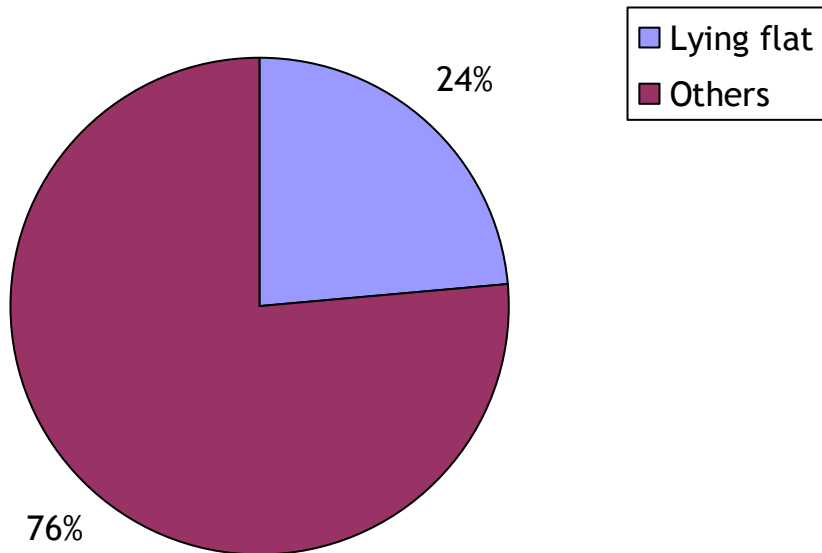
Activities	No. of sample points	Percentage
Panting	610	38.7
Others	965	61.3



Percentage of occurrence of panting behaviours of Sheba.

**TABLE 3.5 Lying flat behaviour profile of Inuka**

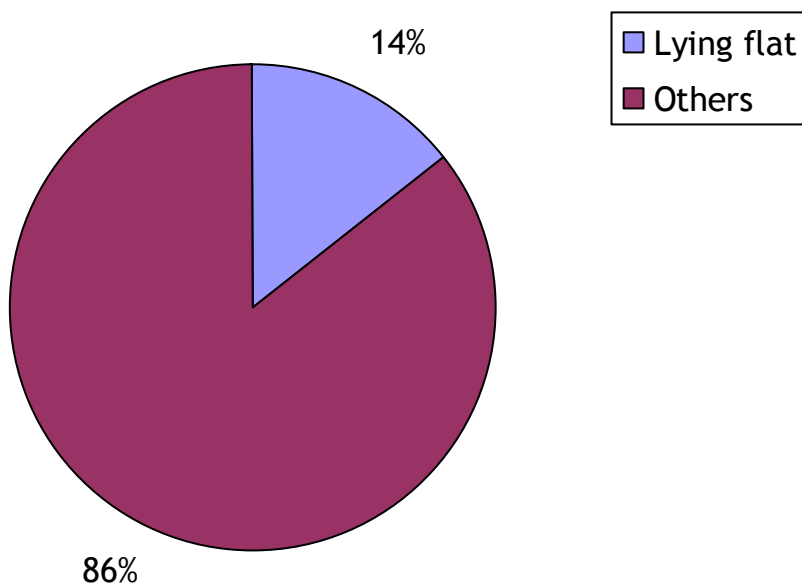
Activities	No. of sample points	Percentage
Lying flat	372	23.6
Others	1203	76.4



Percentage of occurrence of lying flat behaviours of Inuka.

**TABLE 3.6 Lying flat behaviour profile of Sheba**

Activities	No. of sample points	Percentage
Panting	226	14.3
Others	1349	85.7



Percentage of occurrence of lying flat behaviours of Sheba.

### 3.2 Discussion of results



**Sheba panting in the heat.**

The fact that the entire outdoor enclosure is open-air, i.e. the temperature is not regulated in a tropical climate, clearly poses a problem for the polar bears which are adapted to life in extremely cold environments. The polar bears at Singapore Zoo suffer from exposure to extreme heat on a daily basis. Physical stimuli such as heat and cold are known to be stressful to animals.<sup>46</sup>

**Both Inuka and Sheba showed clear signs that they are too hot.** Inuka and Sheba spent 36.0 per cent and 38.7 per cent of the time panting respectively. Inuka and Sheba also spent 23.6 per cent and 14.3 per cent of the time lying flat respectively.

### 3.2.1 Adaptation to Arctic cold

Polar bears are highly adapted to life in the Arctic with their fur, tough hide and blubber layer providing excellent insulation against the cold.<sup>19</sup> Polar bears are so well insulated that they give off no detectable heat.<sup>20</sup>

#### Physiological adaptations

##### *Fur and skin*

In response to the cold environment they live in, a polar bear's coat covers the entire body except for the footpads and the nose.<sup>47</sup> The soles of their paws are densely covered with hair so that only their toe pads and sole calluses are naked.<sup>25</sup> Polar bear fur is thick (640 hairs/0.39 square inch) with tufted guard hairs.<sup>48</sup> They have two layers of fur which serves as an additional means of protection against the cold. The hollow, oily guard hairs are two to six inches long and provide heat preservation while on land.<sup>48</sup> The fact that these guard hairs are hollow allows them to work as efficient solar collectors.<sup>49</sup> The long, clear guard hairs direct ultraviolet radiation towards the skin, which is black (a colour ideal for absorbing radiant heat), to soak up the energy of the sun more efficiently.<sup>47</sup> The guard hairs change 95% of the sun's rays to heat.<sup>48</sup>

##### *Blubber*

A thick layer of fat under the skin covers nearly all of a polar bear's body, including its head and the undersides of its paws. The blubber layer of a polar bear can be up to eleven centimetres thick.<sup>19</sup> On the bear's rump, this layer of fat may be up to twelve centimetres thick. Polar bears also have layers of fat up to four centimetres thick between their muscles, and particularly plump individuals may even have fat deposits up to three centimetres thick around their internal organs.<sup>25</sup> As the fat is stored subcutaneously, it serves as an excellent insulator.<sup>47</sup>

#### Climate experienced by wild bears

Most polar bears in the high Arctic live permanently on the frozen Arctic Ocean, following the edges of the sea ice as it slowly extends southward.<sup>22</sup> During the winter months in the Arctic, polar bears may encounter temperatures of  $-57^{\circ}\text{C}$ <sup>22</sup> whilst the wind chill factor may even cause temperatures to drop as low as  $-70^{\circ}\text{C}$ .<sup>50</sup>

Wild polar bears, once they are adults, only rarely seek refuge from these sub zero conditions (by building dens) due to their highly effective adaptations to life in the extreme cold. Sleeping outside during Arctic gales, snow coats their fur and drifts over their bodies, but their thick coats and layers of fat protect them from cold.<sup>22</sup>

The polar bears of Hudson Bay in Canada are the southernmost population of polar bears in the world and are forced to spend more time on land than their relatives in the High Arctic. Every year as the ice melts in Hudson Bay, the entire population is forced to spend about four months on land, from July until November.<sup>25</sup> This is an unusual and stressful situation for them.<sup>49</sup>

*Ears and tails*

The ears and tails of polar bears are shorter than those of other bears in order to avoid heat loss.<sup>47</sup>

### 3.2.2 Reasons for panting and lying flat

There is no doubt that polar bears are built to maintain their body heat. They do not have any physiological or morphological means of staying cool and therefore have to rely on behaviour to do so.<sup>10</sup>

In tropical climates, conditions of high temperature and humidity can be problematic for all animals. Many animals, particularly birds and mammals,



**Inuka lying flat to dissipate heat from his body.**

have the ability to elevate internal heat production when they get cold. However, they have greater difficulty cooling themselves down when they get 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 temperature, so captive animals must be given the opportunity to 'thermoregulate' by moving to cooler, more shady areas such as forest cover, burrows, rock cavities or pools.

For polar bears, the negative aspect of being so well insulated is that they overheat quickly, even in the Arctic.<sup>19</sup> Any temperature above freezing is warm to a polar bear; at 21.1 °C bears can become severely heat-stressed.<sup>20</sup>



As their fat is stored subcutaneously, it serves as an excellent insulator. As insulators work both ways, while it blocks the cold from penetrating, fat also inhibits heat from dissipating. Heat stress is therefore a problem polar bears face.<sup>47</sup>

The fact that polar bears are carnivorous adds to their problem of overheating. Eating meat and fat generates heat energy, therefore in the wild those polar bears that need to withstand periods of relative heat choose to fast or become vegetarian; the majority choose to fast.<sup>10</sup>

**In this study, both Sheba and Inuka spent a significant amount of time trying to cool down (panting and lying flat).**

As they do not have sweat glands, bears must cool themselves through several unique methods, shared by dogs.<sup>48</sup>

One way that polar bears may dissipate heat is through slobbering tongues, panting like a dog.<sup>48</sup> Panting is rapid, shallow respirations characterized by open-mouthed breathing, often accompanied by a protrusion of the tongue. When an animal pants it provides increased air flow over moist surfaces in the upper respiratory tract through rapid, shallow breathing. The increase in air flow causes an increase in evaporation from the upper respiratory tract. This evaporative cooling helps to regulate temperature.

Polar bears will adopt different postures when sleeping or lying depending on whether they want to get rid of heat or conserve it.<sup>19</sup> The hot spots of bears are the muscles, nose, ears, footpads and particularly the inside of the thighs and “armpits”. Polar bears will lie spread-eagled in their efforts to dissipate heat; their groins and armpits are the only spots on the body that have little fur and no fat.<sup>47</sup> They will lie with their legs (thighs) spread wide to lose heat, often sprawled on snowfields or patches of snow.<sup>48</sup>

### 3.2.3 Heat stress experienced in Singapore climate



Air-con shelters are provided by Singapore Zoo for visitors to cool off from the extreme heat.

The climate of Singapore is characterised by uniform temperature, high humidity and abundant rainfall. The average annual temperature is 27°C.<sup>51</sup> In extreme cases, the temperature can reach a maximum of 35.8°C.<sup>51</sup>

For a species that becomes severely heat stressed at 21°C,<sup>20</sup> there are obviously going to be welfare concerns in subjecting polar bears to daily temperatures of +27°C. The results of this study clearly prove this point.

Singapore Zoo obviously recognises the fact that climate in Singapore is hot and it is uncomfortable to be outdoors in the heat as it offers air conditioned restaurants and six spacious air conditioned shelters purely for visitors to cool off as they walk around the zoo.

In 2005 there was much public debate in Singapore over the keeping of Arctic dogs in a tropical country following the death of an Alaskan Malamut who died after being left out in the sun and deprived of water by its owner. Former zoo chief Bernard Harrison agreed that keeping the dogs here is “crazy”. “They are simply not designed for this kind of weather” he said.<sup>6</sup>

The fact that polar bears are physiologically unsuited to a tropical climate will cause them considerable physical discomfort and suffering in hot conditions. The minimum daily temperature given for Singapore is 23°C - approximately two degrees higher than the 21.1°C temperature at which the bears can become “severely heat stressed”.<sup>20</sup>



The polar bears at Singapore Zoo are housed in an open air enclosure and are only provided

**The polar bears have minimal shelter from the sun.**

with a limited shelter from the intense sun. This comes from a tarpaulin tied high above the enclosure and a small shaded area under the boulders measuring just a few metres squared. The limited shaded area provided by the concrete boulders does not appear large enough to comfortably accommodate both bears lying down.

The polar bears at the Singapore Zoo are fed meat on a daily basis and eating meat in the equatorial heat will generate more heat<sup>10</sup> Although in the wild, polar bears can choose to avoid eating meat if they are heat stressed, in captivity they may not have such a choice since they do not decide what they are fed.

In the report submitted by Acres to the zoo in 2004, it was recommended that, in the short term, the enclosure should be air conditioned as soon as possible.<sup>18</sup> However, this recommendation has not been implemented.

Acres also recommended the provision of additional shade by shade cloth or trees with wider canopies planted outside the enclosure.<sup>18</sup> This recommendation has been partially implemented with a new tarpaulin erected. Acres further recommended that until air conditioning could be installed, large fans could be used and some additional relief could be provided through the use of misters spraying a fine mist into the enclosure.<sup>18</sup> This advice was acted upon in early 2006, five fans are now located high up on the walls surrounding the front of the pool. These fans spray a mist over the pool area. However, the effectiveness of these fans is questionable.

They are relatively small and the mist only seems to effectively reach the pool area. The fans were recommended only to provide short-term relief and air-conditioning should still be installed.<sup>18</sup>

While air-conditioned dens in the back area of the enclosure are provided to the polar bears, the dens are incredibly small.<sup>10</sup>

If the male bear lies down sprawled on his belly on the floor of his den, he will fill the whole space.<sup>10</sup> If he remains in the open-air enclosure, he will suffer from heat stress. If he chooses to enter the air-conditioned dens, he will be confined to an extremely small area. Therefore, either way, he will be uncomfortable.

A pool is provided for the bears, however, the temperature of the water is not cold enough (17 degrees Celsius) for these Arctic animals (sub-zero temperatures). Sea water in the Arctic seas remains at around -20°C all year round.<sup>50</sup>

Sheba was born in a German zoo and came to Singapore as a cub and Inuka was born in Singapore, therefore it is true that neither bear has experienced natural Arctic conditions. **However, this does not mean that the bears are physically ‘adapted’ to the climate in Singapore. They still possess all the physiological adaptations to life in the Arctic.**

Polar bears cannot simply “adapt” to life in an unnatural climate in a short space of time (although they can modify their behaviour). **Adaptation is defined as an “evolutionary process involving genetic change by which a population becomes fitted to its prevailing environment”.**<sup>52</sup> Evolutionary processes, by definition, require the accumulation of genetic differences over long periods of time.

