Captive Polar Bears in UK and Ireland

By

Paul V. Horsman B.Sc, M.Sc, Cert.Ed.

1988

"bears are most amusing, clever, and interesting animals, playful, comic, easily taught a variety of tricks, intelligent, cunning, and restless; easily offended, treacherous and cruel. Thus may their character be summed up. I know of no animal so much petted as a young bear".

Wild Animals in Captivity

by

A.D. Bartlett. 1898

"The polar bear, instead of melting into his background of dazzling white, is a complete blot on the landscape, looking distinctly sooty, a condition that is not entirely the fault of the London chimneys but is rather due to the fact that the animal simply hates the cold, and refuses to enter its bath when the temperature falls below 45°. These bears, emanating from the coldest regions, are, curiously enough, happiest during a heat wave, when, unlike many of the tropical inhabitants of the Menagerie, they suffer no inconvenience, but on the contrary enjoy life in the full glare of the sun. It may be truthfully said that the appearance of ice invariably gives the Zoo polar bears cold feet. They are afraid the ice may let them down. Very gingerly they shuffle round the pool, backs pointing towards the ice, and at intervals test the surface with their enormous hind feet. Usually the ice gives way and they hurriedly retire to await a thaw".

Animals in the Wild and in Captivity

by

E.G. Boulenger. 1930

"Once a musk ox lamented to the polar bear. "It is not well to try one's stregth against those that live on the surface of the earth, those who have swift ones to let loose upon us, and have weapons that can spring forth from their hands".

The polar bear said, "Those that live on the surface of the earth are not difficult to strike down with a blow of one's paw, if only one can come at them from behind".

Inuit Legend

Captive Polar Bears in Britain and Ireland

CONTENTS:

List of Figures:

List of Tables:

List of Plates:

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Dr. M.F. Stevenson of Edinburgh Zoo
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Mr. P. Wilson of Dublin Zoo
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Preface

This report has been written using as much relevant information as possible. I hope that it is an even-handed treatment of the problems of captive polar bears. As such various sentences and paragraphs should not be taken out of context and the author should be consulted before any statements or quotes are extracted and used elsewhere.

Paul V. Horsman, B.Sc., M.Sc., Cert.Ed.

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Captive Polar Bears in the UK and Ireland

1. Introduction

Polar bears have been kept in captivity since Egyptian and Roman times - though how the bears got to Egypt is a mystery (Davids and Guravich 1983). In about 880 AD Harold the Fairhead of Norway is reported to be the first European king to catch polar bears. Emperor Henry III of Germany and King Henry III of England had polar bears as mascots at court. Today polar bears are exhibited in zoos throughout the world. According to the International Zoo Yearbooks (1964 - 1967, 1973, 1975), 172 institutions contain at least 401 polar bears world-wide though it is likely that both the number of bears and the number of institutions is somewhat higher.

This report is the result of a survey carried out to obtain information on captive polar bears in Britain and Ireland, and to relate this to the role of zoos in modern society.

2. Survey Method

Each zoo and safari park was called by telephone to discover where polar bears are exhibited. Then letters were written to request an appointment to discuss the animals. Occasionally the letters were followed up by telephone calls. The zoos were visited and between two and four hours spent observing the bears, recording their behaviour, the approximate dimensions of the enclosures and any other relevant material. Where possible educational material used by the zoos was obtained and interviews held with various zoo personnel.

The following points were discussed at the interviews:

1. The number of bears exhibited; their age and history.

2. Had the zoo experienced any particular problems with the bears.

3. Whether the zoo had passed recent inspections by Health and Safety staff and whether they complied with the Zoo Act.

4. Whether the animals had bred and reared young successfully.

5. Was any scientific research work being carried out on the bears.

6. What was the zoo's historical record in keeping polar bears?

7. What educational material was provided and/or information given to the public.

8. Did any of the bears exhibit behavioural problem such as constant repetitive (stereotyped) behaviour?

9. General points and questions about polar bears in captivity and the role of zoos.

3. Results

Nine zoos in Britian and Ireland exhibit polar bears:

1. The Bristol, Clifton and West of England Zoological Society.
2. Chessington Zoo Ltd; Surrey
3. North of England Zoological Society, Chester
4. Dudley and West Midlands Zoological Society Ltd
5. The Royal Zoological Society of Scotland, Edinburgh
6. Flamingo Land Zoo and Family Funpark, North Yorkshire

7. The Zoological Soceity of Glasgow and West of Scotland
8. Belfast Zoological Gardens, Bellvue
9. The Royal Zoological Society of Ireland, Dublin

The response from the zoos was variable, some were very helpful, one refused to co-operate and occasionally letters and telephone calls were ignored. At the end of the survey an interview was held with Dr. Brian Bertram of the London Zoological Society, where polar bears have been exhibited for a number of years and the zoo is currently developing a new polar bear exhibit.

1. <u>The Bristol, Clifton and West of England Zoological Society: Director: Mr. G.R. Greed</u>

There are two bears on exhibit, although there are three bears at the zoo, Over the past 150 years polar bears have been exhibited in three locations at Bristol:

1. In the bear pit - now long abandoned
2. From the 1870s until the war in a barred enclosure
3. Since the last war in an enclosure built in 1939.

Since 1947 six adult polar bears have been exhibited. William and Cynthia were imported as cubs from Norway in 1947. William died on May 16 1959 from a condition known as volvulus; Cynthia died in July 1980 after showing signs of senility. Sebastian, offspring of William and Cynthia was born in December 1958 and died November 25 1977. Nina was born at Copenhagen Zoo in 1958 and imported in 1959; Janina, offspring of Sebastian and Nina, was born at Bristol in November 1974 and Misha, a male, was bought from Chipperfield's Circus in 1979 as a replacement for Sebastian.

The bears presently living at Bristol are: Nina, aged 26; Janina aged 11 and Misha of unknown age.

During the 1960s and 1970s, three bears were successfully bred and sent to the other institutions:

Sabrina, born to Sebastian and Nina, in November 1966 and sent to London in 1969 - she is now at Chester.

Brunella, born to Sebastian and Cynthia in December 1970 and sent to Paris in 1972.

Ninian, born to Sebastian and Nina in December 1970 and sent to Zurich in November 1971.

The females breed from seven to 21 years old, but over the last ten years polar bears have not bred successfully. On one occasion Janina was released from her maternity den too early and she gave birth in January in the outer enclosure. Bristol's policy is to avoid hand-rearing which is very difficult (Wortman and Larue 1974) and allow the mother's to rear their cubs; this appears to be the view among most zoo personnel. Bristol zoo developed the technique of using underflooring heating in the cubbing dens. This has been adopted in many zoos around the world and is reputed to have increased the survival rate of cubs.

Janina and Nina were the only bears on view, Misha is too aggressive and is kept behind the scenes during the day. He was bought from Chipperfield's Circus where he had been confined in a travelling wagon for anything up to eight years. Due to his confinement, Misha has developed a "very distressing stereotypic behaviour". Despite this he has successfully mated with Janina.

Once stereotypic behaviour has developed it is virtually impossible to eliminate (Meyer- Holzapfel 1968), hence it is difficult to know what is best for bears like Misha - his conditions are now better than they were during his confinement in the circus, but the stereotypic behaviour is probably fixated.

Mr Greed admitted that keeping polar bears in captivity is fraught with difficulties. One of the main problems at Bristol is that the bear enclosure is built in an outer corner of the zoo and the dens are adjacent to very busy street traffic which has increased greatly over the last 20 years (see figure 1). The disturbance has been exacerbated by the location of a bus terminal at the corner during the 1970s and the opening of a sports centre on the opposite side of the road. This means that it is impossible to achieve the quietness and seclusion necessary for successful breeding. The growing disturbance may explain the lack of breeding success over the last ten years.

Generally Bristol Zoo is changing its emphasis to develop specialised exhibits such as aquaria and insect displays. It is felt that such exhibits are more satisfactory for urban zoos. It is extremely doubtful that Bristol will continue to exhibit polar bears beyond the next three to six years. The other two bear enclosures are being demolished this winter. During this phasing out period "you can't just get rid of (the bears) and perhaps while they are here it is best to give them as satisfactory conditions as possible". Mr Greed felt that as the polar bear "is a hunter and solitary and may roam up to 300 miles a year in wide open spaces. They are constantly on the lookout so may not be best in captivity even if they are given a wide open enclosure".

The Exhibit

The enclosure is located in a corner of the zoo adjacent to a road junction. The outer wall is also the boundary of the zoo (figure 1). There is a notice at the back of the enclosure which says that the two bears are Janina, born November 29 1974 and Nina, Born in Copenhagen on October 27 1958.

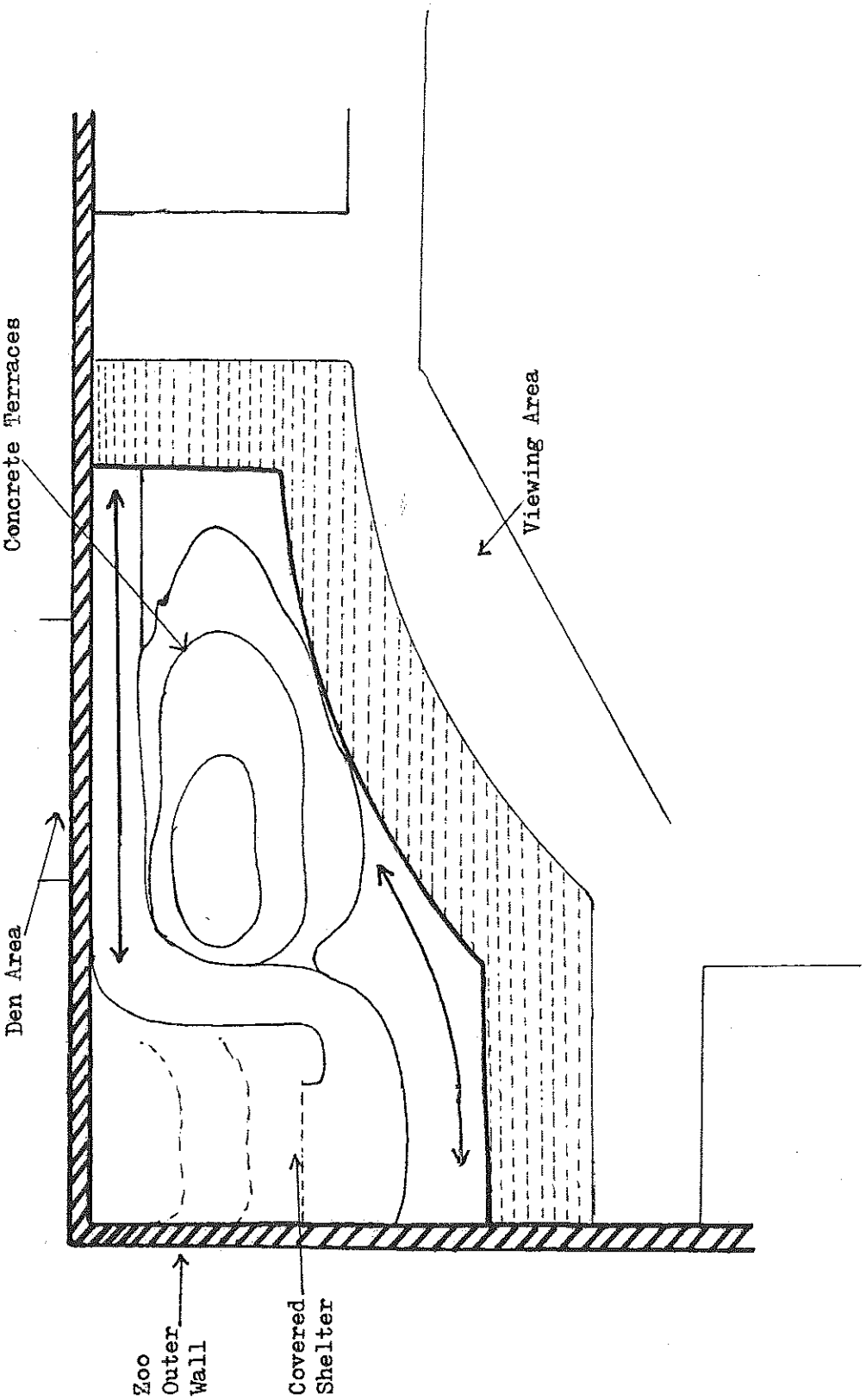

Figure 1: Plan view of the polar bear enclosure at Bristol zoo (approximate area: 360 sq. m.)

↔ - areas where the bears paced.

Plate 1: The stereotypic head-shake demonstrated by one of the bears at Bristol zoo. a - the left side of the pace on the back terrace; b - the left side of the pace on the front terrace.