The welfare implications of keeping polar bears in unsuitable climates was highlighted in 2001, when there was international outrage at the conditions of polar bears being kept at a circus in Puerto Rico. The conditions the bears were kept in were judged “inhumane”: “The polar bears were kept in tropical heat of as much as 112°F (44.4°C), often without air conditioning or

Other ways of cooling down but not provided at Singapore Zoo

Polar bears can weather the heat by digging deep day beds in the soil until they reach the permafrost. These day beds are often shaded by long grasses and hummocky terrain.<sup>10</sup> They may also take mud and dust baths to cool down.<sup>48</sup>

Wild polar bears may jump into the cold Arctic Ocean to cool off if overheating.<sup>20</sup>

Wild polar bears will also balance energy expenditure and food intake to regulate their body temperature.<sup>48</sup>

However, the polar bears at Singapore Zoo cannot dig day beds, jump into ice cold waters nor choose the food they eat.

access to pools of cold water”.<sup>53</sup> The polar bears were subsequently confiscated by the U.S. Fish and Wildlife Service. When commenting on the case, Dr. Naomi Rose, Humane Society of the United States marine mammal scientist, noted that the bears were "forced to live in the most unnatural conditions. In the Arctic, air temperatures rarely exceed 65°F in the summer, and water temperatures always hover around freezing. In the winter temperatures dip well below zero. Even in this natural environment, overheating can be a serious concern for polar bears, especially if they exert themselves. Forcing these bears to perform tricks in tropical conditions places them at risk of overheating and suffering collapse.”<sup>53</sup>



### 3.2.4 Algal growth in fur



**Inuka covered in algae.**

Both bears have in the past shown signs of algal growth in the hair shaft, causing their fur to turn green. The algae responsible are thought to be blue-green algae (Cyanophyta) which grow inside the hollow outer guard hairs.<sup>54</sup>

Green fur is apparently a phenomenon only ever seen in captive polar bears and only in warm weather. There have been no comparable records of green bears in the wild, and no algal associations have been found with the pelts of wild bears.<sup>54</sup>

The algae itself does not harm the bear; it is what the algae signifies that is the problem. In captive polar bears in the summer months the habitat of the hollow hairs suit the algal cells well as it is warm and moist.<sup>54</sup>

The rampant algal infestation of the fur of the Singapore zoo polar bears is therefore a clear indication that their fur is warm and moist which strongly suggests their bodies are hot and also indicates that their fur is damp for substantial periods of time. The appearance of algae in the hair shaft is therefore likely to be partly caused by the fact that the bears have no soft substrates that they can use to dry off when they come out of the water.

### 3.3 Conclusion

The polar bears are undoubtedly too hot living in Singapore's climate. They are physiologically adapted to an Arctic climate and simply cannot adapt to a tropical climate.

There is no doubt that Singapore Zoo recognises the fact that the climate in Singapore is hot and it is uncomfortable to be outdoors in the heat as it offers numerous air conditioned facilities for visitors.

While air-conditioned dens in the back area of the enclosure are provided to the polar bears, the dens are grossly undersized.

If the male bear lies down sprawled on his belly on the floor of his den, he will fill the whole space. If he remains in the open-air enclosure, he will suffer from heat stress. If he chooses to enter the air-conditioned dens, he will be confined to an extremely small area. Therefore, either way, he will be uncomfortable.

Singapore Zoo does recognise the need for some animals, such as the jackass penguins, to have fully air-conditioned enclosures.

For the short-term improvement of the welfare of the polar bears, a fully air conditioned enclosure and chilled pool water should be provided for the bears.

However, in the long term, once Sheba passes away, Inuka should be relocated to a facility where the local climate is more suitable.





## CHAPTER 4

# EFFECTS OF CAPTIVITY ON SINGAPORE ZOO POLAR BEARS

### 4.1 Detailed behavioural study: Effects of captivity

#### 4.1.1 Methods

A preliminary study was conducted in August 2005. The preliminary study provided an opportunity for the observers to familiarise themselves with the behavioural repertoire of the animals, as well as refining the observation protocol.

Since data on behavioural states rather than events were collected and the subjects were sampled using a few behavioural categories (Table 4.1), the polar bears were observed in their enclosure using instantaneous and scan animal sampling.<sup>45</sup> Scans were made every two minutes to determine which of the behaviour categories (defined in Table 4.1 and 4.2) each individual was engaged in. The sampling interval of two minutes was chosen after the preliminary study, since it gave the closest account of their behaviour.

*Ad libitum* sampling was also used to record novel or intriguing behaviours and actions.

Following the preliminary study, observations were made from September until December 2005 between the hours of approximately 1000 and 1730 for a total of seven days. Observations were made for 3150 minutes with a total of 1575 sample points.

**Table 4.1 Categories of behaviours observed in the captive bears**

<b>Activities</b>	<b>Definition</b>
<b>Inactive</b>	
Resting	Body stationary and not involved in any significant activity.
<b>Active</b>	
Abnormal behaviour	A behaviour that, by and large, does not occur in the wild.
Show behaviour	An unnatural behaviour performed on demand during the token feeding show.
Locomotion	Movement of the entire body on land exceeding one metre.
Swimming	Movement through the water of more than one metre.
Feeding	Actively manipulating food with the intention of eating it. This category includes drinking.
Social behaviour	Any form of interaction where there is contact between individuals.
Play	Significantly manipulating and moving objects.
<b>Out of sight</b>	
Out of sight	Inside the night den.

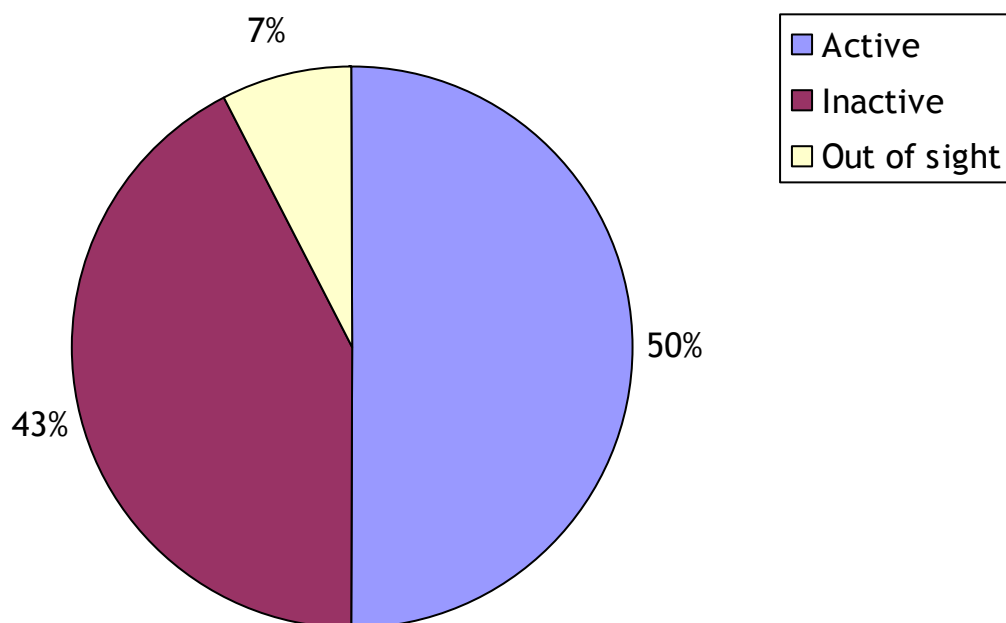
**Table 4.2 Categories of abnormal behaviours**

<b>Activities</b>	<b>Definition</b>
Head weaving	The moving of the head from side to side in a repetitive motion.
Pacing	The constant motion of an animal between two or more points in an enclosure in a repetitive manner.
Stereotypic swimming	A constant swimming pattern between two or more points within a pool in which movements are repetitive.
Tongue playing	Constant manipulation of the tongue with no apparent purpose.
Swaying	Side to side motion, sometimes causing the front legs to lift, causing a bouncing effect.
Neck turning	When an animal throws its head back in a violent circular motion, sometimes during a change of direction during pacing/walking about the cage, but may occur from a stationary position as the animal resumes forward movement.

### 4.1.2 Results

**TABLE 4.3 Activity pattern of Inuka**

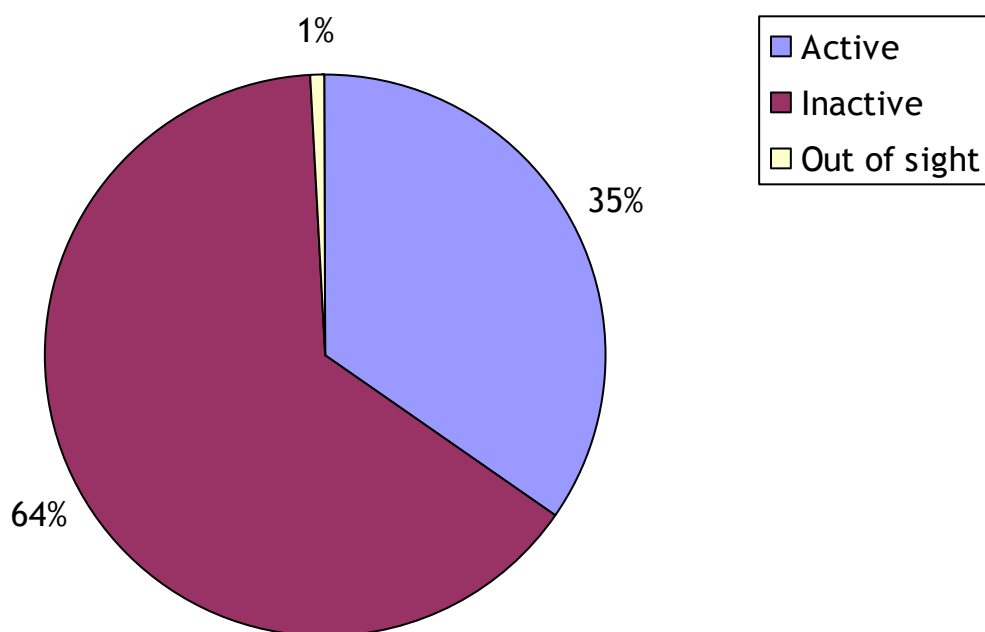
Activities	No. of sample points	Percentage
Resting	670	42.5
Abnormal	508	32.3
Show	8	0.5
Locomotion	50	3.2
Swimming	78	5.0
Feeding	47	3.0
Social	43	2.7
Play	53	3.4
Out of sight	118	7.5



Percentage of occurrence of inactive and active behaviours of Inuka.

**TABLE 4.4 Activity pattern of Sheba**

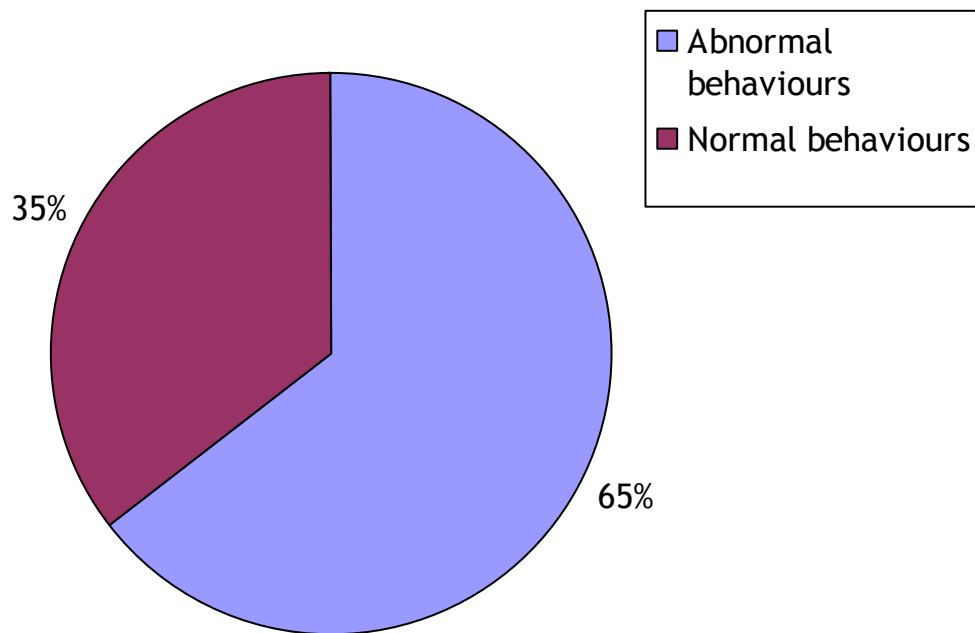
Activities	No. of sample points	Percentage
Resting	1018	64.6
Abnormal	310	19.7
Show	7	0.4
Locomotion	55	3.5
Swimming	60	3.8
Feeding	40	2.5
Social	43	2.7
Play	31	2.0
Out of sight	11	0.7



**Percentage of occurrence of inactive and active behaviours of Sheba.**

**TABLE 4.5 Abnormal behaviour profile of Inuka.**

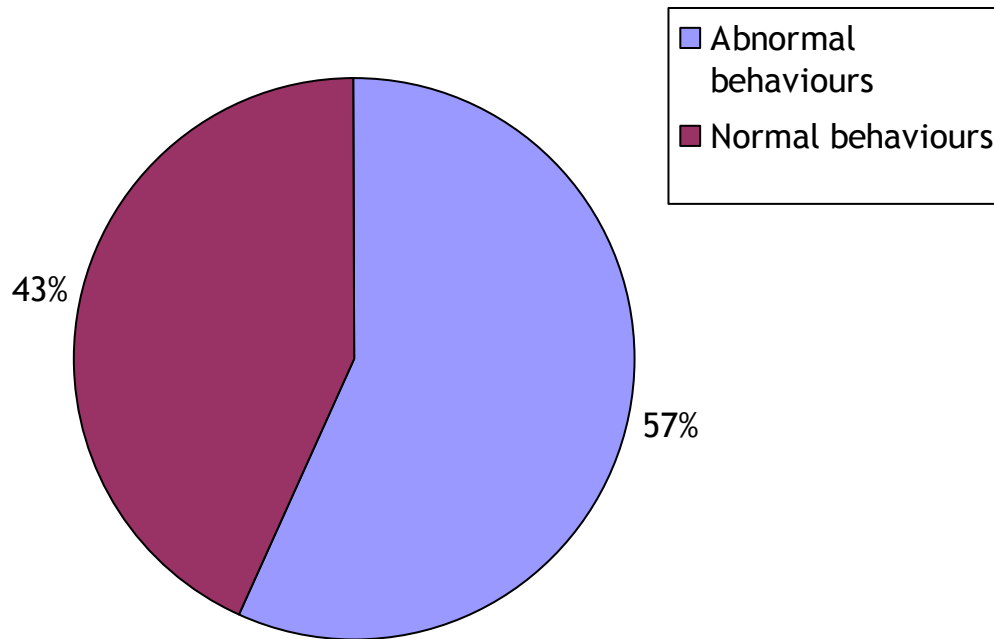
Activities	No. of sample points	Percentage
Head weaving	163	32.1
Pacing	97	19.1
Stereotypic swimming	238	46.9
Others	10	2.0



**Percentage of occurrence of abnormal behaviours displayed by Inuka during active periods.**

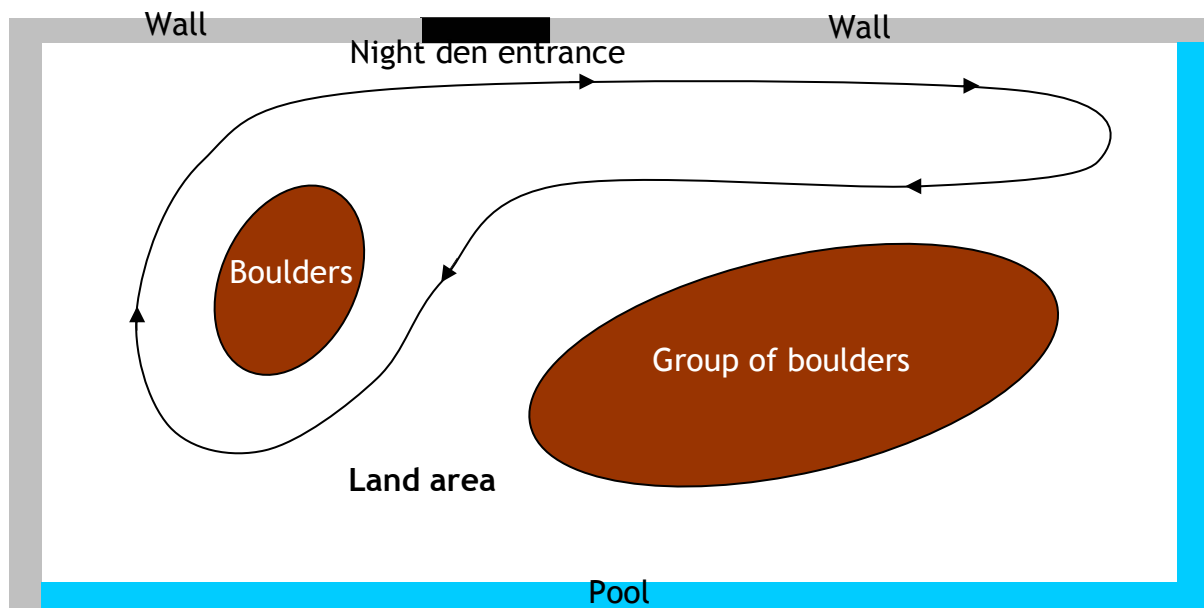
**TABLE 4.6 Abnormal behaviour profile of Sheba.**

Activities	No. of sample points	Percentage
Head weaving	278	89.7
Pacing	9	2.9
Stereotypic swimming	22	7.1
Others	1	0.3



**Percentage of occurrence of abnormal behaviours displayed by Sheba during active periods.**

## 4.2 Discussion of results



Above: Inuka pacing. He spent 64.5 per cent of the active periods performing stereotypic behaviours.

Below: The pacing route most commonly walked by Inuka.

Both Inuka and Sheba displayed high levels of inactivity; 42.5 per cent and 64.6 per cent respectively. Inuka and Sheba also displayed high levels of abnormal stereotypic behaviours; 64.5 per cent and 56.7 per cent of the active periods respectively.

#### 4.2.1 Prevalence of abnormal stereotypic behaviours and inactivity

Both bears spent a large proportion of their time inactive, especially Sheba. This is likely due in part to the extremely hot ambient temperatures that they are exposed to on a daily basis and the uninteresting living conditions.

Excessive inactivity in zoo animals is one of the recognised signs of chronic stress.<sup>7</sup> Animals housed in a barren environment show an overall decrease in interaction with the environment.<sup>55</sup> This decrease in interaction results in a high level of inactivity. The lack of sufficient space, climbing structures, manipulable objects, enrichment and proper feeding husbandry all contribute to this lack of activity and the resulting boredom of the bears. Broom and Johnson (1993) emphasise that a “profound lack of stimulation is something to which no vertebrate is likely to adapt”.<sup>56</sup>



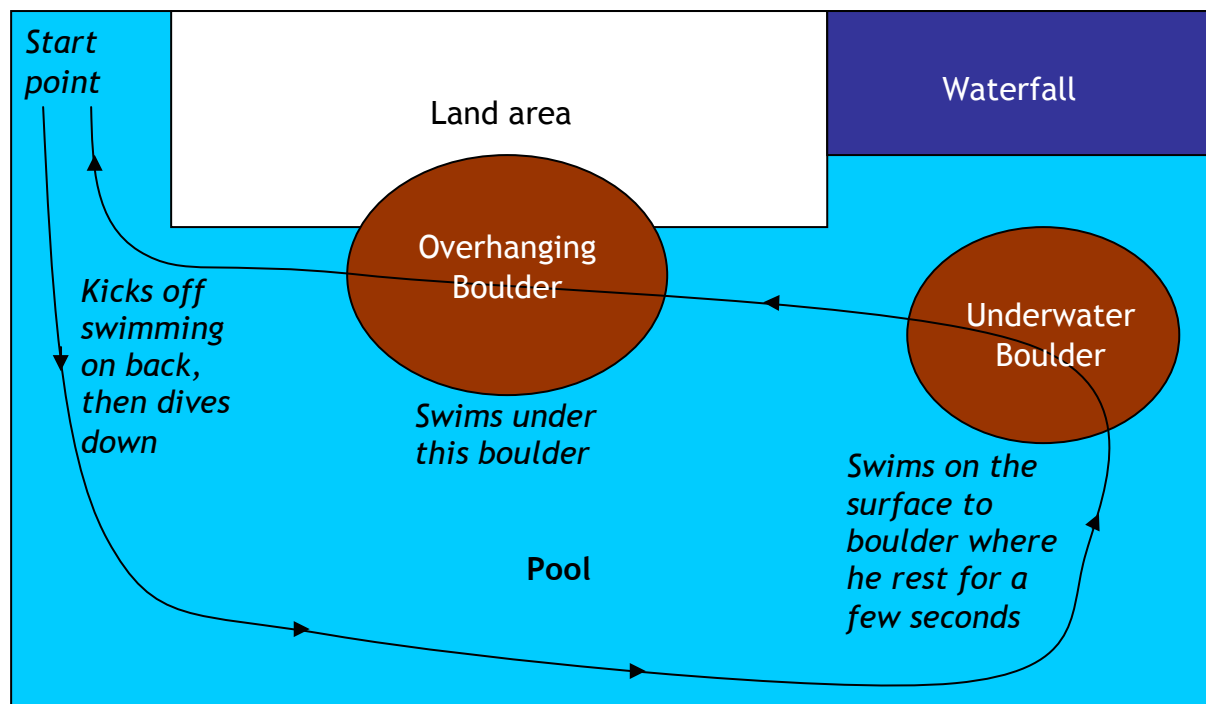
**Both polar bears spent an excessive amounts of time engaged in inactive behaviours.**

Whether in the wild or in captivity, every living organism is affected by the environment in which it lives.<sup>8</sup> Individuals have to constantly adapt to the changing environment. However, some environmental stimuli are so intense, prolonged or frequent that adaptation is impossible<sup>56</sup> and this result in an increased level of stress in the animals. This can be manifested in a variety of ways, including changes in the animal’s behaviour.

Following initial exposure to a stressful stimulus, the general emergency response is initiated, but once control over the situation is not achieved, two distinct coping mechanisms become activated in both humans and non-human animals.<sup>57</sup> They are referred to as active and passive chronic stress response.<sup>8</sup>

The active chronic stress response is characterized by active attempts to control a situation by fighting or fleeing. The passive chronic stress response is initiated after active strategies have failed to resolve the problem.<sup>8</sup> It is characterized by increased pituitary-adrenocortical activity, immobility and indications of depression.<sup>8</sup> It is also characterized by the behavioural





response termed 'learned helplessness'.<sup>58</sup> This involves the shift of the behaviour of the animals from an active state into a more passive, inactive state.

Both Sheba and Inuka have been recorded displaying various abnormal stereotypic behaviours including pacing and swimming in a stereotypic fashion. Sheba also appears to have developed a chronic tongue playing habit which has been recognised as a form of stereotypic behaviour.<sup>59,60</sup>

Stereotypic behaviours are repeatedly performed, relatively invariant movement patterns with no apparent function or goal.<sup>61</sup> These behaviours are clearly an indication of an abnormal animal-environment interaction.<sup>7</sup> For most wild mammals in captivity, this probably means that the animal grew up in or is currently living in an environment suboptimal for meeting its natural, species-specific behavioural needs.<sup>7</sup> These stereotypic behaviours are almost unique to captive animals.<sup>59</sup>

Stereotypes in captive animals have been associated with poor welfare for five decades.<sup>8</sup> This is because they tend to develop in situations that have been identified as stressful and aversive.<sup>7,62</sup> On the basis of behavioural and physiological evidence such situations include lack of stimulation, unavoidable fear or frustration<sup>63</sup> and absence of a resource, or resources, required by the animal.<sup>64</sup> Such resource requirements can range from access to more space, a more complex, quieter or more interesting environment, food, social and sexual partners, or ability to perform certain behaviours.

Bears generally have large home ranges in the wild. These species that are wide-ranging and opportunistic might be expected to have a greater tendency to develop certain atypical behaviours such as stereotypic pacing. Bears and small carnivores are particularly sensitive to “motor restraint by lack of space”.<sup>8</sup>

The expression of stereotypic behaviour is “the most common visible sign of psychological disorder in all species of zoo bears”.<sup>9</sup>

### **4.3 Conclusion**

Based on the results of the study and clear evidence of significant behavioural abnormalities for Sheba and Inuka, the welfare of the polar bears at the Singapore Zoo appears to have been severely compromised. Their high levels of inactivity and abnormal stereotypic behaviours are a clear indication that their current living conditions fail to meet their species-specific needs.

These welfare problems are likely to be a result of the problems in enclosure design and husbandry at the Singapore Zoo discussed in Chapter 5.

## **CHAPTER 5**

# **PROBLEMS IN POLAR BEAR ENCLOSURE DESIGN AND HUSBANDRY AT SINGAPORE ZOO**

The polar bear enclosure at Singapore Zoo is undersized, barren, poorly designed, does not accommodate any soft substrates and does little to satisfy the biological and behavioural needs of the bears. These suboptimal conditions have most probably contributed to the high level of abnormal stereotypic behaviours and inactivity discussed in Chapter 4.

### **5.1 Problems in enclosure design and husbandry**

The urgent need to apply biological knowledge of the species' natural lifestyle to the captive environment is habitually emphasised throughout the contemporary bear husbandry literature.<sup>8</sup>

There are a number of problems with both enclosure design and husbandry practices for the polar bears at the Singapore Zoo. These problems have been highlighted by the previous report submitted by Acres and WSPA.

The following sections provide an overview of the problems and compare the current Singapore Zoo polar bear enclosure and husbandry practices to those described in standards contained in national legislation, zoo guidelines and recommendations made by animal welfare organisations.