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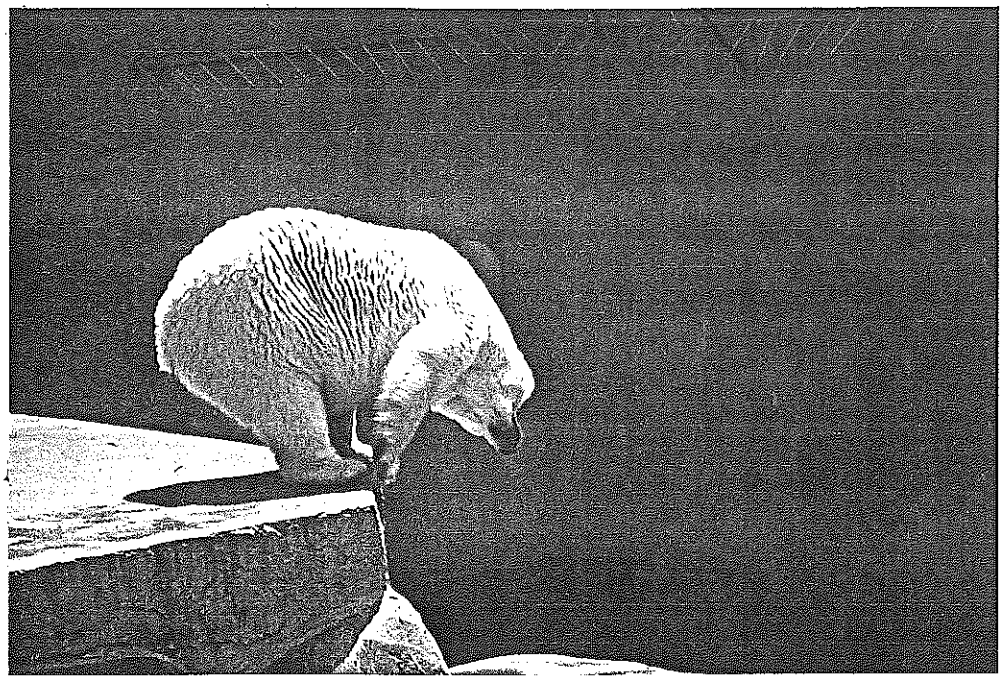

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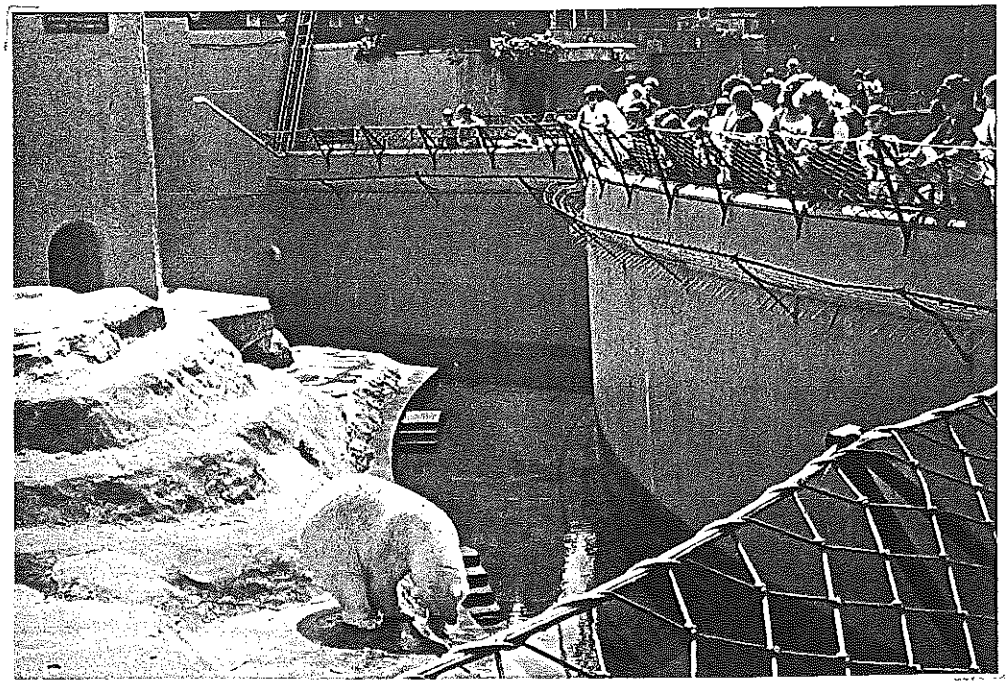

I watched the bears for two periods of two hours each. Bear 1 (they were not identified) spent most of the time pacing and swam twice. At the end of the walk from left to right, the animal shook its head in a characteristic way, swung the front right leg outwards and then turned to pace to the left (Plate 1). At the end of the walk towards the left the animal simply turned around. This pacing, with the head shake at the right turn was repeated constantly, and occasionally the animal pushed the second bear out of the way in order to complete the ritual head-shake.

Bear 2 spend about an hour lounging on the highest point of the enclosure, occasionally clicking her tongue. The rest of the time she also paced but without any head-shake. Both animals paced on the flat parts of the enclosure (figure 1).

2. Chessington Zoo Ltd
Head Keeper: Mr. R Eaton

Chessington has two bears, both born at Karlsruhe: Clyde on November 20 1981 and Bonnie on December 1 1981. They were imported in 1982 when six months old. The zoo has exhibited a pair of bears previously which were over 20 years old. The male died ten years ago and the female was sent abroad, it is believed to Hamburg, 1980 or 1981. Chessington has never bred polar bears but it is hoped that Bonnie and Clyde will breed.

At present the enclosure is close to a funfair machine or "Waltzer", regarded as a "monstrosity" by Mr Eaton (figure 2). However the zoo is investing between 170,000 and 200,000 in extending the enclosure and removing the Waltzer. The new development will probably double the size of the enclosure and will enable people to walk down an underpass and see the bears from the same level. The bears have now been removed to London while the new construction is being built.

The zoo obviously believes it has a long future as it is investing in several new developments.

The only physical problem to date was a skin complaint resembling mange that Bonnie developed. After attempts to trace the cause it was felt that there may be something in the mackerel that the bears were eating. This may be the same problem encountered at Edinburgh where it was discovered that oil was the cause (mackeral is an oily fish). The trouble has now cleared up and there have not been any further problems.

It was suggested that I could talk to the people involved in the research and building of the new enclosure, but unfortunately despite my letters and a phone call, the zoo has not followed this up.

The main aim of the zoo is to breed the bears. Mr Eaton admitted that he had not thought of conservation as being a possible reason for keeping the animals, although the guidebooks report that when the bears are "mature it is hoped that they will breed, since polar bears are now an endangered species, with only an estimated 10,000 still existing in the wild". Mr Eaton agreed that bad zoos should be closed down and he always checks any establishments that their animals are going to.

The Exhibit

The bears had half a beer keg in the enclosure to play with, but apparently they will play with any simple thing. During two hours watching the bears the male paced back and forth, the female was more interesed in playing with the barrel. Mr Eaton remarked on the intelligence of the male: to get the bears into their dens at night, food is put inside but the male will often block the gate open with his back foot and drag his food into the open to prevent being closed in.

In front of the enclosure there is an information notice (figure 2) which reads as follows:-

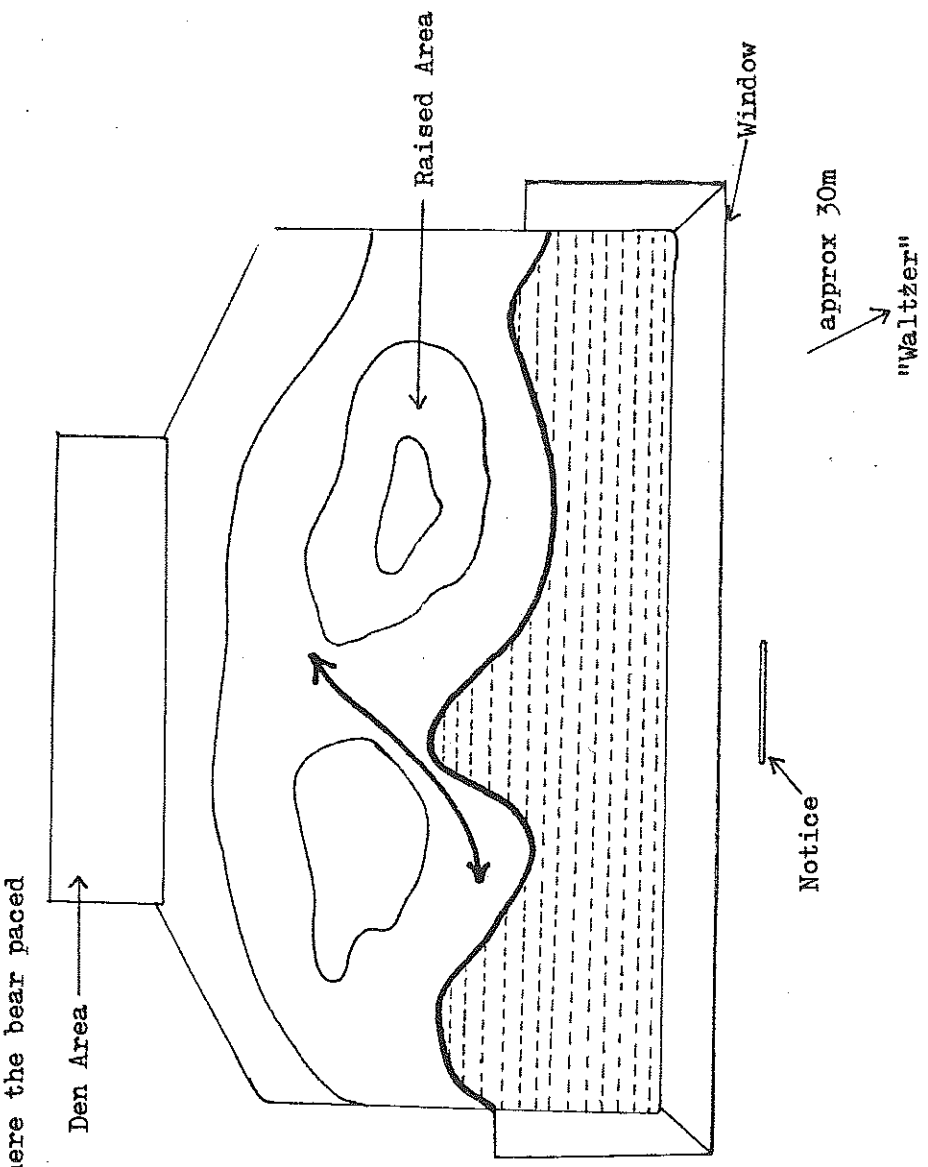

Figure 2: Plan view of the polar bear enclosure at Chessington zoo (approximate area: 625 sq. m.)

↙↗ - area where the bear paced

Bonnie and Clyde. Born Karlsruhe Zoo
Clyde. 20.11.81
Bonnie. 11.12.81

Polar bears can live up to 40 years and it will be at least 5 years before our pair are old enough to breed. A breeding den is already built for them. Females give birth once every 2 years to one or two blind hairless cubs which are dependent on their mother for the first months of their life. A fully grown polar bear can attain a length of 10 feet and stand 5 feet to the shoulder. They originate from the Arctic and coastal zones of Russia where they feed mainly on seals.

During the observation time it was noticed that no one stayed longer that about 30 seconds to look vaguely at the information. In addition it is difficult to appreciate sizes such as 10 or 5 feet, and a map would be more use in indicating the distribution. Forty years is an exceptional age for polar bears to live; 30 is more usual and in the wild the bears give birth every three or four years (Demaster and Stirling 1981) although it may be every two years in captivity.

The guidebook says their "incredible swimming ability enables them to catch seals which constitute their main source of food". Although the animals are very good swimmers, they catch most of their food on the ice by ambushing seals at their breathing holes, not hunting them in the water. It should also be noted that the bears will eat seaweed, scavenge other vegetable matter and hunt other small mammals during periods when the seals are not available. However, generally the guidebook is quite good and informative with a 'walkabout quiz' for children to follow.

There is a circus within the grounds of Chessington run by Tamara Hassani daughter of Coco the Clown. This runs entirely on the artistry of its performers and no animals are used in the show, which was apparently a lifelong dream of her father's. Such a circus should be encouraged as an example of how performing animals are not needed to attract people to a show. It would be a welcome improvement to see such circuses touring the country.

3. North of England, Zoological Society, Chester
Director: Dr. M Brambell
Curator of Mammals: Mr. N. Ellerton

Chester has two bears: Sabrina born in Bristol in 1966 and Amos born in Moscow in 1965. Amos has had some skin problems which is thought to be seasonal and Sabrina has something wrong with her wrist which will have to be X-rayed.

In 1962 there were four bears, one male and three females; two cubs were born in 1965 but died in about 30 days - it is thought they were eaten by the female. Two more cubs were born in 1967, one was eaten and an attempt to hand rear failed. A further cub was born in 1974 and hand rearing again failed.

In 1976 the male died aged 26 years followed by one of the females (Rack) in 1977 aged 30 years. In 1979 a second female (Motty) had to be destroyed. A male aged seven months and a female aged nine months were imported in 1980 from Copenhagen and one month later the remaining original female died aged 39 years. Unfortunately during the winter of 1980, the new female died after an accident under the ice in the pool; a female was then imported from Toronto in February 1982.

Plate 2: The polar bear Sabrina at Chester zoo; a - walking in reverse clicking her tongue and, b - swaying her head from side to side. The problem with her front wrist can also be seen.

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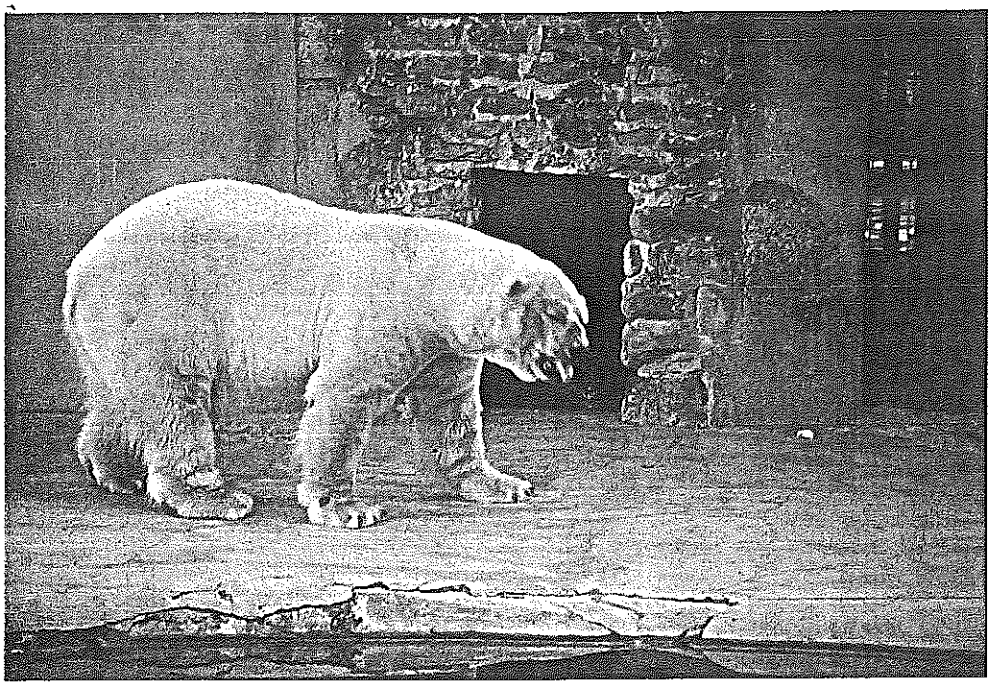

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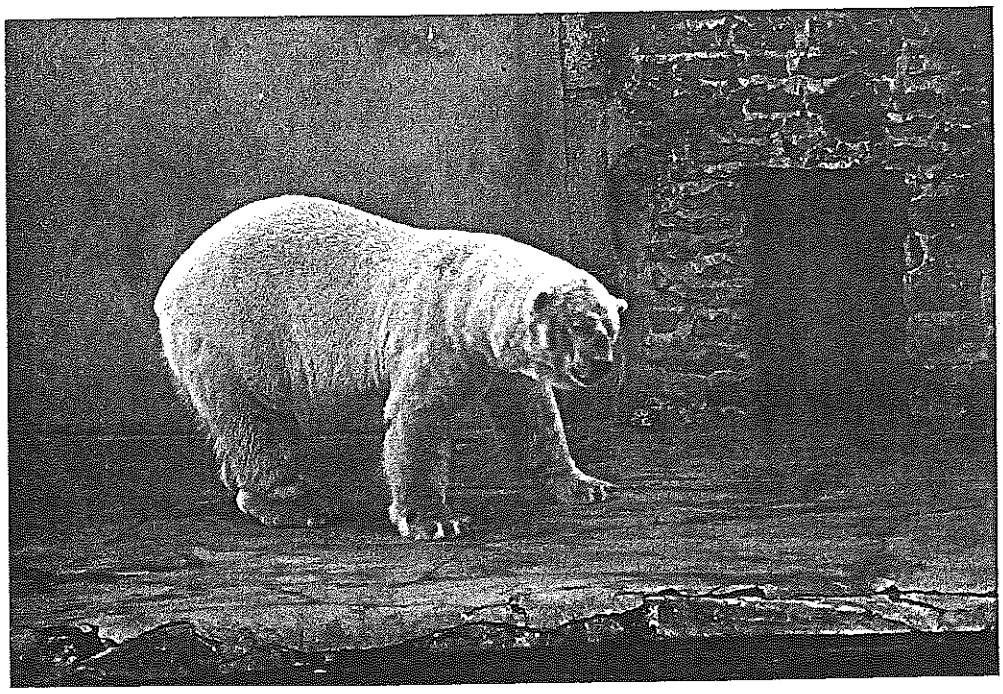
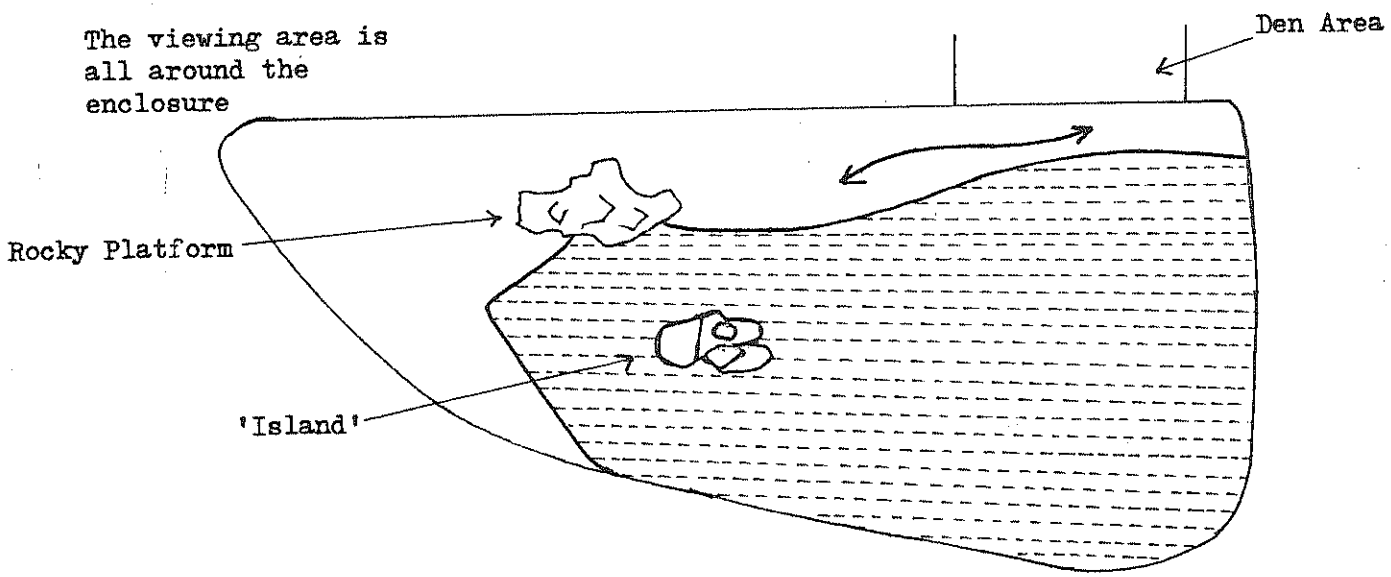


Figure 3: Plan view of the polar bear enclosure at Chester zoo (approximate area: 1,200 sq. m.)

↩ - area where Sabrina was pacing



The male died in 1983 and the post mortem showed a contusion on the brain and drowning. It is thought that the new female must have hit the bear in the water causing a sharp intake of breath. In 1984 this female had to be destroyed because of bad stereotypic behaviour; it was felt that it would be difficult to bring in another male because of her behaviour and a bear should not be left on its own. On October 2 1984, the present two bears were bought from Whipsnade Zoo.

I had long and helpful discussions with Dr. Brambell and Mr Ellerton. There are difficulties with breeding polar bears in captivity and Chester has not succeeded. It was agreed that the conservation argument for keeping the animals in captivity is weak and that it may now become evident that they should not be kept in captivity. However it was pointed out that some bears in Canada become closely associated with humans - particularly at Cape Churchil which is on the migration route. It is expensive to transport bears to other areas and some animals always find their way back. A few bears are shot and some go to zoos. However the bears in Churchill provide a tourist attraction and it is reported that the locals just accept the bears as part of everyday life; accidents involving bears are remarkably rare (Davids and Guravich 1983).

The Exhibit

The enclosure at Chester is one of the largest in surface area but the pool takes up a large proportion of the area (figure 3). At the enclosure information is given on a notice in four stages: a picture of the animal, its name and a distribution map; the habitat, its performance in zoos; and the world population trend. The guidebook gives the remaining information such as their size, diet, a little about their morphology and adaptations to Artic conditions and their breeding. Its conservation status is mentioned though no numbers are given and, although hunting and killing are reported as causes for it being an endangered species, no mention is made of current threats such as oil exploration in the Arctic.

OnlySabrina was seen, she displayed some stereotype pacing walking forwards and then reversing swaying her head from side to side and clicking her tongue (plate 2).
Chester provides a Zoo Education Service for Teachers which appears very good. 'Talk-walks' are advertised as well as information sheets, work packs and work books geared for all ages of students from primary school to CSE, O and A level and include YTS courses, Nursery courses and post A level courses such as undergraduates and teacher training. Classroom facilities are available and help with back up work. Chester takes its educational role seriously.

Dr. Brambell believes that zoos are going to be more involved in the conservation of species in the future, but feels that zoos must co-operate. He is in favour of closing down bad zoos, but believes that there is a future role for zoos in that, in some cases, they can provide a reservoir of species that, through human activity - political or industrial - are endangered in the wild. He readily agrees that this work cannot be done alone and must be in conjunction with the conservation of the wild habitat.

4. Dudley and West Midlands Zoological Society Ltd

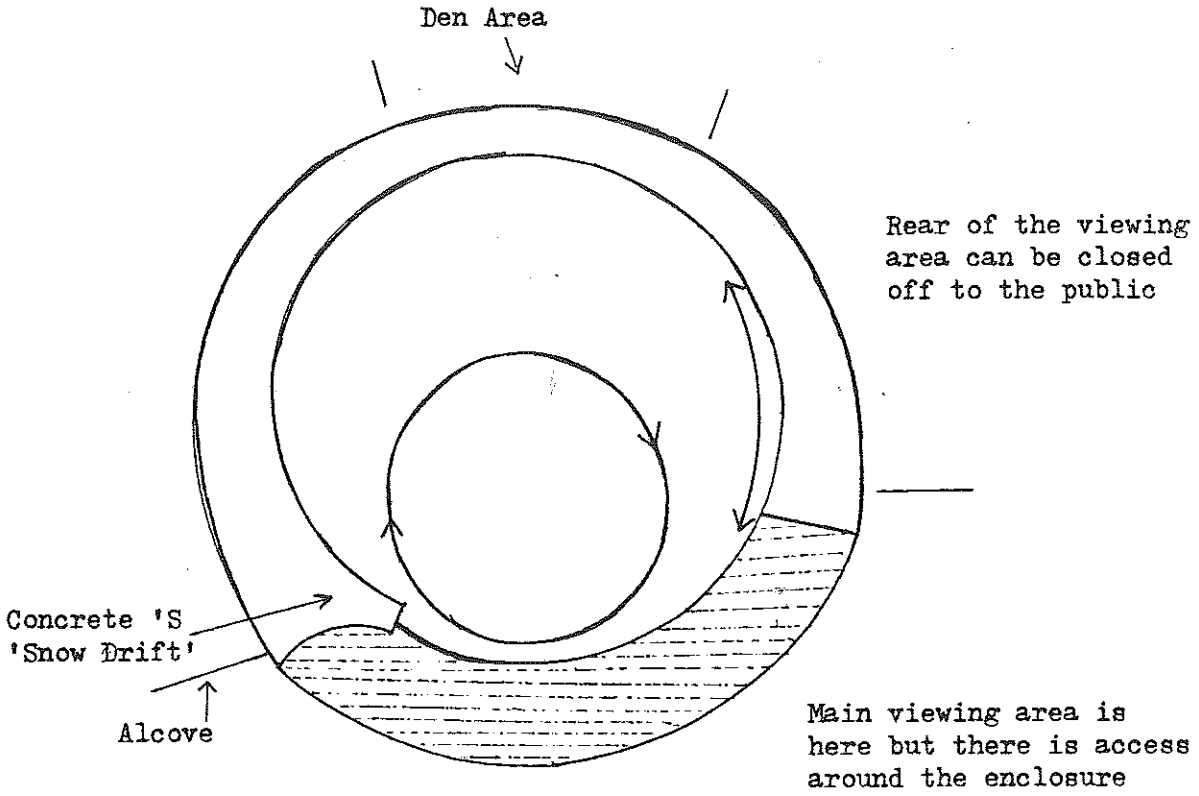
Curator: Mr. C. Round

Two polar bears are on exhibit which are on permanent loan from London Zoo. Pipiluk, the male was born at Whipsnade in 1985, Mosha is female and was born in Moscow in 1965. Both bears have been at Dudley for about eight months and it is hoped that they will breed from next April. Pipiluk and Mosha have bred in London but none of the cubs survived.