There are a number of guidelines and legislations that have been written and published by zoo associations, zookeeper associations, individual zoos, governments and animal welfare groups regarding the minimum standards acceptable regarding the keeping of wild animals in captivity. Many of the guidelines and legislation recognise bears as animals with special needs and make specific recommendations accordingly, either for bears in general or for specific species. Some include specific guidelines for polar bears.

A number of guidelines and legislation, specifically written for bears, will be used throughout this report for comparative purposes. Further details regarding these guidelines and legislation can be found in the WSPA report “Keeping bears in captivity”.<sup>2</sup>

## Guidelines and Legislations

### Guidelines<sup>2,12,13,14,15,16,17</sup>

#### *TAG guidelines*

In 1998 the Taxon Advisory Group (TAG) of the European Endangered Species Program (EEP) published guidelines for keeping bears in captivity. The EEP is a subdivision of EAZA (European Association of Zoological Parks and Aquaria).

#### *ABWAK guidelines*

In 1992 the Association of British Wild Animal Keepers (ABWAK) published a compilation of articles with management recommendations for bears written by various authors: "Management guidelines for bears and raccoons."

#### *IBF guidelines*

In 1996 the International Bear Foundation (IBF), Rhenen, Europe published the proceedings of an international workshop on captive bear management: "Large bear enclosures". The group made recommendations relating to bear management.

#### *UFAW recommendations*

In 1993 UFAW (Universities Federation for Animal Welfare) published a report based on behavioural studies of polar bears in zoos in the United Kingdom: "The behaviour of captive polar bears". Subsequently, UFAW made a number of recommendations about the keeping of polar bears in captivity.

#### *WSPA recommendations*

WSPA has also recently compiled a set of Recommended Minimum Needs for captive bears in the report "Keeping bears in captivity". Although not published yet, these guidelines will be referred to. The WSPA report reviews current guidelines for keeping bears in captivity and compiles a set of best standards, termed Recommended Minimum Needs. These are based on current knowledge on how bear species should be kept but will be continually updated as knowledge increases.

### Legislation<sup>5,11,44,65</sup>

The various legislation in place for different countries regarding specific recommendations for polar bears will be referred to for comparison where applicable, such as when considering size of enclosures.

Throughout the report, the standards contained in the Polar Bear Protection Act of Manitoba will also be used as a benchmark set of standards against which the standards at Singapore Zoo can be measured. The Manitoba standards are comprehensive, cover a wide range of husbandry areas and the Act has actually been passed as a law.

Recommendations of the Scientific CITES Authorities of Liechtenstein and Switzerland and the Province of Newfoundland and Labrador- Wild Life Act will also be discussed.

## 5.1.1 Problems in enclosure design

### Size of enclosure

The amount of space provided for the polar bears in both the outdoor enclosure and indoor dens is inadequate and fails to satisfy the standards required by certain legislation. The enclosure is too small overall to allow for the expression of a full range of species-typical behaviours and movements. This has probably resulted in the high levels of abnormal stereotypic behaviours recorded during the study (Chapter 4).

One of the most obvious problems with the polar bear enclosure at Singapore Zoo is the small amount of space, especially dry land area, provided for the bears. Polar bears are renowned for their nomadic lifestyle and have exceptionally vast home ranges in the wild. The home range of a polar bear in the wild can reach 31,000 square miles.<sup>1</sup> The Singapore Zoo polar bear enclosure thus provides only approximately 0.0000005 per cent of the polar bear's natural home range.

### *Outdoor enclosure*

The outdoor enclosure, including the pool, has an area of approximately 391m<sup>2</sup>.<sup>66</sup> The surface area of the pool is larger than the area of dry land of the exhibit. The dry land area of the enclosure is small and offers no room for significant exercise or a meaningful enrichment programme. Once the boulders are taken into account, the actual floor space available to the bears is even more limited.

In terms of outdoor enclosure size, the polar bear enclosure at the Singapore Zoo does not meet the minimum standards stated by the Polar Bear Protection Act, Manitoba. It falls far short of the

### Legislation regarding enclosure size

The Polar Bear Protection Act, Manitoba<sup>11</sup>

- An exhibit area in a facility containing one or two polar bears must be at least 500 m<sup>2</sup>. The size of the exhibit area must increase by an additional 150m<sup>2</sup> for each additional polar bear in the facility.
- An off-exhibit area in a facility containing one or more polar bears must be at least 75m<sup>2</sup>. The size of the off-exhibit area must increase by an additional 25m<sup>2</sup> for each additional polar bear in the facility.
- A facility must have a holding area for each polar bear that is at least 4m x 3m x 2.5m.

Scientific CITES Authorities of Liechtenstein and Switzerland<sup>65</sup>

- Although not legally binding, the Scientific CITES Authorities of Liechtenstein and Switzerland, 1989 recommended a minimum enclosure size for two polar bears of 400m<sup>2</sup> land surface area (100m<sup>2</sup> per additional adult) and a minimum pool surface area of 100m<sup>2</sup> (50 m<sup>2</sup> per additional adult).

Province of Newfoundland and Labrador- Wild Life Act<sup>44</sup>

- For polar bears, the minimum surface area per pair is 4,500m<sup>2</sup> with a minimum additional 2,000m<sup>2</sup> per animal.

requirements stated in the Province of Newfoundland and Labrador- Wild Life Act and those recommended by WSPA (Appendix 1). It does not fulfill the recommended minimum size of outdoor land surface area recommended by the Scientific CITES Authorities of Liechtenstein and Switzerland.

#### *Off-exhibit area*

Else Poulsen was given a tour of the bear's indoor dens during her visit to the zoo in 2005. According to her report, the dens are too small.<sup>10</sup> She suggests that if Inuka lies down sprawled on his belly on the floor of his indoor cage he will fill the whole space. Else also expressed doubts as to whether Sheba would be able to lie down on the floor with her legs sprawled to cool off in any of her three cages. The platform between the two inner dens and the door to the outdoor exhibit is described as being too small to seat both bears at the same time and is too small to accommodate a lying bear. As stated by Poulsen (2005), **"The back areas have no redeeming qualities for polar bears. Nothing living should be housed in those cages."**<sup>10</sup>

Enclosures containing captive wild animals should provide sufficient space to allow the expression of a full range of species-typical behaviour and movements. Lack of space is a major factor contributing to poor welfare for captive animals. Enclosure size has been identified as a factor influencing the development and form of stereotypic behaviour.<sup>67</sup> Smaller, less complex enclosures are known to result in stereotypic, self-destructive and other abnormal behaviour in a variety of mammals and birds.<sup>60,68</sup> In addition, it has been found that for carnivores, frequency and prevalence of pacing is positively correlated with home range size in the wild.<sup>69</sup> Both polar bears at the Singapore Zoo were observed displaying a high level of abnormal stereotypic behaviours (Chapter 4).

The amount of space provided for captive animals is so critical to their well being, especially for wide-ranging animals such as polar bears, that minimum enclosure size requirements for certain species are actually stated by law in some countries or provinces within countries.

## Overall enclosure design



**The polar bear enclosure has a concrete substrate and lacks any functional furniture for the bears to utilise.**

**The overall enclosure design is outdated, lacking in complexity and does not meet the bears' needs on some very basic levels.**

In the past, bear enclosures have typically been made of concrete, rock and water, with few, if any, moveable objects. The Singapore Zoo's polar bear enclosure embodies this outdated concept. It is now recognised that there is little in such an area that relates to the natural habitat of the animals. Consequently, when polar bears are kept in enclosures of such design there is little to stimulate their natural behaviour and well-being.<sup>36</sup>

Opinions on appropriateness of current bear enclosures are generally in agreement that bare, concrete enclosures are not suitable environments for bears (Appendix II).

The style of the polar bear enclosure at the Singapore Zoo is that of a typical North American 1960's-1970's cement fortress exhibit style. Such enclosures are known to damage an animal's mental and physical well-

being<sup>10</sup> The problem with these old designs is that they do not meet the bear's needs on some very basic levels.

The outdoor enclosure of the polar bears comprises a dry cement peninsula and a pool. The dry cement area is completely barren apart from a few boulders and therefore lacks any complexity. The outdoor enclosure is concrete and there is therefore no natural ground vegetation, trees or bushes. There are no natural substrates provided and no furniture other than the artificial boulders.

Clearly, the outdoor enclosure at Singapore Zoo does not fulfill many of the requirements and recommendations stated by the various zoo associations and animal welfare organisations (Appendix II) in terms of providing the essential components of a polar bear enclosure. It is hard to see how the enclosure at Singapore Zoo can accommodate for a full behavioural repertoire when there are clearly no possibilities for foraging, digging, climbing and resting in natural substrates.

#### Legislation regarding enclosure design

##### Polar Bear Protection Act, Manitoba<sup>11</sup>

- The exhibit should be of sufficient size and design to discourage the development of unnatural behaviours, enable the animal(s) to exercise a range of physical activities to maintain good physical condition and facilitate public interpretation.
- The indoor areas of a facility must have skylights to provide natural lighting. Any artificial lighting in a facility must be of an intensity that does not threaten the well-being and comfort of the polar bear.

Furthermore, there is no choice of microclimate provided for the bears and their limited view out of the enclosure is restricted to the areas where visitors stand.

Many of the guidelines recommend a minimum of two separate outdoor enclosures to house two polar bears for segregation purposes. At Singapore Zoo there is only one enclosure.

Both the TAG and WSPA guidelines recommend that the ratio of water to land must not exceed 1:3. At the Singapore Zoo the surface area of the pool is larger than the dry land portion of the exhibit. Polar bears are bears first and marine mammals second,<sup>10</sup> so the enclosure design should reflect this, which it clearly does not.

**Overall, the outdoor exhibit gets a failing grade for polar bears according to Poulsen (2005).<sup>10</sup>**



### *Off-exhibit area*

The bears spend the vast majority of their time in the indoor enclosures, therefore the standard of these facilities is critical for the overall well-being of the bears. According to Poulsen (2005), the back areas for the bears are wholly substandard.<sup>10</sup> The area where the indoor cages are located is described as dark and humid with no natural light. The bears cannot see out of the indoor dens.<sup>10</sup>

The off-exhibit area for the bears does not comply with the Polar Bear Protection Act, Manitoba, standards which state that indoor areas must have natural lighting.

The indoor areas clearly do not fulfill many of the requirements and recommendations stated by the various zoo associations and animal welfare organisations (see Appendices). WSPA guidelines state that dens that are bare damp and with a concrete floor are not acceptable. They recommend that indoor facilities should be as interesting and hospitable as outdoor quarters with elevated resting platforms and they should allow for entry of natural light. ABWAK guidelines state for indoor accommodation, bears should be able to view beyond their enclosure boundary (Appendix II).

## Substrate

The polar bear enclosure does not accommodate any soft substrate and the flooring is full concrete. Concrete flooring is an inappropriate substrate for any captive wild animal, including bears, and fails to provide for species-specific behaviours (such as foraging or digging) and the construction of day beds.

The provision of natural substrates should be considered a fundamental need for polar bears when trying to accommodate for their natural behaviour in wild.

As the polar bear enclosure at the Singapore Zoo is concrete there is no natural ground vegetation. The exhibit also does not accommodate any areas of soft substrate. During the study period, the polar bears at the Singapore Zoo were not seen to be provided with any soft substrate or materials suitable for nest building.

### Legislation regarding substrates

Polar Bear Protection Act, Manitoba<sup>11</sup>

- The exhibit area must include an area at least 125m<sup>2</sup> that is covered by soil, straw, wood chips or other suitably soft substrate.

Polar bears are well known for their habit of constructing day beds to rest in. A polar bear day bed is a hole about half to one and a half metres deep and from one to two metres wide usually dug in the snow.<sup>25</sup> Wild polar bears have been shown to manipulate a wide range of soft substrates other than snow to build day beds, including lichen and moss, sand, tall grass and kelp.<sup>36</sup> Soft substrate to dig into of significant depth so they can adjust their own body temperature is a basic polar bear need.<sup>10</sup>

All bears, including polar bears, also build nests, sometimes padded with vegetation, before settling down to sleep at night.<sup>17</sup>

Captive bears appreciate the comfort of nesting material.<sup>13</sup> It has been suggested by some that nest building constitutes a behavioural *need* for bears.<sup>8</sup> The term 'need' has been defined by Fraser and Broom (1990) as a deficiency in an animal which can be remedied only by obtaining a particular resource or responding to a particular environmental or bodily stimulus.<sup>46</sup> If the animal is unable to satisfy a need, the consequence, either shortly or eventually, will be poor welfare.<sup>8</sup> Because bears construct nests both in the wild and in captivity, the inability to do so may lead to behavioural frustration as well as physical discomfort.<sup>8</sup>

The provision of natural substrates, either natural ground vegetation or areas of loose natural materials or both, is a common recommendation in the guidelines of zoo associations and animal welfare organisations (Appendix IV).

**Singapore Zoo does not appear to implement any of their recommendations in terms of providing natural substrates for the polar bears.**

Past studies have provided evidence of a preference for soft substrates exhibited by polar bears. For example, in one documented case at Dublin Zoo, a polar bear was seen to spend eighty per cent of his time in the sand and bark litter following modification of his enclosure to include areas of these substrates.<sup>13</sup>

The provision of natural substrates such as earth, sand or wood chips can lower the thermal load on animals.<sup>8,72</sup> Natural substrates such as earth and wood chips are also desirable as substrates in terms of their manipulability and unlike concrete do not carry the risk of bears splitting their claws.<sup>8</sup>

In the absence of snow to roll in, captive polar bears also require soft substrates to effectively dry their fur after coming out of the water.<sup>10</sup>

The importance of provision of natural substrates for polar bears is so crucial that the Polar Bear Protection Act, Manitoba, requires that polar bear enclosures contain an area of soft substrate measuring at least 125m<sup>2</sup>.<sup>11</sup> Singapore Zoo does not meet this requirement.

### Concrete

As a substrate, concrete fails to provide for any species-specific behaviours such as digging or foraging. Lack of suitable substrate for these behaviours is a serious welfare issue as it limits the opportunities available to the bears to be actively involved in activities such as digging. It has been suggested that animals kept in an environment with little or nothing to occupy their time often show abnormal behaviour.<sup>70</sup>

Concrete is also particularly unsuitable substrate for polar bears, a species notorious for pacing, as contact with this hard substrate may lead to abrasions and sores on the polar bears' feet, or footpad ulcerations commonly observed in animals exhibiting stereotypic pacing on concrete surfaces.<sup>71</sup> Another problem with using concrete as a substrate, especially in a tropical climate, is that it radiates heat in hot weather,<sup>8</sup> thus subjecting the bears to extremes of temperature. **Concrete flooring is therefore a serious welfare issue for the polar bears at Singapore zoo.**

In the 2004 report, Acres recommended that soft substrates and an area where the bears can construct day beds should be provided and suggested that natural ground vegetation would be the best for the bears.<sup>18</sup>

Acres recommended covering areas with materials of different physical properties in shady and sunny places to create diversity so that the bears can elect day beds appropriate to the different weather conditions. Acres also suggested constructing an area bordered by wooden logs could be filled with soil in which a grass/herb mixture could be sown.

In 1999 a study was carried out at the Singapore Zoo to examine the effects of environmental enrichment on the polar bears. Although as part of the study the authors initially intended to investigate the effect of adding areas of soft substrate to the enclosure, they state that the zoo rejected the use of natural substrates as enrichment because the pool had to stay clear of debris.<sup>66</sup>

However, the possibility of some substrates entering the pool does not necessarily have to present a problem. Most importantly, polar bears do not appear to be affected by cloudy water<sup>36</sup> so the welfare of the bears is not an issue. In addition, it is likely that once the bears get used to the soft substrates they will not tend to spread it around the enclosure.



**Above: Polar bears roll in snow to dry their fur and groom themselves.**

**Below: With no soft substrate, the polar bears at Singapore Zoo can only rub themselves on hard concrete surfaces.**

A previous study showed that when polar bears were given pits of sand and bark in enclosures they did initially spent a lot of time digging and the sand and bark were scattered around enclosure. However, after the animals got used to new areas (after approximately seven days) they left the sand and the bark in the pits.<sup>36</sup> To prevent the bears from tracking the natural substrate into the pool, Acres recommended a concrete lip being constructed around the pool to prevent substrate materials being tracked into it.<sup>18</sup> An effective filter system for the pool could also help negate the problem of substrate entering the pool water. If the zoo still does not want to use certain natural substrates because they will affect the pool water, there are other substrate options such as sand and smooth pebbles which can offer a natural area yet will not cloud water or clog filters.

Any concerns about the hygiene of natural substrates in captive enclosures are also unwarranted.<sup>36</sup> Substrates such as woodchips actually inhibit bacterial survival. It has been found that natural areas can provide behavioural and hygienic benefits for captive animals.<sup>73</sup>

The lack of soft substrate is likely to be contributing significantly to the bear's skin problems and fur loss. During the course of this study the bears were seen to frequently rub their bodies firmly against the boulders and roll on the floor, particularly after coming out of pool. Whilst this behaviour is normal and is a way of drying their fur, when performed repeatedly on a concrete surface the bears are likely to develop skin sores. During the course of this study, Sheba was frequently seen to have red skin and sores.

In the indoor cages, the bears do not receive any bedding and so are forced to rest on the hard cement floor.<sup>10</sup> Both WSPA and UFAW guidelines recommend that nesting materials shall be available in both indoor and outdoor quarters (Appendix IV).

## Furniture

**The enclosure does not provide sufficient furniture for the bears.**

Furniture refers to physical structures within an enclosure that serve to enrich the animals environment, such as climbing frames, giant rocks, mature trees, streams and pools.

As stated by the Secretary of State Standards of Modern Zoo Practice, United Kingdom: “Animals should be provided with space and furniture to allow such exercise or foraging behaviour as is needed for their welfare. Animal enclosures should be equipped, in accordance with the needs of the species, to minimise any abnormal behaviour and to aid and encourage normal behaviour patterns.”<sup>74</sup>

The polar bear enclosure at the Singapore Zoo is barren apart from a few artificial boulders and lacks complexity. There are no natural features such as tree trunks that the bears can exploit or utilise. There are no structures for the bears to climb or elevated resting platforms. The features of the polar bear enclosure appear not to have been altered for some time. The indoor dens contained no furniture at all when they were inspected in 2005.

### Legislation regarding enclosure furniture

The Polar Bear Protection Act, Manitoba<sup>11</sup>

- Exhibit area design: The exhibit area must contain structural features such as resting platforms, waterfalls and nesting sites. It must also contain stabilised rocks, tree trunks or similar materials that are redesigned periodically to provide a change in the environment for the polar bear.

The provision of a variety of structural enclosure features for polar bears to utilise is widely recognised to be of great importance for their well-being by all the zoo associations and animal welfare organisations. Their guidelines recommend a variety of structural features and furniture that should be provided in outdoor bear enclosures for all species (Appendix V). Although unlike other bears wild polar bears do not climb trees, this does not mean that in a captive situation they would not benefit from the opportunity to climb and explore structures. Polar bears in the wild encounter a wide variety of natural structures to climb such as ice ridges, rocky cliffs and mountainsides.<sup>49,19</sup>

For indoor accommodation, some of the guidelines recommend the provision of platforms raised from the ground to provide a more complex environment and resting sites. At Singapore Zoo there are apparently no such features in the indoor polar bear accommodation.

In the 2004 report Acres recommended adding more furniture to the enclosure to make it more complex and interesting to the bears.<sup>18</sup> Root balls, logs and rocks properly placed over a deep natural substrate were suggested to allow the bears to dig beneath them to create resting or even denning places. In addition, it was recommended that the root balls and logs should have intact bark, so the bears can chew it or rip it up. It was also suggested that the bears should be given rotten logs that they can rip apart. **No evidence of any of these suggestions being implemented was apparent during the course of this study.**

## Private areas



**The lack of private areas in the outdoor enclosure means that the polar bears are constantly in public view.**

**The enclosure does not provide sufficient private areas where the bears can adequately retreat from public view or from each other.**

Private areas are extremely important for an animal's welfare and should take precedence over the ability of visitors to constantly view the animals.

Exhibiting animals in a way that does not allow them privacy can result in detrimental physiological and behavioural consequences. The presence of visitors has been shown to have measurable effects on certain aspects of an animal's physical state. For example, a

correlated increase in the cortisol levels in captive animals as the number of visitors increases has been documented.<sup>75</sup> Cortisol is a hormone known to be released during times of stress. Being surrounded by a 'faceless' crowd of unfamiliar and often noisy visitors most likely constitutes a source of stress for the animals.<sup>8</sup>

### Legislation regarding private areas

Polar Bear Protection Act, Manitoba<sup>11</sup>

- Any window that allows public viewing must be located in a position that allows the polar bear to avoid public viewing if desired.



Animals should also be able to retreat from the view of other animals in the same enclosure. Less dominant animals should not only be able to avoid physical contact with dominant animals, but should be able to remove themselves visually as well. Visual barriers should be provided for polar bears as bears are not naturally sociable animals.<sup>13</sup>

The provision of private areas for bears to retreat from the public and cage mates is considered an essential enclosure feature for bears by several of the zoo association and animal welfare guidelines (Appendix VI). The Polar Bear Protection Act, Manitoba, states that polar bears must be allowed to avoid public viewing if desired.

The outdoor enclosure for polar bear at the Singapore Zoo does not provide any privacy areas where the bears can completely retreat from public view or from view of each other. When in the outdoor enclosure and pool, the polar bears are unable to completely avoid visual, auditory and olfactory exposure to visitors, whose numbers may be great.

Facilities that impose such inevitably stressful conditions must be considered inappropriate. As polar bears are by nature solitary animals, the ability for them to escape from cage mates should be considered essential. Also, as Inuka appears to exert dominance over Sheba, it is important that she should be able to retreat from his view whenever she desires.

### 5.1.2 Problems in husbandry

#### Use/access of the indoor areas.

The bears spend two thirds of their lives locked in small, dark indoor cages with no natural light when they are off exhibit.

Providing captive animals with free access to both indoor and outdoor areas may give them more choice and control of their environment.

The Polar Bear Protection Act, Manitoba, requires that polar bears must be allowed to move freely between the exhibit area and the off-exhibit area at all times.<sup>11</sup>

WSPA recommends that bears shall be allowed free movement indoors and outdoors at all times and that polar bears shall have free access to dens at all times.<sup>2</sup>

The polar bears at the Singapore Zoo spend approximately two thirds of the time locked in indoor cages which are described as sub-standard by Poulsen (2005).<sup>10</sup> The fact that these cages, which have been described as small, dark and humid, are the bears primary residence is obviously a major welfare concern.

The fact that the bears are locked inside from between five and six pm every evening until the next morning is a factor that may be very stressful for them as evening/night time are naturally the hours of most activity for polar bears in the wild. If there is no alternative than to lock the bears in at night for security reasons, then at the very least the indoor accommodation should be of a much higher standard and go further towards meeting the needs of the bears as far as possible.

In the past, the polar bears were locked out onto the outdoor exhibit during the day with no indoor access. In a meeting in 2004 the zoo explained that the door was sometimes left open during the day, but this meant that public would hardly see the bears if they retreated into the den often.

In the 2004 report Acres made the recommendation that the bears be given access to the indoor dens at all hours to provide some relief from the heat and humidity.<sup>18</sup> Subsequently, in 2005, Acres was informed that the polar bears now had access to the indoor air-conditioned area during the day.

### Enrichment programme

The Singapore Zoo does not appear to provide a meaningful and sufficient enrichment programme for the bears.

In the wild, polar bears display a compelling curiosity about anything that enters their environment<sup>20,50</sup> and will manipulate objects and substrates in their environment.<sup>76,77</sup> This type of behaviour occurs during hunting and foraging routines and also during the construction of dens and daybeds.<sup>36</sup> Therefore, bears which are denied such behavioural opportunities could be considered disadvantaged.<sup>36</sup> It seems likely that polar bears have an intrinsic ability and motivation to manipulate objects and support for this theory comes from studies which have shown that captive polar bears do manipulate objects regardless of season, sex and age.<sup>36</sup>

It is therefore clear that polar bears are intelligent, inquisitive animals that need constant stimulation. It has been suggested that the investigative and exploratory foraging styles of opportunistic feeders, such as bears, renders them particularly prone to frustration in environmentally-impooverished captive environments.<sup>42</sup> The potential of a species for manipulation and object related activity appears to be an indicator of behavioural and psychological needs in captivity.<sup>78,79</sup>

Environmental enrichment is a technique for improving the environment and/or enclosures of captive animals by increasing their behavioural opportunities.<sup>80</sup> The aim of environmental enrichment is to provide an environment in which captive animals behave as closely as possible to their wild counterpart.<sup>81</sup>

Enrichment may include furniture, but can also comprise non-fixed items such as logs, branches and scratching posts. Many animals can also benefit from auditory and olfactory stimuli (the introduction of new scents and odours has been a successful method of stimulation for several bear species.<sup>70</sup> Ice snacks consisting of fruits, meats etc. frozen in a bucket of water have been seen to keep polar bears occupied.<sup>38</sup>

Environmental enrichment influences the physical, mental and social well-being of captive animals, frequently resulting in beneficial effects on overall animal health.<sup>26</sup> Appropriately planned and implemented environmental enrichment programmes can contribute to improved animal health through creating opportunities for the animal to exert some form of control over its environment.<sup>26</sup>

Environmental enrichment should be viewed as an integral part of an active, preventative, veterinary medicine programme<sup>26</sup> and should not be considered as an optional feature of wild animal husbandry; it should be regarded as a necessity.

At a workshop on the Behavioural Needs of Bears in Captivity, held as part of the First European Conference on the Status, Conservation and Welfare of Bears in Captivity in 1991, it was stressed that, because of the animals' high level of intelligence, novel objects and situations that keep the bears alert and their behaviour flexible should be provided.<sup>82</sup> Sensory stimuli, including olfactory stimulation and a soft environment, were considered a priority.<sup>82</sup>

The provision of enclosure furniture, natural substrates and varied feeding techniques as forms of enrichment have been discussed previously. This section will deal with the concept of an environmental enrichment programme employing other behavioural enrichment techniques involving non-fixed items and other stimuli.

### *Enrichment for the polar bears at the Singapore Zoo*

The enrichment programme for the polar bears at Singapore Zoo appears to be very restricted and of limited benefit to the bears. While some enrichment is provided, the bears interact with it for only short periods of time.