In 1966 two bears came to Dudley from Copenhagen and since then have given birth nine times, four were successfully reared, five were not. The four successful births all went to other Zoos - one to Belfast. It is not known what happened to the original two bears.

Figure 4: Plan view of the polar bear enclosure at Dudley zoo (approximate area: 320 sq. m.)

↙↗ - area paced by the bears



The Exhibit

The enclosure is a pit designed by Lubetkin in the 1930s and has a building preservation order on it as it is an example of one of the first uses of reinforced concrete. This order means that the buildings cannot be changed in any way. The dens are cleaned daily and the pool twice a week; the female is isolated during cubbing and the area closed off to the public. Although the dens are old the ability to completely close off the area to the public may help to explain their breeding success (figure 4).

The first notice to be seen at the pit is a triangle and exclamation mark with "These animals are dangerous" written underneath. Further information is given in a notice hidden to one side under an alcove. During two hours only one person looked at it but she did not read it. Most people just looked down on the bears for a brief time before moving on.

The notice reads as follows:

Polar Bears (Thalarctos Maritimus)

Height:	2.1m
Weight:	550 kg
Gestation:	260-280 days
Number of young:	1 - 4
Longevity:	34 years

Large truely carnivorous bears, seriously threatened with total population of more than 12,000 animals. Local populations are dwindling rapidly. Fur white with yellow tinge. Broad feet are covered with fur. These features are adaptations to life on ice floes and in freezing water. Polar bears eat seals in winter, becoming scavengers in the short Arctic summer.

Plate 3: Dudley zoo's polar bears; a - the circular pathway is clearly seen from the wet paw marks; b - both the bears pacing.

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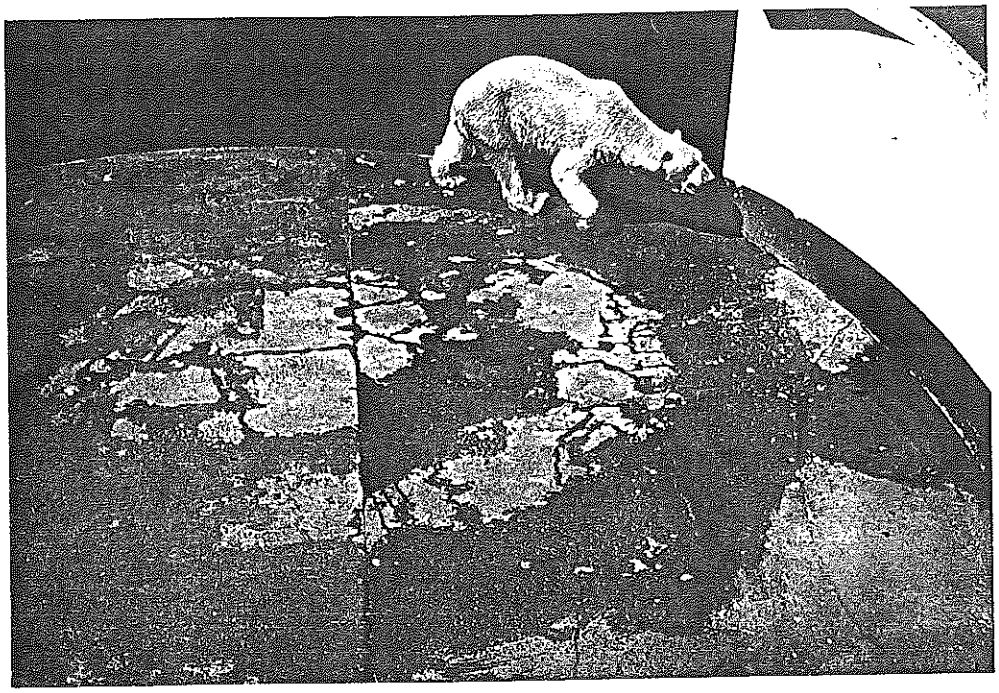

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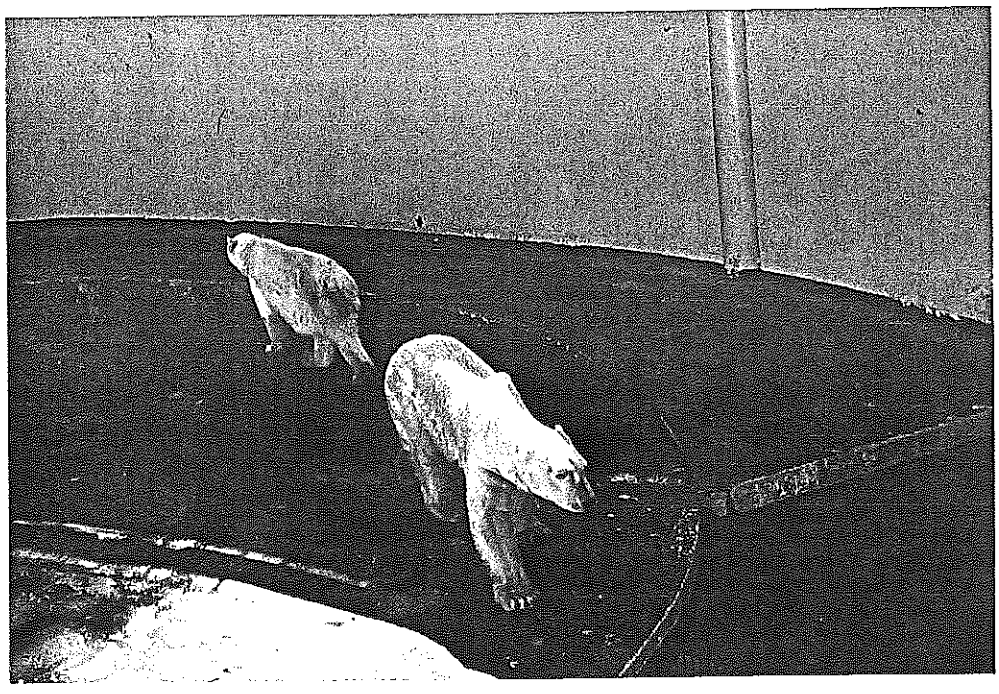


> Decline in the whaling industry in Arctic waters led to the hunting of seals, putting pressure on polar bears. They have also been hunted for their fur. The introduction of guns to Eskimo culture and prospecting for minerals and oil also threatens their survival despite official protection from Canada and the USSR.
> Polar bears do not breed well in captivity but since 1966 Dudley Zoo has successfully bred them on several occasions.

Despite giving the sizes in the notice it is difficult to get a real indication of the animals; this is exacerbated by having to view the animals from above.

The bears looked in good condition. Apparently they are better than when they arrived, when Pipiluk had black patches on his head - a result of rubbing on the bars in the enclosure in London - and was overweight. The patches have virtually gone and he has shed most of his weight.

During the time spent observing the bears, the male paced in a circle, (plate 3) stopping once when the keeper went into the dens and once for a swim. A circular stereotypic pacing has been reported to be caused by keeping the animal in a square enclosure (Meyer-Holzapfel 1968). The female paced constantly back and forth along one side taking eight paces each way, pausing once to look briefly into one of the dens. According to Mr. Round, there is no problem with keeping the bears in captivity as long as they breed.

5. <u>The Royal Zoological Society of Scotland, Edinburgh</u>
<u>Curator: Dr. M. Stevenson</u>

Edinburgh Zoo has two bears: the male, Barney was born at Whipsnade in November 1976 and arrived in Edinburgh in late 1977; the female, Mercedes was wild caught and imported from Churchill in Canada at the beginning of 1984. Edinburgh has

kept polar bears since 1913 but has never been able to breed them successfully. From the late 1920s until 1945, 17 cubs were born but none survived, and then from 1947 two female bears were kept at the zoo; one died in 1975, the other in 1976.

In 1977 two female one year old cubs, Nanuk and Anouska were presented to the zoo by the Canadian government. Then in 1981 a young male was received on breeding loan from London Zoo and was seen to mate in 1981. It is assumed that no cubs resulted from this. The bears were seen to mate in 1982 and work started on maternity dens that was due to finish in October but was delayed until November. The females were then enclosed in their dens.

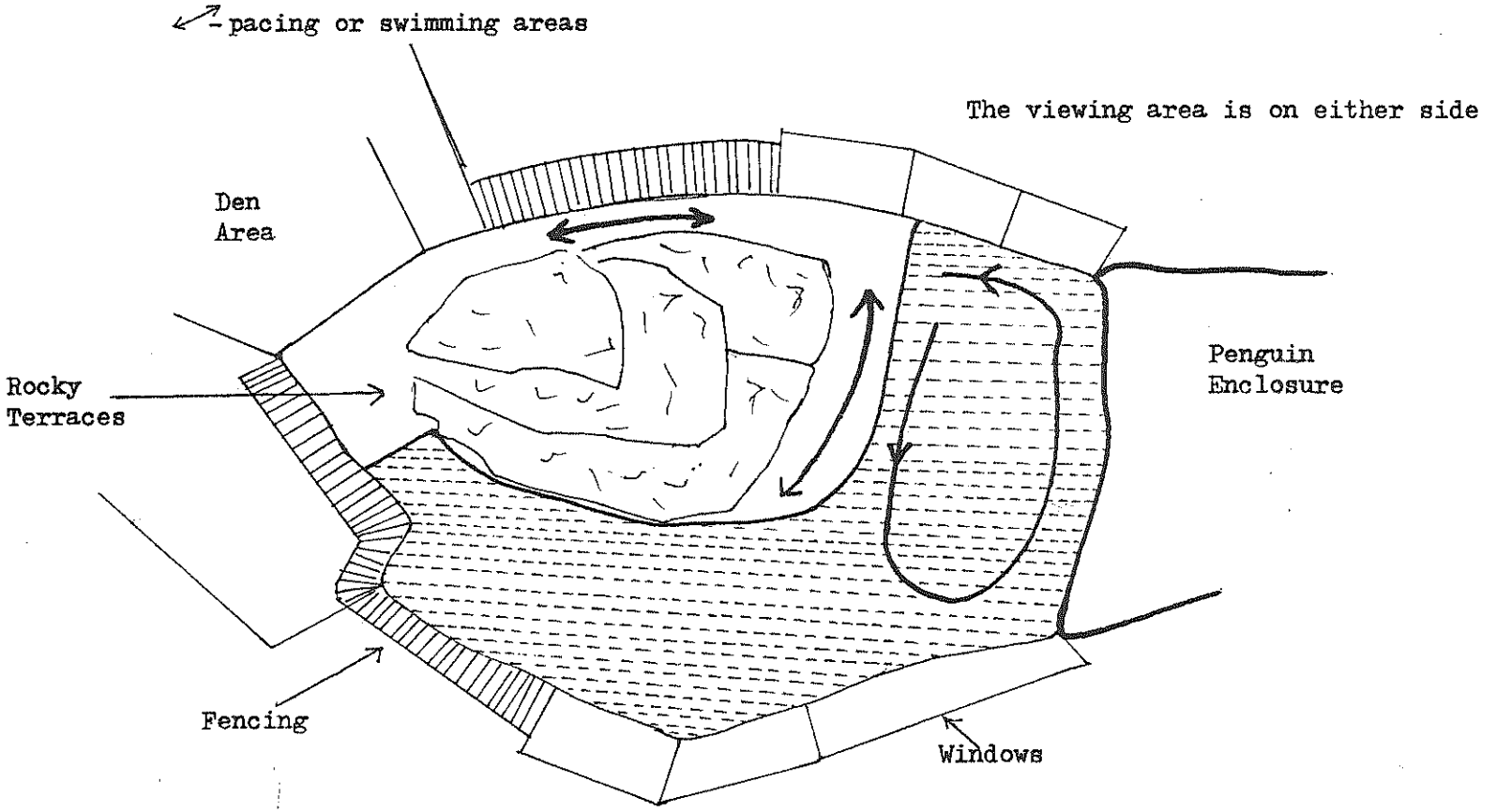
The zoo followed all the recommendations about enclosing the bears in the maternity dens and keeping disturbance to a minimum. But unfortunately both females died within two weeks of being enclosed. A post mortem failed to reveal any clear cause of death. It was discovered that neither bear was pregnant so the conditions that may induce semi-hibernation were not present and the stress of the enclosure may have been sufficient to cause death. It is likely that both bears could hear each other which may have been an additional cause of anxiety. All the decisions regarding breeding the bears in captivity were taken which perhaps emphasises the difficulties encountered in breeding these animals.

As a result of this tragedy the zoo is keeping a very watchful eye on their present female and will be making alterations to their cubbing procedure.

The Exhibit

The bears look in good condition and both spent some time in the water. The male swam in an oval and every time he reached the far side he threw his head back. The female was occupied in picking up debris such as cans, weeds and paper cups from the bottom of the pool. On the terraces

Figure 5: Plan view of the polar bear enclosure at Edinburgh zoo (approximate area: 1,200 sq. m.)



the female paced on top of the display for a short while and the male paced behind the rock pile but continued to throw his head back at the far end of the walk.

The bear enclosure was built in the 1930s with the addition of the present maternity dens in 1982, but there are plans to extend the enclosure to include the present display (figure 5). This will increase the area and provide two places that can be closed off to the female if necessary. There has been some skin problems which have been associated with oil in their diet breaking down vitamin E. This may be similar to the problems encountered at Chessington and possibly Chester.

The zoo takes the educational role seriously and has worksheets and teachers notes for groups ranging from primary through to secondary school. There are adult education classes and a series of collaborative programmes callled "Interlink" that are run with The Royal Scottish Museum, The Royal Botanic Garden, The Commonwealth Institute, Scotland, and The Royal Society for the Protection of Birds. These collaborative programmes are a good innovation with over 1,500 pupils attending in 1984. A large number of students make use of the educational material provided by the zoo (see table 1).

Table 1: Party and Educational Use of Edinburgh Zoo (Anon 1984)

YEAR	1981	1982	1983	1984
TOTAL NO. STUDENTS	120,119	105,176	110,497	106,209

6. Flamingo Land Zoo and Family Fun Park, North Yorkshire
Curator: Mr. N. Wilby

It is unfortunate that Mr. Wilby refused to help in the survey. In his reply to my letter asking for an appointment he stated: "As you are sponsored by an organisation whose sole aim is to close down Zoos by any devious means they feel fit to employ,

I regret, I am unable to assist you in your research." This attitude will only serve to further the feeling that the zoo is not doing all it should to satisfy its role either in terms of a public service or in the captive conditions of their animals.

Flamingo Land is a mixture between a zoo and a Fun Park with roundabouts, swings, a monorail, etc. There are two polar bears in a fairly large enclosure together with a brown bear. It is unlikely that these bears ever meet in the wild, though several zoos have produced hybrids by mating polar bears with different subspecies of brown bear (Anon 1963, 1967 - 1972, 1974 and 1975). It is not known whether such hybrids survived.

The Exhibit

The enclosure is large but, at the time, the area was dirty. A notice at the back of the area attempts to explain the state of the exhibit:

> Visitors write to us about the condition of this pool and area.
>
> We like to clean this pool once a week. Whilst we are cleaning the pool it is necessary to lock the bears up in their den. As they do not like being locked up they go to great lengths to avoid it. Being clever animals it is sometimes impossible to get them inside. Hence the reason that this area is sometimes not as clean as we would like it to be.

Obviously the zoo has had complaining letters from the public. None of the other polar bear exhibits in Britain and Ireland is in such a state, neither is there such a notice - if other zoos can carry out the necessary work, why not Flamingo Land?

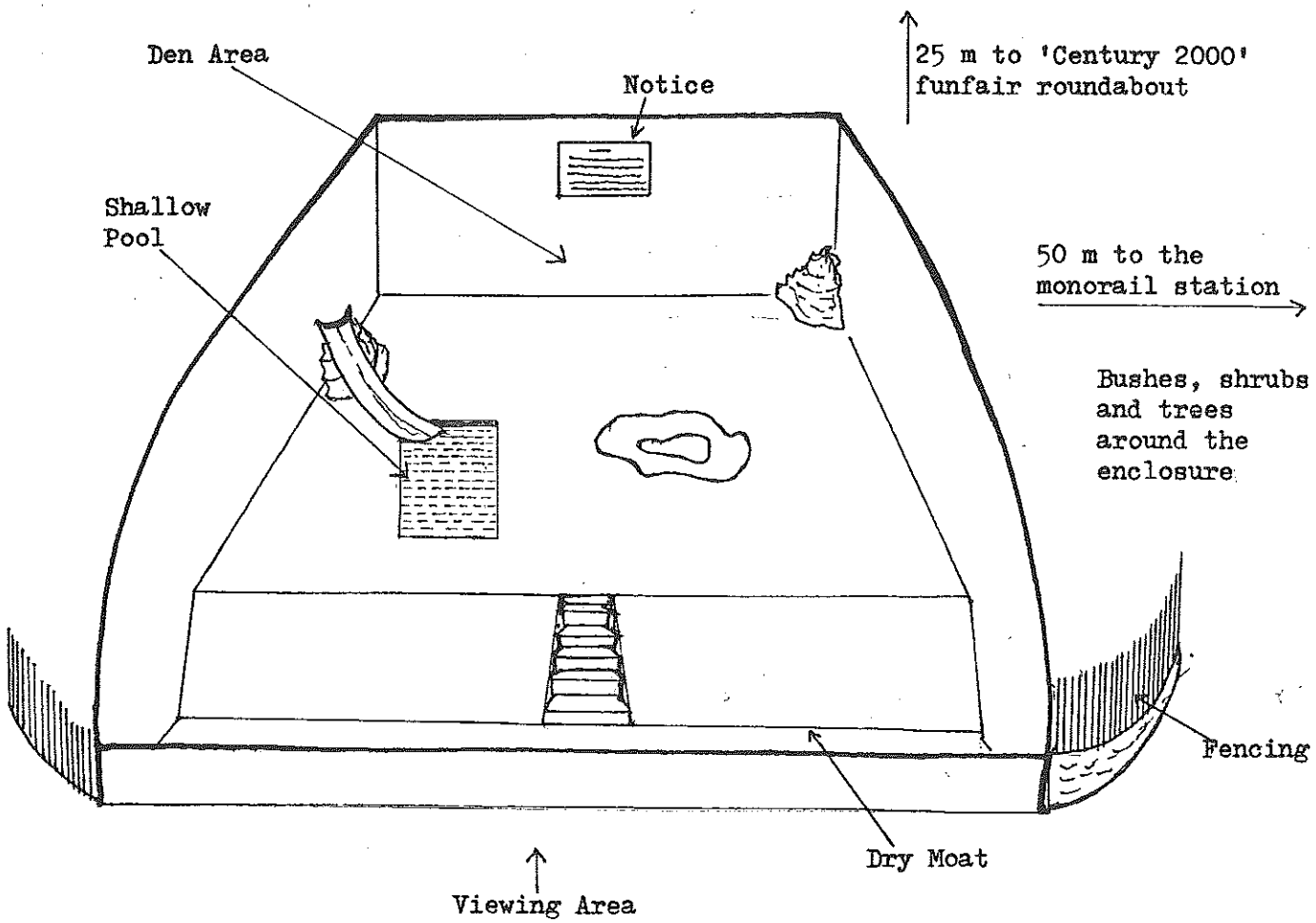


Figure 6: Plan view of the polar bear enclosure at Flamingo Land zoo (approximate area: 1,100 sq. m.)

There is a moat to the front and it is not known whether it was drained for cleaning or if it is permanently dry - which seems more likely (figure 6). Faeces were obvious on the banks of the moat. In the wild, polar bears are fastidious in keeping clean and often defecate into the sea from the edge of the ice (Davids and Guravich 1983). A shallow pool to the middle of the display was dirty and stagnant.

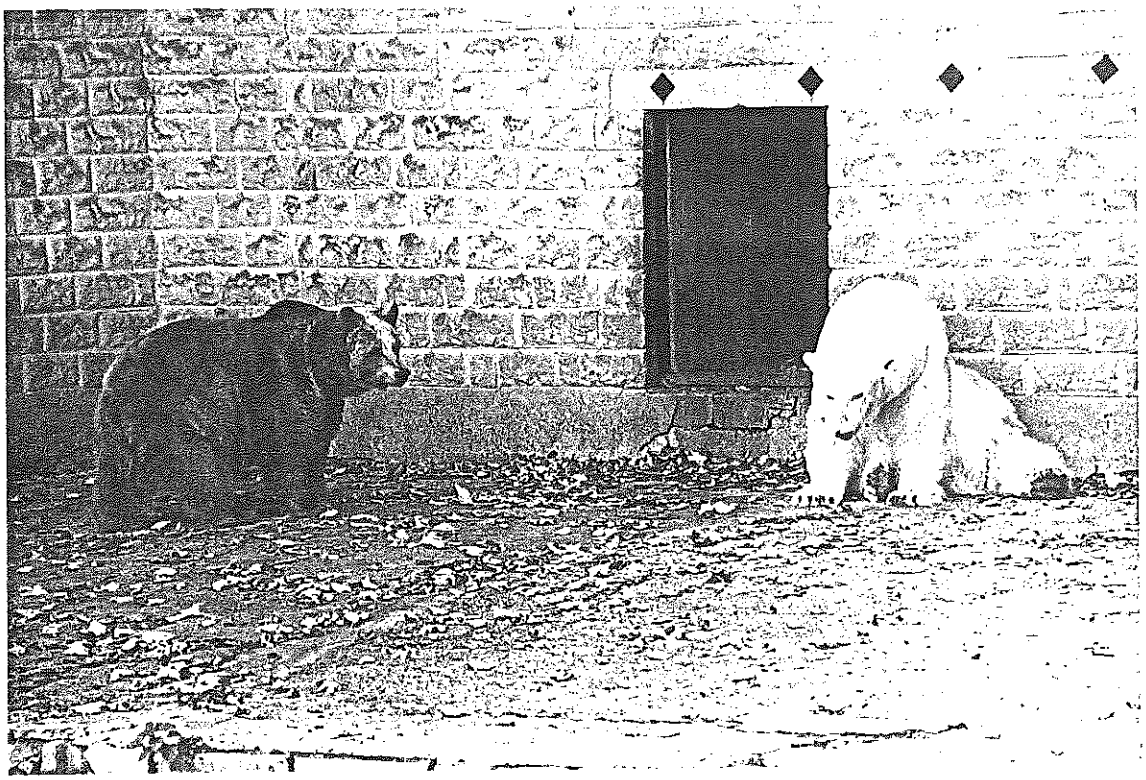
The enclosure is approximately 30 metres from a 'Century 2000' space roundabout and about 50 metres from the monorail station. Obviously during the summer it would be impossible to keep the enclosure relatively quiet.

The bears were not very active. Bear 1 hardly moved during the three hours observation, and just lay at the side of the enclosure. This is not unusual - polar bears spend a large part of their time lounging and sleeping in the wild (Davids and Guravich 1983; DeMaster and Stirling 1981). Bear 2 walked around the pile of rocks once and made a perfunctory attempt at eating some old cabbage leaves before resuming her position laying at the back of the enclosure (plate 4). The brown bear lay in the moat for most of the time, only getting up once and lumbering out of the moat towards the rear of the display to urinate, and then returning to the same spot.

It is unlikely that polar bears have ever bred successfully at Flamingo Land, otherwise this information would have been available. The only information supplied with the entrance fee at the time was a photocopy of the guide leaflet. There was an apology for this with the excuse that they had run out of their printed copies. The information given was minimal and sparse, although the aims of Flamingo Land are set down at the back of the guide. These are as follows:-

Plate 4: The bears in the enclosure at Flamingo Land zoo; a - the brown bear and one of the polar bears at the rear of the enclosure; b - the other polar bear laying at the side of the enclosure. In three hours this bear hardly moved.

-a-



-b-

1. To provide a first class recreational amenity for the people and visitors to this area.
2. To assist in the conservation of endangered species by captive breeding.
3. To encourage in all members of the population especially young people, a deeper appreciation of wild life and the need for its conservation.

It is likely that Flamingo Land meet their first requirement, but it is questionable whether they achieve their second or third aim. Polar bears have not bred and out of 74 exhibits (according to the guide) only 39 are identified as having bred at this zoo, this figure includes animals such as farm stock, soay sheep and several birds - very few of their successfully bred animals are endangered species.

Success at achieving the third aim is difficult to assess. Education is necessary for any appreciation of wild life, but the information given is very poor. The guide is not very informative and there are very few notices at the displays. Each exhibit is numbered, sometimes wrongly - e.g. 52 - the polar bears is also the number I found at the wildfowl lake! The guide identifies the animals and classifies them according to their food: P denotes a Primate meaning that their diet consists of mixed fruit, vegetables, bread, milk, dog biscuits and vitamins; C is a Carnivore eating meat, fish and vitamin supplement and starved one day in seven; H denotes a Herbivore which grazes on grass supplemented with hay and coarse grain with vitamin additive; O is for Ominivore which eats any fruit, vegetables, meat, fish or grain. The only other information given for some of the animals is their distribution.

Hence the polar bear note reads as follows:-

52. POLAR BEARS (C): Arctic regions of Norther (sic) America, Europe and Asia.

BROWN BEAR (O): Scandinavia, Pyrenees, the Alps, Russian and Transylvania.