There were some play objects seen inside the polar bear enclosure during the course of the study. These objects were rubber vehicle tires, plastic balls tied on a rope, barrels and plastic tubes. Exactly the same objects were observed to be present in the enclosure on every visit. The objects all appeared to be very worn and were all covered in teeth marks. No other evidence of a day to day enrichment programme, in the form of provision of new objects, was witnessed.

The Polar Bear Protection Act, Manitoba, requires that those establishments holding polar bears must establish a written behavioural enrichment programme designed to stimulate and encourage natural behaviour in the polar bear.<sup>11</sup>

The guidelines written by zoo associations and animal welfare organisations all stress the importance of behavioural enrichment programmes and give detailed information about various enrichment techniques that should be used for bears (Appendix VII). **It is frequently emphasized that behavioural enrichment is only effective if stimuli/objects are frequently changed. The Singapore Zoo polar bears were seen to have the same play objects on every visit.** All the guidelines stress the importance of using a variety of objects and stimuli and strongly recommend using feeding enrichment techniques. The ABWAK and WSPA guidelines recommend that at least ten objects should be available to polar bears at all times. **The Singapore Zoo polar bears were seen to have about half this number of objects.**

At a meeting in 2005 the zoo said they had been providing ice blocks for the bears as enrichment. However, during the course of this investigation at no time were ice blocks observed being thrown into the enclosure or pool.

At a meeting 2004 it was said that frozen whole watermelons were thrown into enclosure as enrichment. Again, during the course of the investigation this was never observed.

A previous study on behavioural enrichment for the polar bears at Singapore Zoo revealed that coconuts were manipulated the most by the bears and plastic containers the least.<sup>66</sup> The study also revealed that all three polar bears manipulated the leaves provided, rolling on them and resting on them. However, during the course of this study, no coconuts or leaves were seen to be given to the bears whilst the containers remained in the enclosure the whole time.

In the 2004 report Acres recommended the implementation of a day-to day whole and varied enrichment programme by offering a daily range of stimuli to stimulate different senses and elicit natural behaviours.<sup>18</sup> Suggestions included introducing novel enrichment daily and a list of novel objects that could be introduced to encourage exploratory and play behaviour was given. Feeding enrichment by means of providing novel food, scattering food in piles of twigs and straw, concealing food in ice or objects was also suggested. Acres recommended that enrichment material should be frequently changed and offered at unpredictable times of the day.

For the full list of suggestions made by Acres to the Singapore Zoo regarding the implantation of an enrichment programme refer to Appendix VIII.

**In a 1999 report on enrichment for the polar bears at Singapore Zoo, it is stated that at Singapore Zoo, polar bears were not considered high priority for enrichment compared to other animals.<sup>66</sup> The zoo has apparently in the past been reluctant to incorporate some enrichment suggestions. It has been suggested that the environmental enrichment has been restricted because the zoo wants to display animals in their natural environment, with no artificial materials on display. Prior to their 1999 investigation, researchers sent a list of objects that they wanted to try as enrichment items for the polar bears to the zoo. Apparently the zoo rejected some of the objects because they looked unnatural.<sup>66</sup> However, it is important to keep in mind that even though an object might not be natural, it is still capable of eliciting a natural response.<sup>83</sup> Also, enrichment programmes have allegedly been said to take up too much of the keepers time.<sup>66</sup>**

Most of the objects provided for enrichment were badly chewed and Inuka was on one occasion during this investigation seen to actually tear off and

ingest pieces of rubber from a vehicle tyre. The presence of old disintegrating objects in an enclosure that can be easily broken into pieces and consumed obviously poses a potential risk to the bear's well-being.

### **Feeding methods**

**The feeding methods apparently used by the zoo may not be in the polar bears best interests.**

In the wild, polar bears are active hunters and forage feeders. They are continually searching for opportunities to hunt seals, walruses and to find supplementary food sources such as carrion. Some populations are also known to eat berries, eggs and kelp during the times they inhabit terrestrial environments, such as boreal forest, tundra and coastline.

In a captive situation, it is not practical to provide polar bears with seals or walruses to hunt. However, there are certain feeding methods that are generally recognised to be the most beneficial to their welfare.

International bear husbandry standards (e.g., EEP, AZA) emphasize the importance of feeding bears at least three times during the day.<sup>8</sup> In captive situations, it seems that bears benefit if their food expectations are met promptly, as early in the morning as possible to alleviate the stress associated with the anticipation of food.<sup>36</sup> Random scatter feeding and modification of feeding techniques may prove beneficial for polar bears.<sup>38</sup>

According to the zoo keepers, the polar bears are fed their main meal in the evening inside the indoor cages. This method of feeding one main meal a day in the evening may lead to stress, as the bears are anticipating their food all day. This also constitutes a predictable, dull feeding routine. As a result, the amount of time spent feeding is likely to be short, offers few challenges and requires little, if any, foraging effort.

The Polar Bear Protection Act, Manitoba, requires that those keeping polar bears must ensure that the regular feeding schedule is supplemented by irregularly timed and located feedings involving foods not normally served.<sup>11</sup>

The recommendations by the various zoo associations and animal welfare groups are in general agreement about the importance of using a variety of methods of food delivery (Appendix VII). Feeding methods that allow for extensive foraging, natural manipulation, and processing including scatter feeding, hiding food and burying food in soft substrates are widely recommended. Some of the guidelines suggest giving the bears some of their food at irregular times of the day. The UFAW and WSPA guidelines both recommend feeding the main meal early in the morning. Some guidelines suggest that polar bears benefit from food that floats.

During the course of this study there was little evidence of any scatter feeding or any other type of feeding enrichment methods being employed in the outdoor enclosure. There did not appear to be anywhere in the outdoor enclosure where food could be hidden or buried to make feeding times more

interesting. At no time were the bears seen to be foraging for food and the floor of the enclosure was always clean suggesting the absence of any scatter feeding and indicating that food is not available adlib. No feeding enrichment devices were apparent in the outdoor enclosure.

The token feedings occur at the same time each day. During the study period, the food provided consisted of small, uniform chunks of meat, or dead fish, always of the same size. The items fed to the bears during the token feedings were always eaten within a few seconds. Live fish were also thrown into the pool for the bears (usually Inuka) to catch. The bears often did not even try to catch the fish, indicating that the novelty value of this practice has already worn off. Research has proven that feedings, performances or shows that take place at exactly the same time every day lead to the development of stereotypic behaviour.<sup>10</sup> **While the feeding of live fish may be considered as enrichment by the zoo, the fact that it is provided at the same time each day means that it has become a routine for the bears, rather than an enrichment.**



## 5.2 Physical signs of stress

### 5.2.1 Minimal lean body mass<sup>10</sup>

Healthy polar bears carry hundreds of pounds of fat firmly attached to the muscle tissue. However, both Sheba and Inuka exhibit minimal lean body mass (L.B.M.) i.e. are lacking muscle, which is a problem in captivity for both males and females. Inuka does not have the muscle build up that he requires for his age and his size, probably as a direct result of lack of exercise and inappropriate diet. In the wild, healthy adult male polar bears do not have visible necks due to a massive build up of muscle tissue from their shoulders to the base of their heads. In males L.B.M. can be diagnosed by the obvious appearance of the neck, which is observed in Inuka. When a female polar bear with insufficient L.B.M. stands up all of her fat falls down to her hips and she takes on the classic ‘pear shape’ and can be described as a “pear bear”. Sheba has minimal L.B.M. and fits this description and can be therefore be described as a “pear bear”.

### 5.2.2 Fur loss<sup>10</sup>

Both bears have a history of repeated severe fur loss. Over the period of this study, both Sheba and Inuka were seen to have large bald patches over their bodies. Sheba was also observed to have some kind of skin rash on her back, with missing fur and sores. Previous studies and observations have also reported severe fur loss for both bears. In February 2005, Inuka had reportedly lost all of his guard hairs which is not a natural state as at no time during a normal moult does a polar bear lose all of its guard hairs at one time; the normal moult is a gradual process. Severe fur loss is most often stress related and long term stress probably plays a role in the fur loss for both Sheba and Inuka.



**Sheba showing signs of severe fur loss**

### **5.2.3 Condition of teeth<sup>10</sup>**

Sheba has significant deterioration of her teeth and has lost three of her four canines. According to Poulsen (2005), in a captive bear such dental deterioration signifies inappropriate diet, presentation and long-term dental care.

## **5.3 Conclusion**

There are substantial enclosure design and husbandry problems at Singapore Zoo that severely compromise the welfare of the polar bears. Singapore Zoo fails to satisfy a number of key criteria identified in the Province of Manitoba polar bear husbandry standards.

## **CHAPTER 6**

### **ANALYSIS OF THE EDUCATIONAL BENEFIT**

#### **6.1 Educational value of captive polar bears in Singapore**

A survey of over two hundred visitors carried out by Acres at the polar bear exhibit in March 2006 revealed that only 20.6% of the visitors read any of the signs. Most only looked at one or two signs for a few seconds and no visitors were seen to read all the signs.

The time that adult visitors spent looking at the polar bears was also examined in a survey of more than 200 visitors during the same period. The average time adult visitors spent looking at the polar bears was found to be only 46.3 seconds.

##### **6.1.1 The polar bear token feeding shows**



**Inuka ringing a bell for food.**

The Singapore Zoo appears to pride itself on the “educational value” of its animal shows. Ms Fanny Lai, Executive Director of Singapore Zoo and Night Safari, in a news release regarding animal shows in August 2005 stated “Studies have shown that watching a live animal show where animals are

demonstrating species-appropriate behaviour can leave a lasting impression in the minds of zoo visitors”.<sup>84</sup> In the “wonders of the wild” show, each “performance” is said to “highlight the animals’ natural behaviour in the wild”.<sup>84</sup>

On the Singapore Zoo website, the following statement is made: “At the Singapore Zoo we believe in maintaining our animals’ natural instincts and behaviours through activities. Such activities help to deepen our understanding towards them and even participate in the wonders of their ways!”<sup>85</sup>

However, this line of thinking apparently does not extend to the polar bear shows in which the polar bears perform several unnatural behaviours that are totally inappropriate for the species.

The polar bears are used in “token feeding” shows for the public three times a day from Monday to Saturday and four times a day on Sundays and public holidays. As documented as late as March 2006, during these shows, both Inuka and Sheba are repeatedly required to demonstrate unnatural behaviours for the reward of a piece of food. Sheba is asked to “wave” to the audience with her paws. Inuka is encouraged to splash around in the water- a behaviour which is explained as being “his version of a belly dance”. Inuka is also told to stand on his hind legs on a boulder and ring a bell suspended on a rope above the enclosure. After this he proceeds to hit his paws together at which point the presenter claims that he is “asking for a round of applause”.

The educational benefit of watching a polar bear waving, ringing a bell, clapping his paws together or ‘belly dancing’ is obviously highly questionable. Making animals perform these unnatural tricks, purely for the entertainment of the audience, teaches nothing about the natural behaviour of polar bears; it simply reinforces the outdated idea that animals exist purely for human entertainment. Children may well go away from the show thinking that wild polar bears ‘belly dance’, wave hello and clap their paws.

The polar bears are given live fish to demonstrate their hunting skills as part of the show. Whilst this may confer some benefit to the polar bears by serving as a brief distraction from their mundane lives, again this demonstration is of limited value in terms of teaching the audience about polar bear behaviour in the wild. Polar bears are powerful hunters, and rely on their stealth when hunting on land for the seals and walrus which make up the bulk of their diet. A wild polar bear’s diet consists of ninety five per cent marine mammals<sup>47</sup> and wild polar bears only very rarely hunt and eat fish.

### **6.1.2 Information signs**

There are a number of signs located in the vicinity of the polar bear viewing area displaying brief snippets of information about polar bears in the wild and giving some basic polar bear facts and figures. There are also several signs with detailed information about the polar bears at Singapore Zoo.

The educational value of this exhibit is negligible. For the most part, visitors ignored the signboard information and spent only a very short time at the exhibit. A large majority of people seemed to arrive at the exhibit only for the purpose of watching the show and left immediately once it was over, without reading any of the signs. Therefore, the only message that they take away with them is what they have seen in the show, which, as explained previously, is questionable and may be counter-educational because it provides misleading information about polar bear behaviour.

## **6.2 Conclusion**

It is doubtful that there is any legitimate educational benefit to having polar bears at the Singapore Zoo. The fact that the bears are displayed in an entirely artificial context, the short amount of time visitors spend at the enclosure (46.3 seconds), their limited interest in the signs and the distorted messages they receive through the bear's unnatural tricks combine to make the exhibit educationally counterproductive.

Acres urges the Singapore Zoo to end the display of unnatural tricks during the token feeding sessions.



## CHAPTER 7

# GLOBAL PROGRESSIVE MOVEMENT

### 7.1 The phasing out of polar bears in captivity

Because of the innate difficulties of providing the spacious and stimulating environment required by captive bears, many zoos, including those in the United Kingdom, no longer hold bears in their collections or have decided not to replace current stock after the bears die.<sup>86</sup> This situation is perhaps most apparent in the case of polar bears.

Polar bears are one of the species for which the effects of captivity have been studied in detail.<sup>36,37,38</sup> The results of such studies have highlighted the ubiquitous incidence of abnormal behaviour for polar bears in captivity and highlighted the immense difficulties in meeting the needs of this species in a captive environment.