It is difficult to believe that this very sparse and sometimes incorrect information (polar bears do not only eat meat and fish - unless this denotes their food in captivity) leads to a "deeper appreciation of wild life and the need for its conservation". There is no information about which animals are endangered, nor of the reasons why, there are no distribution maps or details of the sizes and natural habitats of the animals. I feel that the majority of young people visiting the zoo would probably be more interested in the Funfair than the animals which are simply numbers. The longest that anyone stayed to look at the bears during the observation time was about one and a half minutes to take a photograph.

The cover of the guide shows six pictures, two contain animals - dolphins and flamingo - the rest show Funfair exhibits. "Don't miss the exciting new dolphin and circus shows. Performances throughout the day" it urges visitors. Flamingo Land is more a Funfair that a serious zoo.

7. The Zoological Society of Glasgow and West of Scotland

In my first telephone call to Glasgow, I was advised not to "come a long way because they (the bears) are not worth seeing as they are old and it is an old exhibit". When I asked further, it was said that "we feel that polar bears perhaps should not be kept in urban zoos as they do not react well to captivity."

I then wrote letters asking for an appointment to discuss the bears and telphoned several times but was unable to get a reply. Possibly the zoo feels sensitive about their exhibit which is a pity as I feel that more information would have been very useful.

The enclosure is old and large (figure 7) with a large pool and contains two bears. I watched the animals for about three hours periodically. One bear spent some time lounging on the terraces and then moved off to the dens, the second bear spent time swimming back and forth across the pool and then came out onto the terraces and paced back and forth. The enclosure is terraced towards the back but the surrounding fencing is large enough for any views out to be excluded (plate 4).

According to the International Zoo Yearbooks (Anon 1967-1975) between 1967 and 1975, 13 cubs were born, but none survived. It is not known if Glasgow has reared cubs successfully.

The guidebook contains a paragraph about each animal in the zoo. In the paragraph on polar bears we are told that it is the largest bear and the most carnivorous, with a thick coat that provides warmth and camouflage. We are told that the animals have powerful limbs and large claws and that the bears swim well "helped by their broad paws and layer of body fat (perhaps this needs explaining)."

Figure 7: Plan view of the polar bear enclosure at Glasgow zoo (approximate area: 700 sq. m.)
↩↗ pacing and swimming area

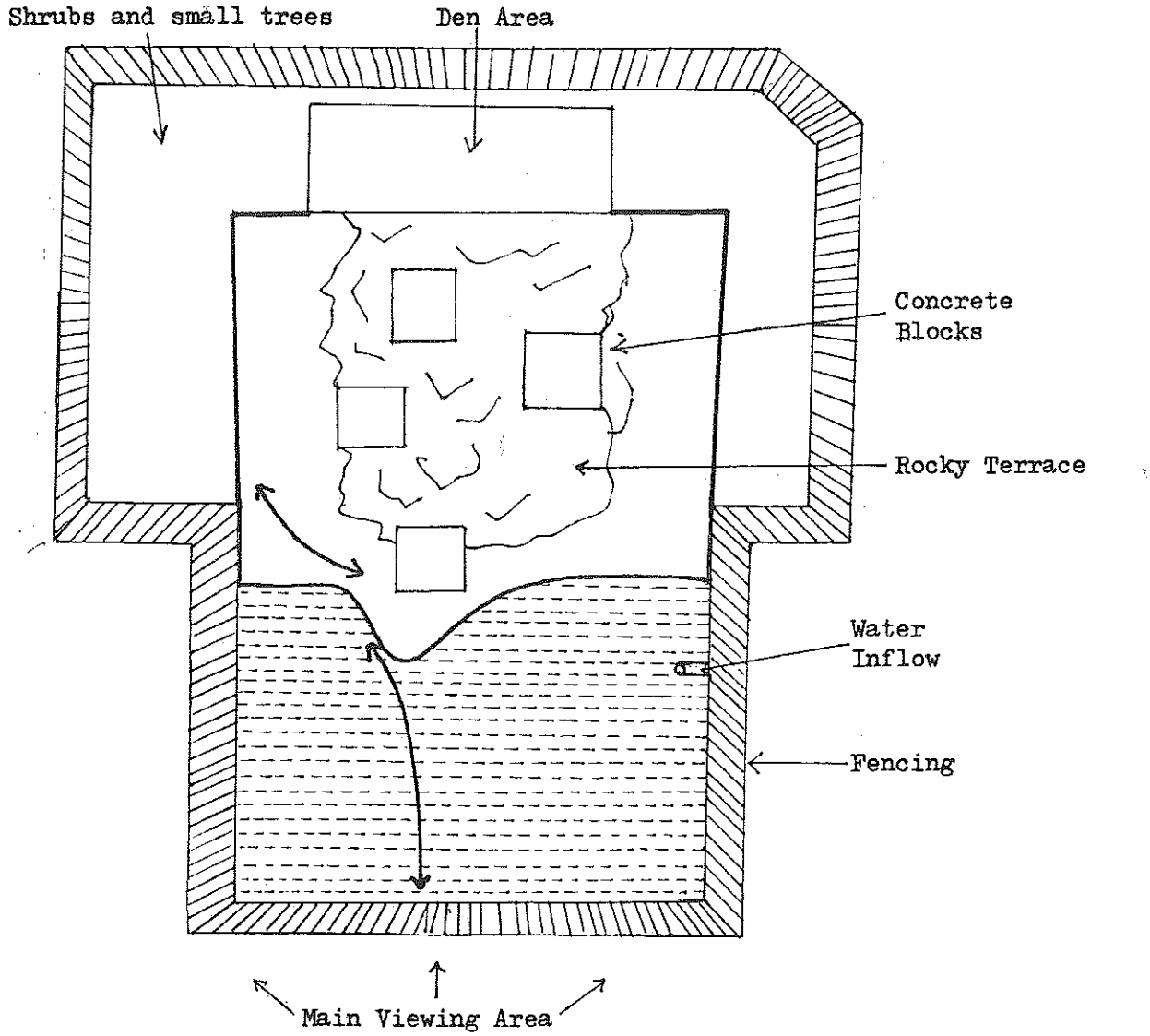


Plate 5: The polar bear enclosure at Glasgow zoo; a - most of the exhibit is made up of a rocky terrace; b - the bear paced on the flat area to the front left.

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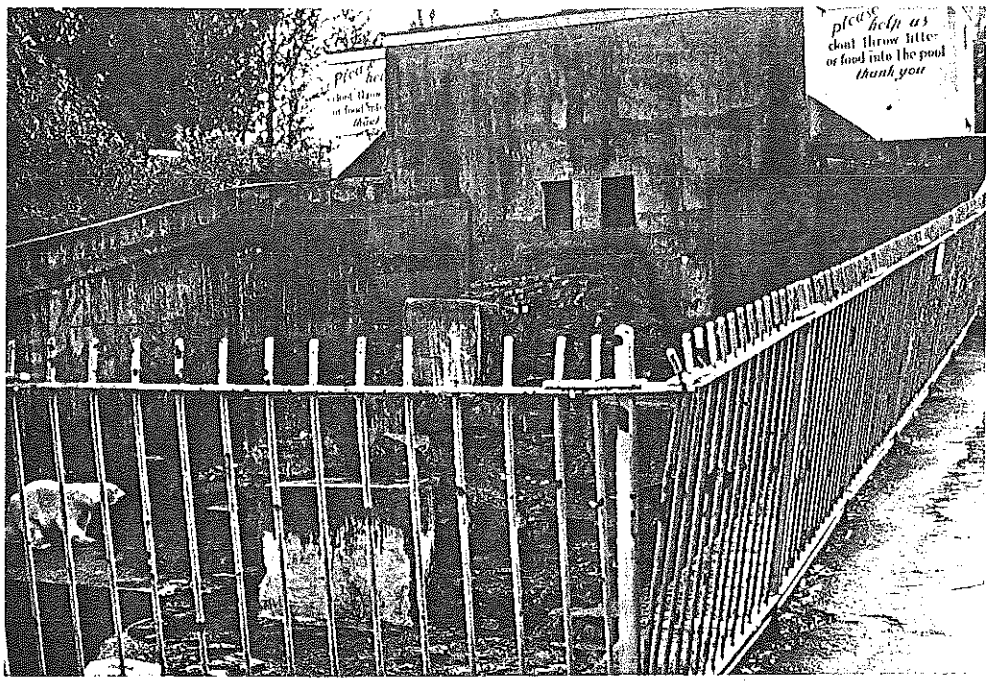

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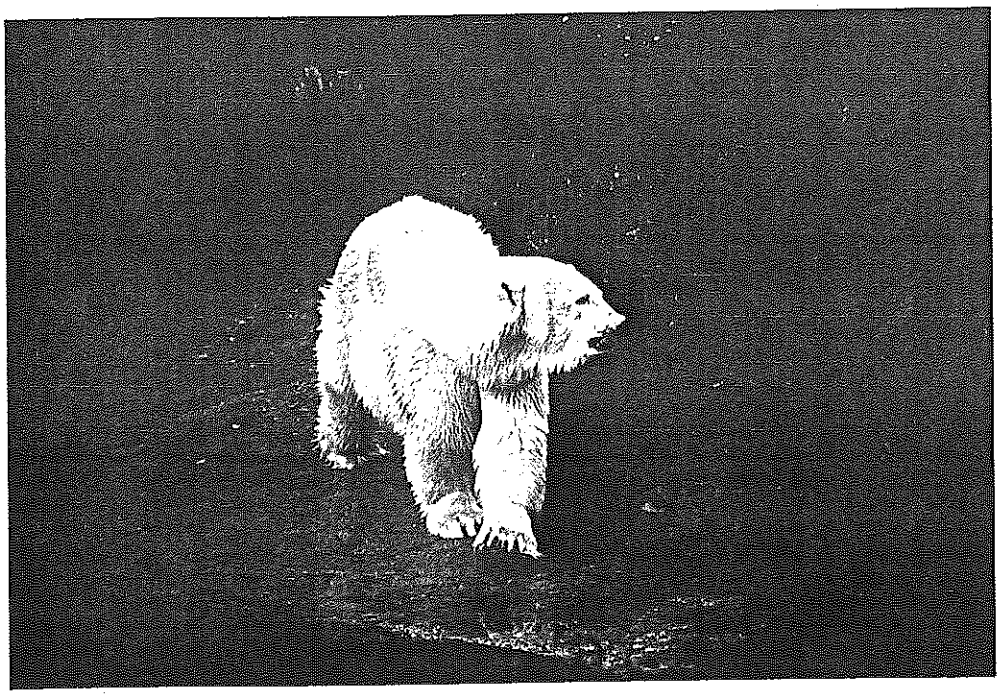


When the ice melts, the bears move on to land and feed on fish, small animals and plant material". This also requires further explanation. The end of the paragraph says that the bears have been reduced in numbers due to hunting "but with conservation measures, there are about 20,000 left in the wild". Nothing is said about the modern threat to the bears or what the new conservation measures are.

The zoo has an education department which organises guided tours, talks and study sessions and advertises a wide selection of information leaflets and worksheets.

8. Belfast Zoological Gardens, Bellvue
Managers: Mr. Martin and Mr. Stronge

There are three bears: Dudley, the male came from Dudley Zoo, and two females Wash and Tumble (they have been adopted by Thor Appliances who make washing machines). Dudley is five years old, the females are twin four year olds born at Winnipeg Zoo in Canada. Only Dudley was seen as the females were enclosed in their maternity dens.

The zoo has kept polar bears since it opened in 1936 but they have not yet bred any bears successfully. In 1972, the single male Peter, died aged 30 years. A young pair were then brought from another zoo in Northern Ireland which was closing down, and these bred but never reared their cubs (the International Zoo Yearbooks 1979 and 1980 report that two cubs were born in 1977 and 1978). In 1980 both the bears died of a closteridial infection aged 11 years.

The Exhibit

The polar bears are enclosed in a large naturalistic exhibit (figure 8), the best seen in this survey. It is obvious that a lot of time, effort and money has been spent. In fact the zoo is undergoing several developments which are scheduled to be finished in 1989. The basic ideas are to get away from barred cages and give a large area for the animals. The public are allowed to view from specific points so the animals have secluded areas.

The polar bear enclosure has a waterfall at one end that flows via two small pools into a larger pool. The dens are at the extreme right of the exhibit and there appears to be no public access around the back so it should be possible to keep the dens relatively quiet and undisturbed.

The information notice is large and prominent: it includes a drawing of the animals and a distribution map and reads as follows:-

> Polar Bear. Thalarctos Maritimus
> This, the most polar of all animals, is well adapted to life in the icy Arctic regions. The waterproof fur provides warmth and camouflage. It has a thick insulating layer of fat and the soles of the feet are covered with fur.

It is an excellent swimmer and covers great distances on ice floes. Human invasion of its habitat has greatly reduced its numbers, now estimated at about 10,000.

Distribution

Arctic areas of North America, Europe and Asia.

Habitat

Icebergs and sea of the Arctic Ocean

Breeding and Social Life

Pairing in the wild takes place in April; the males then migrate south and the females construct a roomy oval snow den where they give birth usually to helpless twin cubs, in December. The mother is devoted in her care and the cubs are extremely playful. They are weaned at 21 months and the family usually disperses at the end of the second year.