Even at progressive, professionally-managed zoos, there remain severe problems with polar bears displaying abnormal behaviours. Regardless of whether or not enclosures fulfil the various recommendations for polar bears, stereotypic and abnormal behaviours still prevail.<sup>38</sup> In a study of polar bear behaviour in British zoos, it was found that the design or size of enclosures did not have any significant influence on incidences of stereotypic behaviour.<sup>38</sup> Even for the bears living in the largest enclosure in this study, four different stereotypic behaviours and apathetic behaviour were recorded. In another large enclosure which followed the layout suggested as being the most suitable for polar bears (level, with raised areas and containing few rocks), the stereotypic behaviours observed were as extreme as anywhere else.<sup>38</sup> These observations strongly indicate that, for polar bears, simply changing the layout/design and increasing the size of enclosure is still not enough to eradicate or even limit the occurrence of abnormal behaviours.

The question therefore remains; will there ever be an enclosure adequate enough to prevent or eliminate stereotypic behaviour in polar bears? An evaluation of all of the evidence leads to a resounding no. Certainly at this point in time no one has come close to designing an enclosure that meets the needs of polar bears and because of the nature of this species it is doubtful that anyone ever will.

Zoos in the United Kingdom have been phasing out the keeping of polar bears in recent years. Since the 1990s, six zoos in the United Kingdom have stopped keeping polar bears.

Today there is just one polar bear still being held in captivity in the United Kingdom at Edinburgh Zoo, and the public pressure on the zoo not to acquire any more polar bears once she dies is immense.

With regard to the trend towards phasing out the keeping of bears in zoos, the Chief Curator at Chester Zoo, the United Kingdom's largest zoological garden has stated, "...if we cannot provide for the environmental requirements of any animal properly we should not keep them. Historically, a number of bear species were kept here but since the last aged female polar bear died here in the early 1990s we have not felt it appropriate to replace her...In summary, historically bears have had a 'poor deal', somewhat masked by their [physical] resilience."<sup>70</sup> Similarly, the following response was given by Chester Zoo when questioned on the absence of polar bears at the zoo: "Our last two polar bears were Amos who died in 1989 leaving Sabrina who unfortunately died of a tumour in 1992. A decision was taken at that time, not to keep Polar Bears in the collection any more as it is very difficult to provide the right kind of conditions for the type of environment they require and, they are no longer a highly endangered species." (Email correspondence, 27 January, 2006).

The situation is much the same for zoos in Switzerland. Until a few years ago, Basel Zoo and Zurich zoo were the only two zoos in Switzerland still keeping polar bears. Both zoos have now come to the conclusion that, in principle, polar bears should not be kept under the conditions the zoos can offer at present.<sup>87</sup> As the zoos cannot at present build large new exhibits that meet the requirements of the species, the keeping of polar bears has been phased out.<sup>2</sup>

Similar enlightenment is also found in Germany, where zoos are phasing out the keeping of not only polar bears, but also other bear species.<sup>2</sup>

In 1993, the Universities Federation for Animal Welfare (UFAW) published a report based on behavioural studies of polar bears in the United Kingdom entitled "The behaviour of captive polar bears".<sup>36</sup> Subsequently, UFAW made the following statements and recommendations about the keeping of polar bears in captivity:

- Zoos have the responsibility to improve the environments in which the polar bears are kept according to UFAW recommendations.
- Where conditions are so poor that improvements are impracticable the animals should be found new homes or as a last resort humanely put down.
- In the absence of suitable environments polar bears should not be bred.



- The keeping of polar bears should be phased out as the present captive population declines.
- Until a suitable environment can be built that meets all the bears' behavioural needs UFAW cannot recommend that polar bears should be kept in zoos.

It is not just animal welfare bodies and the zoos themselves that are expressing reservations about the keeping of bears in zoos. The bear Taxon Advisory Group (TAG) of the European Endangered Species Program (EEP) holds the opinion that “ Zoos should not consider designing enclosures for bears unless they can meet all their behavioural needs...[If a large and natural enclosure is not feasible] then serious questions have to be asked as to whether a smaller enclosure is suitable and precisely what the grounds may be for the reduction in welfare inevitable in a restricted place...the fewer the natural elements (trees, ground vegetation, hills, rocks, creeks or lakes), which provide the special activity areas, in an enclosure, the more difficult it becomes to and the more carefully it must be planned and designed to allow for a range of normal behaviours...the more options, with regards to substrates, vegetation and structures, that we can offer the animals, the greater the likelihood that we shall be able to meet their demands.”<sup>17</sup>

Clearly then, as knowledge about the detrimental effects of captivity on the well being of polar bears increases along with awareness of the immense difficulties in fulfilling their needs, progressive zoos are choosing to stop keeping this species on welfare grounds. Public enlightenment and concern have no doubt also played a key role in bringing about these changes.



## CHAPTER 8

# RECOMMENDATIONS

Since the Singapore Zoo polar bears cannot be released to the wild, they should be moved to more appropriate accommodation elsewhere.

Until the Singapore Zoo polar bears are moved, the zoo should make every effort possible to improve their living conditions, so the bears can, at the very least, express some of their natural behavioural repertoire. The zoo should also implement measures to try to mitigate the physical effects of the inappropriate climatic conditions in Singapore as far as possible.

Singapore Zoo should immediately end the display of unnatural tricks during the token feeding.

Below are recommendations for short-term improvements to the polar bear enclosure. **These recommendations will only reduce the amount of abnormal behaviours and inactivity but probably not completely eliminate them.** These recommendations are based largely on the EEP Ursid Husbandry Guidelines by the European Association of Zoos and Aquaria. Perhaps the most important short-term improvement is providing a variety of enrichment and this is touched on in greater detail.

### 8.1 Short-term recommendations

#### 1. Providing an area where the bears can construct day beds

When resting, bears use day beds on the ground. These beds may be natural depressions or may be constructed by the bears, who scratch away vegetation and soil to create a shallow depression or pit.

#### 2. Providing soft substrates

Natural ground vegetation is the best substrate for all bear species as it allows them to scratch, dig and construct pits and holes for resting. Food can also be scattered over the substrate or buried in it for the bears to find.

In addition, areas covered with materials of different physical properties in shady and sunny places will create diversity so that the bears can select day beds appropriate to different weather conditions.

An area bordered by wooden logs can also be filled with soil (10-20cm) in which a grass herb/mixture can be sown. This is possible even in extremely small enclosures of 200 square metres; the area may need to be regularly re-seeded.

Providing natural substrates in enclosures that feature a pool may be problematic as the bears may track a great deal of substrate material into the pool. However, a concrete lip can be constructed around the pool to prevent substrate materials from being tracked into it. An effective filter system can also help to negate this problem.

### **3. Lowering the temperature in the enclosure**

The enclosure should be air-conditioned as soon as possible.

The water in the pool should be cooled further, so the bears can obtain even greater relief from the heat.

### **4. Providing more furniture**

Even though the Singapore Zoo polar bear enclosure is exceptionally small, additional furniture should be added to make it more complex and interesting to the bears. Root balls, logs and rocks properly placed over a deep natural substrate may allow the bears to dig beneath them to create resting or even denning places. However, the construction has to be worked out in such a way that despite digging, the system will not collapse and bury the bear.

In addition, the root balls and logs should have intact bark, so the bears can chew or rip it off. Ideally, there should also be rotten logs that they can rip apart.

### **5. Providing enrichment**

Environmental enrichment aims to stimulate a wide range of species-specific behaviours, which are performed in normal sequences and frequencies.

There are two approaches to enriching an animal's environment. Both are necessary to achieve positive results.

- Including within enclosures, facilities which enable the animals to undertake a wide range of natural activities by providing a variety of appropriate natural materials, structures and substrates.
- Day-to-day enrichment by offering a daily range of stimuli, which stimulate different senses and elicit natural behaviours.

The first approach is static, changes will occur only occasionally. Complex topography, vegetation in the form of trees, bushes and ground flora together with artificial constructions and the provision of a variety of substrates will form integral parts of new enclosures from the very beginning. Even old enclosures can be modified so that they are more complex and interesting, by adding new substrates, vegetation and

furniture which will facilitate the applications and enhance the effects of the second method of dynamic day-to-day enrichment.

Some novel enrichment should be included in daily husbandry. This will ensure that the environment is stimulating, provided the enrichment materials are frequently changed and offered at unpredictable times of the day.

Feeding enrichment is particularly valuable because it stimulates all the animals' senses and elicits exploration and manipulation. It can also increase the amount of time spent foraging.

Providing novel food as enrichment influences the level of activity immediately after its introduction, but there is no long-term effect over the day. Scattering food in piles of twigs or straw and hiding it inside objects, however, extends periods of foraging, increasing behavioural diversity. Feeding enrichment will require greater ingenuity in very small, poorly equipped enclosures, so techniques such as concealing food in ice or inside objects may help to solve the problem.

Feeding enrichment reduces walking and pacing in favour of manipulation, foraging and exploration, as stereotypic behaviour is commonly linked to feeding behaviour.

*Prolonging foraging and feeding behaviour:*

- Ice blocks with food in different sized buckets without handles.
- Ice blocks with food in large tubs.
- Fish or nuts in a plastic can with small openings.
- Whole cucumbers or melons.
- Branches.
- Honey, ketchup or mayonnaise smeared in or on traffic cones or buckets.
- Hides and bones of cattle or horses.
- Food which float, such as nuts or apples, should be occasionally scattered in the water.

*Encouraging exploratory and play behaviour:*

Every new object, irrespective of the material of its construction, stimulates exploratory and play behaviour.

- Large plastic cans, tubs, pipes and traffic cones.
- Wooden logs, branches and twigs.
- Ropes.
- Large indestructible balls, such as "boomer balls".
- Large fishing floats.
- Empty rope reels.

*Stimulating olfactory and rubbing behaviour:*

- Different flavours (from drugstores or perfumeries) on the ground and on elevated structures to elicit sniffing behaviour.
- Hides for rolling and rubbing.
- Resin or spruce-needle oil on tree trunks and the ground elicits rubbing.
- Scent trails sometimes leading to concealed food items.

## **6. Starting an enrichment programme**

The ideas and practical suggestions made above should be applied in such a manner as to provide the bears with options for a sufficient variety of activities to enable them to carry out a broader range of natural behaviours. While many of the activities will, by necessity, be quite different from those experienced by bears in the wild, the daily programme should aim to keep the animals occupied as much as possible.

Thus it should aim to provide the individual bear with:

- Security from disturbance or harassment, in the form of nesting sites and means of avoiding threats from conspecifics; a good relationship with familiar, friendly keepers (of the utmost importance if the animal is to feel relaxed and safe).
- An environment which provides the kind of complexity (environmental diversity) to which the animal is naturally adapted, including such features as soft ground nesting sites for polar bears.
- Opportunities for the animals to achieve simple goals with a reward, such as retrieving food from concealed pipes. This is often referred to as “control of the environment”. Given appropriate facilities, bears may create their own goals in play, for example, polar bears have invented games involving stalking and pouncing on traffic cones, or bouncing a ball off a wall.
- Unpredictability in the form of variations in the diet, novel objects, training to new tasks, novel arrangements of existing materials.

It must be emphasized that environmental enrichment is more than placing a toy in a cage: it is a whole and varied programme designed to give animals variety and choice.

## **8.2 Long-term recommendations**

Since the polar bears at Singapore Zoo cannot be released to the wild, they should be moved to more appropriate accommodation elsewhere. However, as there are concerns as to whether Sheba would survive a relocation (due to her age), Acres recommends that only Inuka be relocated once Sheba passes away.

Singapore Zoo can clearly afford this since for the financial year of 2004/2005, Wildlife Reserves Singapore had a surplus of thirteen million dollars.

While locating a suitable facility for Inuka in a more appropriate climate, Acres urges the Singapore Zoo to ensure that any potential recipient institution be equipped with a large naturalistic bear paddock(s) that meets the various guidelines (in appendices) outlined in this report as far as possible.





## CHAPTER 9

### CONCLUSION



Polar bears are poor candidates for captivity, even in the best of circumstances. They are extremely wide-ranging, highly intelligent, cold weather carnivores, so they are highly problematic to house and care for in captivity. In fact, many experts believe they are one of the species most ill suited to captivity. This belief has already resulted in a reduction in the number of captive polar bears in some regions (e.g., United Kingdom) and increased criticism of the keeping of polar bears worldwide.

This report reaffirms the inherent difficulties in keeping polar bears without compromising their welfare. The report also clearly shows that the polar bears at Singapore Zoo are living in suboptimal conditions. Based on the scientific studies conducted, both bears are showing signs of heat stress and high levels of inactivity and abnormal stereotypic behaviours.

These welfare problems can be attributed to both the climate in Singapore and the enclosure the bears live in. The polar bear enclosure at Singapore Zoo is undersized, barren, poorly designed and does little to satisfy the biological and behavioural needs of the bears. The enclosure only provides only 0.0000005 per cent of the polar bear's natural home range.

Singapore Zoo states that they are “always increasing our level of standards with changing times and are not easily satisfied with status quo”. It is time for the zoo to recognise that polar bears should not be in captivity in tropical Singapore.