Body Length

Males: 241 - 251 cm
Females: 180 - 210 cm

Body Weight

370 - 410 kg (some fat laden bears in the Siberian Arctic can reach 1,000 kg).

Life Span

30 - 40 years

Feeding

The main diet is the fat and viscera of the ringed seal which is stalked across the ice or ambused in an ice hole. Lemmings, birds, fish, carcasses, berries and lichens supplement the diet in summer.

Figure 8: Plan view of the polar bear enclosure at Belfast zoo (approximate area: 3,200 sq. m.)

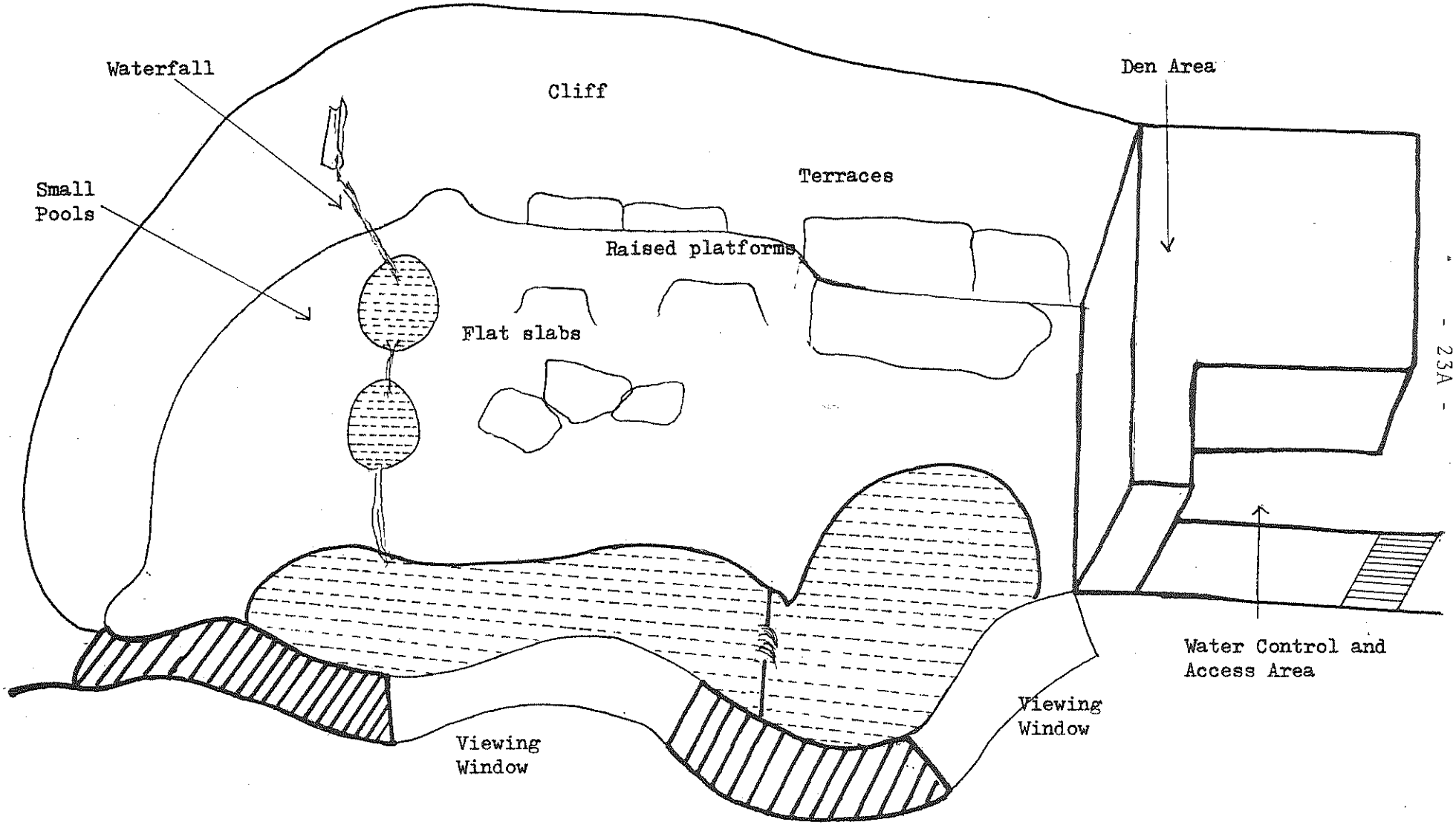
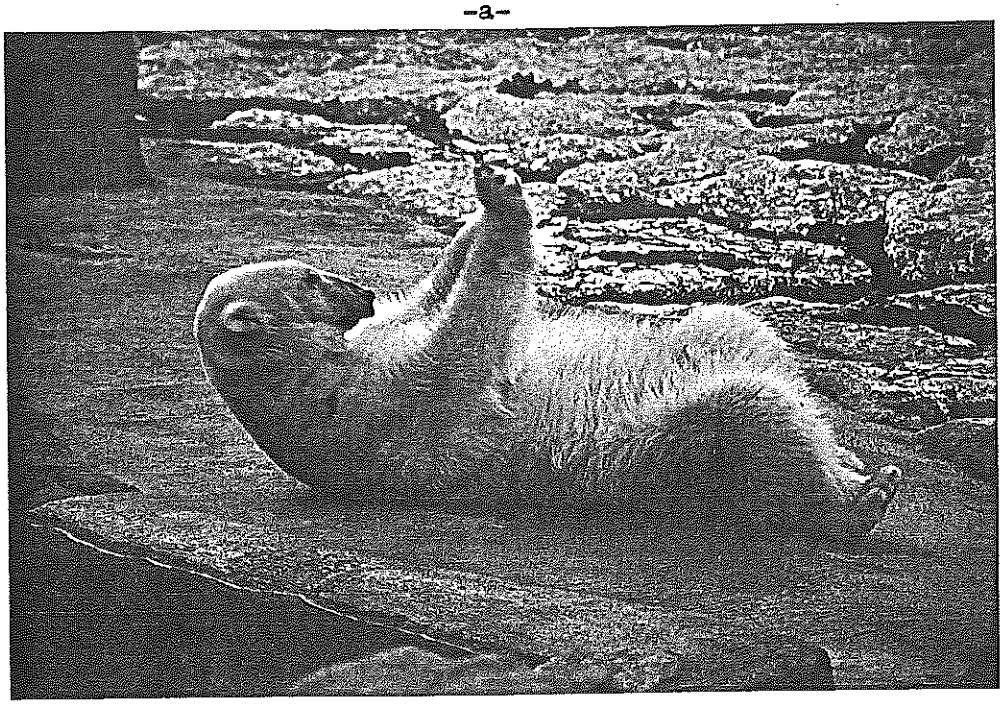


Plate 6: Dudley, Belfast zoo's male polar bear rubbing himself on the concrete; a - a sore can be seen at the top of the fore leg; b - and there are sores on the back of the neck.

-a-



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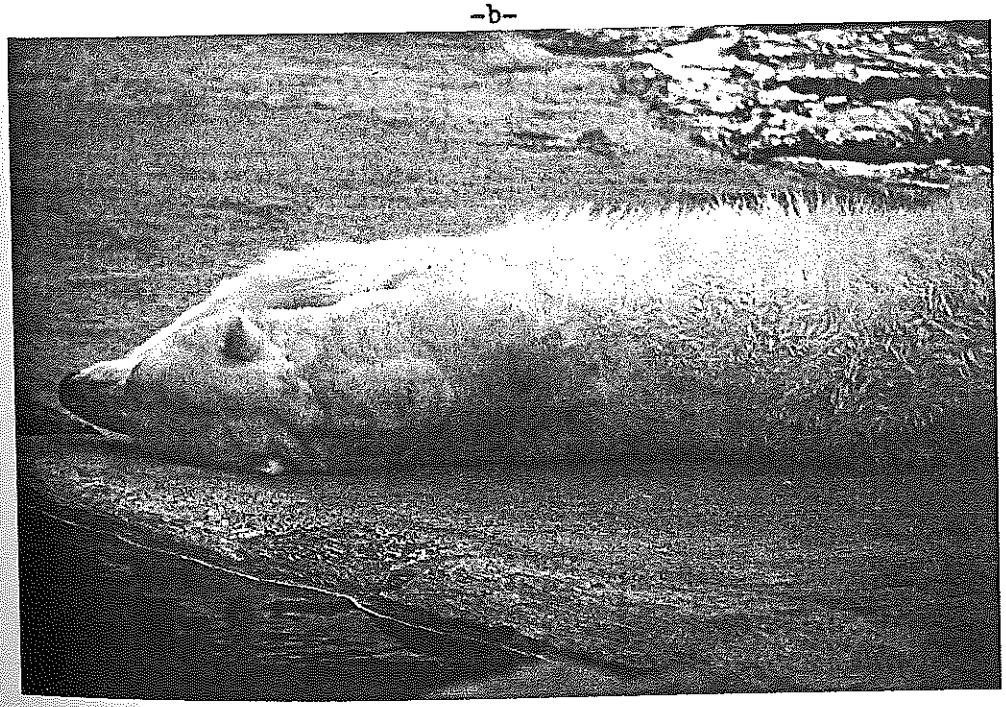

According to the guidebook the exhibits use natural water but I may have detected a smell of chlorine and perhaps the water is treated at this exhibit.

During two hours observation, Dudley lay by the side of the upper large pool, often scratching and rolling on his back to rub himself vigorously on the concrete. He has some kind of skin complaint as sores were clearly visible on the back of the neck and tops of both fore legs (plate 5). Mr. Martin reported that they did not know the cause of these and were waiting to see the vet. However he has been giving cod liver oil to the bear for the last one and a half months. He did not know of the skin problems that were reported in the bears at Edinburgh and Chessington that were attributed to oil in the diet.

Both females are enclosed in their cubbing dens though neither has gone into semi-hibernation and they were still active after a month. Nobody is allowed to go near the dens during the week although Mr. Martin and Mr. Strong (the director) check that the animals are keeping well. They are aiming to rig up a baby alarm system to monitor any sounds as camera equipment is too expensive. Mr. Martin did not know of the tragedy at Edinburgh when the two females died in their enclosures, nor of the mistake at Bristol when Janina was released from her den too early.

At present, the zoo has no plans for any of the young bears. They may go to other zoos, though it is felt that the enclosure could cope with at least one more female.

The guidebook outlines the history of the zoo and reports on the developments that have taken place and some of the ideas behind them. There is a general paragraph about the group of animals followed by a more specific account of the particular species. Belfast does not appear to have a great many species, but the exhibits are thoughtfully constructed with education and the animals in mind. There are other facilities such as the library, records room, an education centre and an interpretive centre.

9. The Royal Zoological Society of Ireland, Dublin
Director: Mr. P. Wilson

I received an informative reply to my letter from Mr. Wilson. Dublin has two bears on display, a male and a female which were received from Winnipeg Zoo on February 15 1980. They were just over a year old when they came to Dublin and were originally found as orphans in Churchill, Canada. Since 1953 Dublin has had three other bears; one was euthanased because of old age, one was sold and the other went to another zoo on an exchange basis.

One cub was born in each of the years 1966, 1967 and 1969, but all died within two or three days of birth.

The Exhibit

The enclosure is fairly small (figure 9) with three terraces, two den entrances are visible and there is a water-filled moat with a fountain to the front. The male spent most of the time pacing on the front terrace, taking nine and a half steps (the maximum possible on this terrace) in either direction (plate 6). The animal nodded its head just before it turned at the right side and just before he turned on the left he dragged the left fore foot. The behaviour was repeated exactly. Occasionally he stopped on the right side to sit and look about for a few minutes. The female stayed in the entrance to one of the dens, only standing up once to yawn and shift her position.

The routine stopped when they were fed; the female came out of her den and the male stopped pacing. Afterwards the female paced slowly at the back of the enclosure but did not appear to have any marked stereotypic behaviour. The male swam for a short while and then emerged and continued pacing; then the female returned to her den and lay down.

The only information given about the species is on a notice which reads as follows:-

Polar Bears sponsored by Willwood Silversmiths

Polar Bears
Order: Carnivora Family: Ursidae
Species: Thalarctos Maritimus

Food: The most carnivorous of all bears, Polar Bears live mainly on seals though they do hunt other animals. In summer they also eat quantities of berries, grass and lichens. When hungry they will scavenge and eat anything from wood chips and seaweed to carrion.

Breeding: Mating (the only time Polar Bears come together)
Usually takes place in April and the gestation period is about 8 months. In Autumn the female digs a den in the snow into which she retires for the winter. Her cubs, usually 2, are born in December- blind, tiny and almost naked. They are kept warm by her fur and the warmth of the den. In spring the family emerges.

STATUS: IUCN Vulnerable.

I could not buy a guidebook, but the zoo has produced a brochure commemorating the 150th anniversary, which traces the history of the zoo from the early 19th century and reports on plans for the future. The Zoological Society recognises that they should change their role and orientate more to education and conservation. They envisage appointing an education officer and have plans to build an education centre with permanent displays and lecture theatres. A new tropical house is also in the offing.