Since the Singapore Zoo polar bears cannot be released to the wild, they should be moved to more appropriate accommodation elsewhere. As there are concerns as to whether or not Sheba, the twenty seven year old female polar bear will survive the relocation, Acres is recommending that Inuka, the younger polar bear, be relocated once Sheba passes away.

Acres does not support the construction of a new enclosure for the Singapore Zoo polar bears. It is not possible to construct an exhibit in Singapore that can accommodate polar bears in a way that satisfies their biological and behavioural needs and that can completely mitigate against the deleterious effects of Singapore’s tropical climate.

Until Inuka is moved, Acres urges the Singapore Zoo to implement the recommendations contained in this report to improve the bears living conditions. Acres would be glad to assist the Singapore Zoo in this aspect.

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## APPENDIX I: GUIDELINES FOR ENCLOSURE SIZE

### WSPA

Minimum size of enclosures for polar bears:

- Minimum surface area per pair outdoors = 4,500m<sup>2</sup>
- Minimum surface area per additional animal = 2,000m<sup>2</sup>
- Pool facilities = 100m<sup>2</sup> per two bears; 50m<sup>2</sup> per additional bear.
- Minimum requirement for dry, resting and social areas for polar bears= 37.16m<sup>2</sup> per 2 bears, 3.72m<sup>2</sup> per additional animal.
- Den should be 1.0-5.0 x 0.7-3.9 x 0.3-1.9 (length x width x depth m).

Enclosure size shall prevent persistent conflicts between individuals, prevent wear down of physical characteristics of the enclosure, and prevent unacceptable levels of parasites and pathogens.

### TAG

Considerable space is required in order for animals to move freely amongst each other, structures, vegetation and substrates.

The recommended size of indoor cages and recommendations for the sizes of platforms/nest baskets are as follows:

- Floor space = 18.0 m<sup>2</sup> (2 x head-body-length)
- Smallest side = 3.0 m (head -body-length)
- Resting place = 4.8m<sup>2</sup> (head-body-length x shoulder height)
- Streams or pools should be around 100m<sup>2</sup> with shallow and deep water.



## APPENDIX II: GUIDELINES FOR ENCLOSURE DESIGN

### WSPA

- Polar bears require two separate, large and overgrown outdoor enclosures for segregation purposes.
- For non-breeding animals the absolute minimum number of enclosures is two of equal size.
- The enclosure has to accommodate for a full behavioural repertoire, and it has to accommodate for species needs as well as specific individual needs. It shall provide the animals with a choice of environment and socialising, and it shall give the animal a sense of being in control. It shall be a large natural enclosure with concrete serving only as security and safety for animals and public. The permanent features of an outdoor enclosure shall provide key facilities for swimming, seclusion, nesting facilities as well as denning facilities. Indoor facilities shall be as well equipped as outdoor enclosures and shall be comfortable.
- Bears shall not be kept in traditional pits or concrete enclosures.
- Concrete shall be restricted to security fences, supporting steep slopes or as the base of steps or step slopes.
- All species must have a den or nest box appropriate for the species. Indoor facilities shall be as interesting and hospitable as outdoor quarters and they shall have skylights and windows to allow for entry of natural light.
- Temperature, ventilation and lighting shall at all times be suitable for the animal's comfort and well-being.
- Dens that are bare, damp and with a concrete floor are not acceptable.
- There shall be at least two entrances to indoor facilities, with free access from the outdoor enclosure.
- Indoor facilities shall provide resting platforms (not more than 1m above the ground for ground dwelling species, for older individuals not more than 10-20cm above ground, for individuals that are not able to climb nesting materials must be provided on the ground).
- For non-breeding bears there shall be a minimum of  $(n + 1)$  inter-linked indoor cages.
- Structures and furniture shall be well placed to allow animals to move freely.
- In polar bear enclosures the water to land ratio shall not exceed 1:3 and water must be cooled.

### TAG

- Enclosures of concrete are not suitable bear enclosures.

- For polar bears the ratio of water to land must not exceed 1:3.
- There should be at least two entrances to indoor facilities from the outdoor enclosure.

Both WSPA and Tag guidelines state that essential enclosure features include:

- Provision of microclimate to provide sunny, dry and sheltered in cool weather; shady and open to the wind. This can be created by shrubs and trees, hills, horizontal wooden logs, large roots, sewer pipes, rocks, caves in rocks, old barrels, and large boxes. The provision of observation points to allow viewing beyond the enclosure provided by trees, hills, rocks, dead trees forming climbing frames with platforms is also considered essential.
- Provision of hiding places for food to stimulate foraging behaviour such as piles of logs, rocks and wooden logs which can be moved by the animals, pipes installed vertically in the ground, tree pipes.

#### ABWAK

- When constructing new enclosures design should maximise choice and control for the animals in captivity and provide means for the animals to express a full behavioural repertoire, e.g. foraging, digging, climbing and resting in natural substrates. Two separate outdoor areas are necessary in order to segregate animals for breeding purposes, illness or aggression and for easy cleaning of the exhibit.
- For indoor accommodation, topography should allow for bears to view beyond their enclosure boundary to avoid stereotypic behaviours.
- Polar bears must have pools with clear water. Underwater viewing is not recommended, as glass walls prevent keepers from supplying animals with enrichment items which the animals potentially could use to break the glass. And underwater viewing requires clear water conditions so natural substrates that may block drains and cloud water cannot be used.

#### UFAW

- Simulating sea-ice habitat by building concrete enclosures with blue pools can no longer be considered appropriate for polar bears.
- Polar bear exhibits should include two separate paddocks in order to separate individuals in times of sickness, reproduction and aggression. These areas should contain large overgrown areas that will stimulate a wide behavioural repertoire.

#### IBF

- If breeding is not the purpose of the exhibit, the absolute minimum number of enclosures is two of equal size. Keeping bears in only one large enclosure should be avoided.

## **APPENDIX III: GUIDELINES FOR PROVISION OF SUITABLE CLIMATE**

### **WSPA**

- Facilities shall provide appropriate temperatures that meet the species natural needs. Facilities shall provide shelter from various weather conditions, e.g. dry areas and shade at all times for all individuals.
- Structures shall provide shelter in different weather conditions.
- Outdoor facilities shall protect against weather and sunlight.
- All bear species must have access to cool, shady places during hot summer days.
- In polar bear enclosures water must be cooled.

### **TAG**

- All bear species must have access to cool, shady places during hot summer days and some species may choose shady places even at relatively low ambient temperatures. Structures within the enclosure should provide shelter in different weather conditions.

## APPENDIX IV: GUIDELINES FOR SUBSTRATE

### WSPA

- All individuals shall have free access to substrates at all times and in different microclimates. Substrates shall not be harmful to the animal's skin or fur, and it shall be provided in such amounts as to accommodate for a full behavioural repertoire.
- For all bear species substrate shall consist of natural ground vegetation. It shall be available in both shady and sunny places in order to provide a choice of microclimate according to the weather conditions.
- Ground surfaces shall vary across enclosures, incorporating natural vegetation, earth, grass, bushes and trees.
- A sufficient quantity of areas/pits shall be available to accommodate all individuals in the enclosure.
- Nesting materials shall be available in both indoor and outdoor quarters. Areas shall contain materials such as dry leaves, hay, straw, wooden shavings or wood chips.

### TAG

- Areas should contain materials such as dry leaves, hay, straw, wooden shavings or wood chips.
- Natural ground vegetation that is the best substrate for all bear species should be placed in both shady and sunny places in order to provide a choice of microclimate according to weather condition.
- When planning new enclosures, ground vegetation should, if possible, consist of natural flora, otherwise a grass/herb mixture along with trees and bushes should be used.

### ABWAK

- When constructing new exhibits for polar bears, areas of natural vegetation should be available where animals can express their full behavioural repertoire.

### UFAW

- For polar bears, existing enclosures should be modified and should incorporate natural substrates and natural areas. Pits of sand, bark litter, soil or pebbles stimulate digging, building daybeds, rubbing and foraging. And it provides the animal with a comfortable resting area. There should be sufficient numbers of pits and natural areas so that one individual does not monopolise these substrates.
- Bears should have nesting materials (straw, wood wool, branches or leaves) in both indoor and outdoor quarters.

## **APPENDIX V: GUIDELINES FOR ENCLOSURE FURNITURE**

### **WSPA**

- Enclosures shall contain suitable features to enable bears to climb, to view horizons, as obstacles to keep bears apart and for retreat to avoid visual contact between individuals.
- Shrubs and tree branches shall be included in the enclosure in order to hide food and encourage natural foraging behaviour.
- Structures and furniture shall be well placed to allow animals to move freely.
- Enclosures shall be equipped with claw logs (tree trunks, logs etc.) of sufficient size to allow for proper claw or talon exercises.

### **ABWAK**

#### **Polar bears:**

- When improving existing enclosures introduce: large tree trunks, sand pits, bark litter pits to allow for foraging, digging, building daybeds, climbing and resting in substrates.
- Indoor accommodation: Wooden platforms raised above ground

## APPENDIX VI: GUIDELINES FOR PRIVATE AREAS

### WSPA

- Animals shall have adequate retreating facilities away from people and other individuals.
- Individuals shall be able to seek seclusion at all times.
- Enclosures shall contain suitable features as obstacles to keep bears apart and for retreat to avoid visual contact between individuals.

### TAG and WSPA both recommend the following:

- Hiding places for bears to avoid conspecifics and visitors are essential requirement for bear enclosures. These may be provided by shrubs and trees, hills, horizontal wooden logs, large roots, sewer pipes, rocks, caves in rocks, large boxes and barrels.
- Obstacles to deter bears from attacking each other are essential. These can be trees and shrubs, large horizontal logs or tree trunks.

### UFAW

- Visual barriers can be introduced into existing enclosures to provide the animals with the opportunity to be without visual contact and to prevent aggressive interactions.

## **APPENDIX VII: GUIDELINES FOR ENRICHMENT PROGRAMMES**

### **WSPA**

- Polar bears shall have various enrichment objects available, these shall vary in shape, size, texture and colour. A minimum of 10 objects should be available in one enclosure and at least one per individual. All non-consumable and consumable enrichment items should be supplied in sufficient amounts to occupy all individuals in the exhibit.
- Environmental enrichment shall be a priority for daily husbandry, i.e. time, facilities and budget shall be appropriate for the welfare of the animals.
- Enrichment is a necessity in all bear enclosures, also large natural enclosures.

### **TAG**

- Day-to-day enrichment is only effective if stimuli/objects are frequently changed.
- For polar bears, the following feeding enrichment techniques are recommended: ice blocks with food in different sized buckets without handles; ice blocks with food in large tubs; fish or nuts in a plastic can with small openings; whole cucumbers or melons; branches; honey, ketchup or mayonnaise smeared in or on traffic cones or buckets; bones of cattle or horses; hides.

### **ABWAK**

For polar bears enrichment items that induce play and more social interaction should be introduced, as well as greater use of the enclosure and a higher level of activity. The objects should be of varying shape, size, colour and texture and offered with a minimum of 10 objects in an enclosure. Always provide at least one object per individual.

### **UFAW**

- Animals have more of a choice and a sense of control of their environment if they have a wide variety of objects to choose between. Moveable objects should on a regular basis be removed and introduced to the enclosure in order to stimulate exploratory and play behaviours.
- With large food items and inedible play objects enough should be provided to activate all individuals at the same time.
- Environmental enrichment should be a priority on a daily basis. There should be enough time, facilities and appropriate budgets for enrichment programmes.

## IBF

- Enrichment is a necessity in large natural enclosures, and a programme should be set up for any given bear enclosure.
- Feeding enrichment shall be explored, such as changing the times of feeding, hiding food items, supplementary feeding (vegetables, fruits, browse, rawhide dog bones and live or fresh fish), finely chopped and scattered/hidden frozen blocks of ice or containers that offer manipulation.
- Introduce manipulative objects or objects for exploration, e.g. traffic cones, “boomer” balls, heavy rubber buckets. Rotate these items daily or periodically.



## APPENDIX VIII: GUIDELINES FOR FEEDING TECHNIQUES

### WSPA

- Food shall be provided at different times throughout the day, at least three meals per day, and on an adlib basis. Meal frequency shall increase gradually for species that naturally adapt a seasonal variation in feeding motivation.
- The animal's main meal of the day shall be fed in the morning at a fixed time and it shall not be fed indoors.
- Feeding methods shall allow for extensive foraging, natural manipulation, and processing. Most foods shall be scattered or hidden in the outdoor enclosure.
- Polar bears benefit from feed that floats in water.
- Clean fresh drinking water shall be available and accessible at all times for all individuals.

### TAG

- Food should be presented so that manipulation, processing food items and extensive foraging will stimulate natural conditions. Meat should be provided as whole animals or large carcass portions. For polar bears, food that floats should occasionally be scattered in the water.
- Seasonal variations in feeding motivation should be taken into account in feeding management.
- Animals should be offered at least three meals in a day with most food scattered in the outdoor enclosure.
- Feeding enrichment should take into account that different species have different ways of foraging, i.e. utilise different food seeking skills.

### UFAW

- Bears should receive their main meal early in the morning in order to reduce the animals' stress level in anticipation of food.
- In order to stimulate foraging behaviour, foods should be scatter fed or embedded in containers or blocks of ice two to three times a day at irregular intervals and with different contents.

### IBF

- Scatter feeding at different times a day must be considered.