Figure 9: Plan view of the polar bear enclosure at Dublin (approximate area: 310 sq. m.)

↔ Pacing area

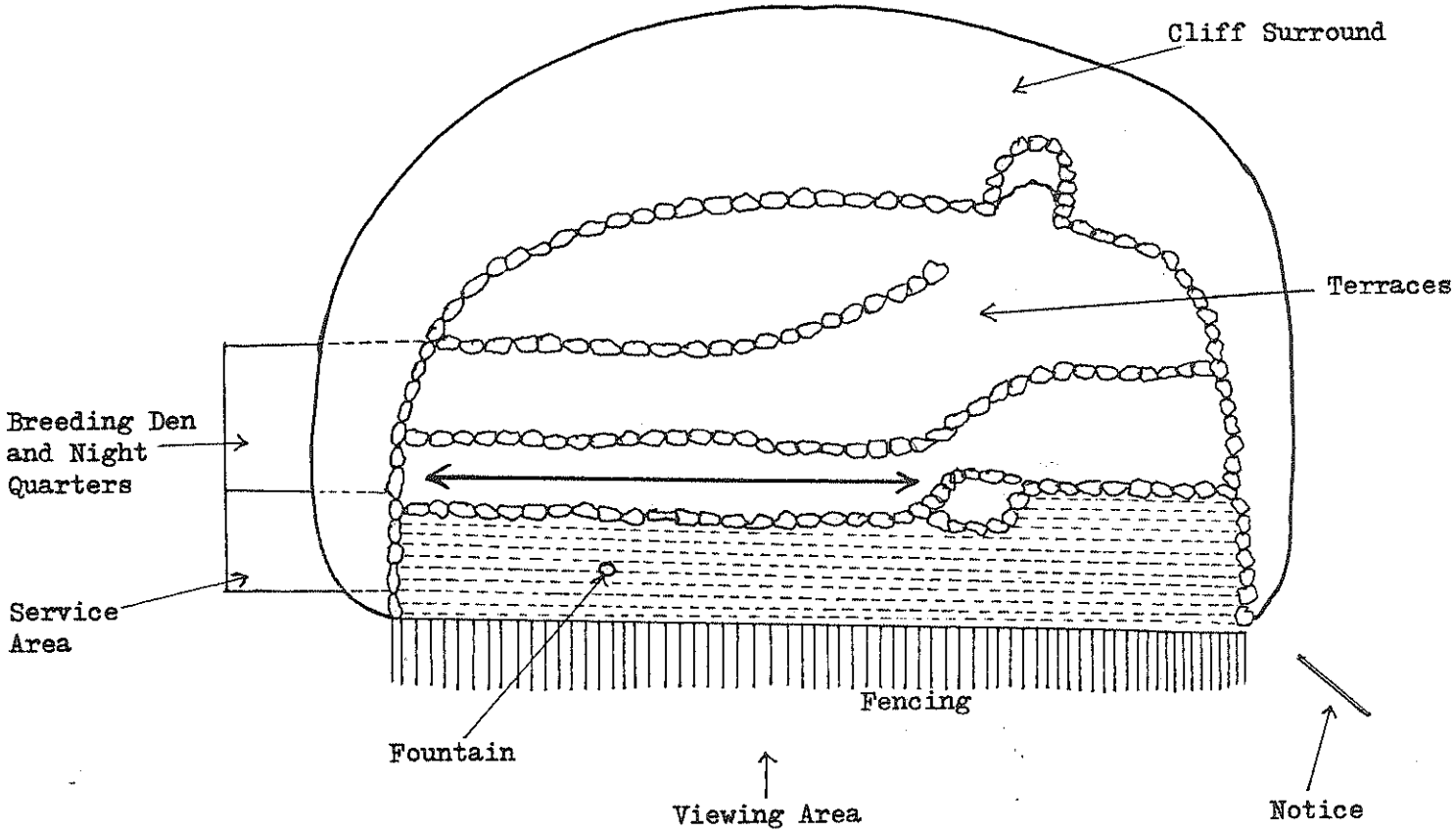

Plate 7: The polar bears at Dublin; a - the male at the end of the pace on the front terrace and nodding his head; b.- the female in the den entrance

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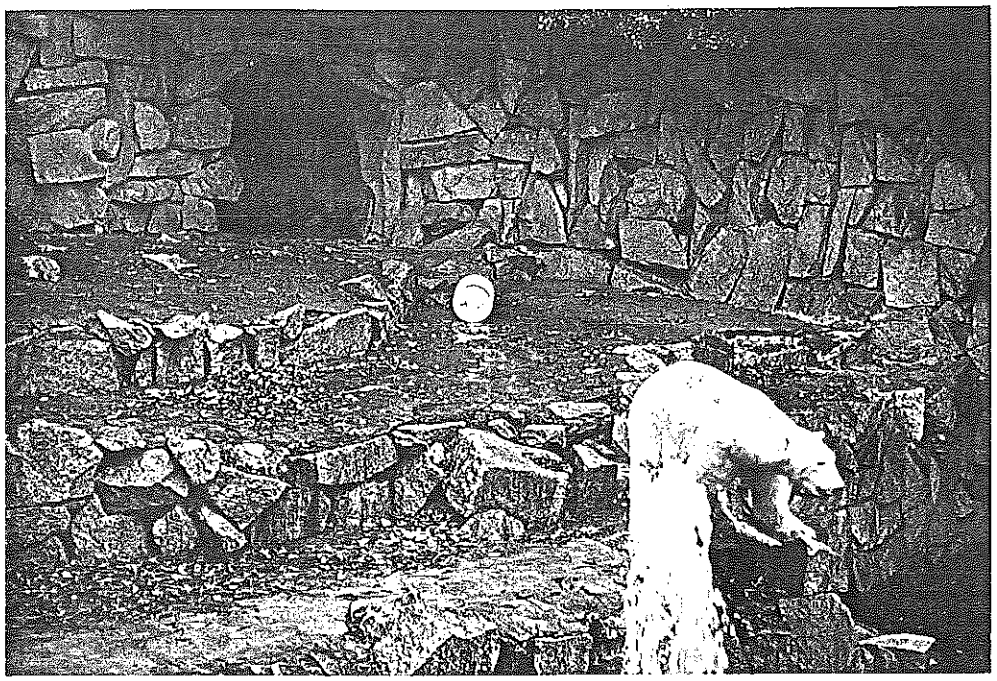

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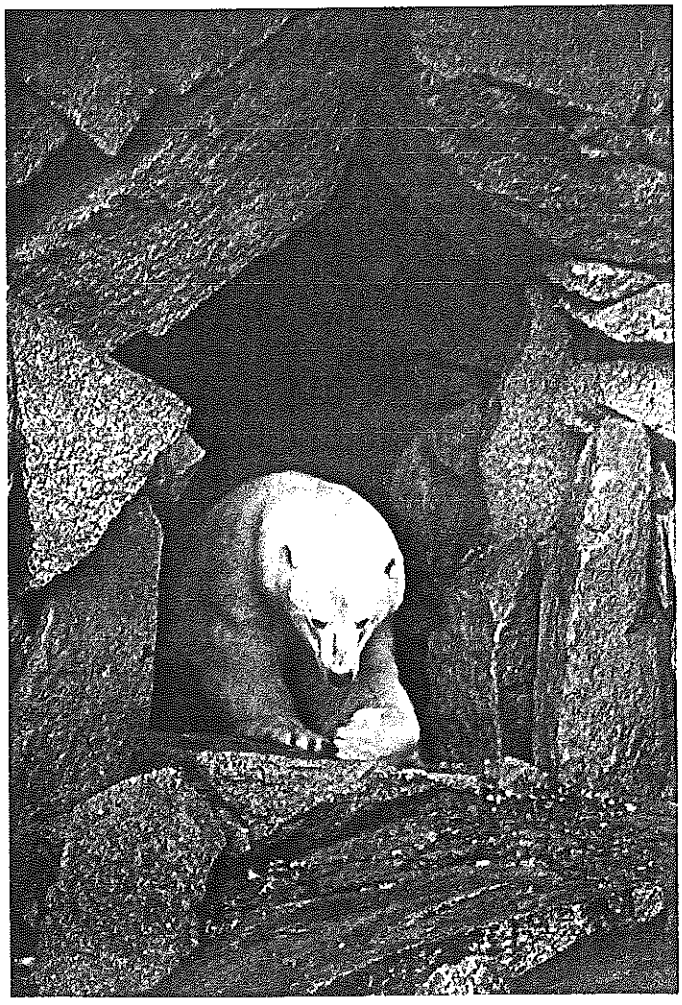


The Society is considering working with University College Cork to build a large wildlife park at Fota Island outside Cork City. The park will be a spacious outdoor environment and provide an area for breeding endangered species.

10. The Zoological Society of London
Curator of Mammals: Dr. B. Bertram

I had a long and helpful discussion with Dr. Bertram about the proposed exhibit at London Zoo, the captive breeding of polar bears and the role of zoos in conservation and education.

The London Exhibit

At present London has no polar bears of its own although the bears from Chessington are housed temporarily until their new enclosure is finished. However the zoo has exhibited several bears in the past both in London and at Whipsnade, and is planning a new exhibit that will be as naturalistic as possible with an underwater viewing area for the public. It is hoped that the bears will be kept active with techniques such as looking for food underwater, or perhaps by giving them areas where they can dig dens.

Dr. Bertram agrees that it is necessary to avoid the development of stereotypic behaviour; keeping the bears active will help and will also attract people to the display. The University Federation for Animal Welfare (UFAW) is looking at ways to keep animals occupied when in captivity.

It is possible that the exhibit planned at London will be mixed with Arctic foxes. Such a mixed exhibit appears to have been successful at Omaha Zoo in the USA (Thomas 1968).

Breeding

Polar Bears have bred and been reared successfully at London Zoo: in 1965 (Pipiluk - now at Dudley), in 1967, 1970 and 1972. But there have been at least eleven unsuccessful attempts. It was admitted that there are problems in breeding the animals but it is difficult to isolate any particular factor that may be responsible for either success or failure; many factors could be involved. Some bears may breed and rear successfully on one occasion but fail on another despite being given the same conditions. But Dr. Bertram does not feel that ambient general noise may have a serious effect although an occasional unusual or loud noise may be deleterious. Another problem may be the difficulty in getting the mother to semi-hibernate which could be related to the temperature. A useful survey would be of the zoos world-wide that have bred the bears to see if there is any correllation with the climate. Australia for example, has only bred polar bears once in the last 50 years and this is in Adelaide Zoo in the South (Anon? 1985).

However, Dr. Bertram is not too worried about the low rate of success in breeding and rearing the polar bears in captivity. He says that if polar bears in captivity were to rear their young as successfully as other bear species, then contraceptive practices would soon need to be implemented to prevent overcrowding.

Conservation

Dr. Bertram and other personnel, claim that zoos are necessary as a safety net for breeding species that may be endangered in the wild. There have been successes such as the case of the scimitar horned oryx from the area of Chad and Niger. Sixteen years ago there were 2,000 in the wild but about 15 years ago some were taken into captivity and today there is a captive population of between 300 and 400 - but that animal is extinct in the wild. It remains now to encourage political stability and habitat protection in their native areas and the animals can be re-introduced to the wild.

There are other unpredictable disasters. Dr. Bertram cites the example of the black rhinoceros. The white rhinoceros has been protected for several years and zoos have established captive breeding programmes, but the black rhinoceros population was around 40,000 and there was little worry about their future. When the price of oil increased, the Arab States increased their revenue and there was money to pay for genuine rhinoceros horn and the wild population crashed from 40,000 to 8,000.

It is difficult to predict effects on the wild habitat. Natural disasters, industrial and pollution effects can cause unforeseen problems which may be exacerbated by political instability or just basic lack of co-operation. In such cases, Dr. Bertram argues, captive breeding programmes can provide a safety net and save species that would otherwise become extinct.

For this to work efficiently, zoos must co-operate and captive animals should be regarded as a total world population rather than isolated individuals or groups in each zoo. The studbook scheme was established to accumulate in one place all the information for each species in captivity. Each species has a particular expert to look after the studbook, for example Dr, Bertram has the giant panda studbook. The polar bears studbook is run by Dieter Schwarz at Rostock Zoo in Germany. Here, in theory, all the information about the world captive population of polar bears and their pedigrees should be noted.

Education

London Zoo has educational facilities to deal with parties and groups at all levels. However, there is a problem with visitors to the zoo as about 30 per cent are from overseas and may not all be very conversant with English, which limits the use of commentary tapes and the success of English notices. But the educational value of just seeing a polar bear, is difficult to assess.

Polar bears, according to Dr. Bertram, attract people, but as with many zoo animals, the interest is much greater when the animals are active. If they are resting or pacing repeatedly then people will not stay long, are less likely to read the notices and therefore will learn less from the exhibit.

Discussion

1. The Rational Behind the Existence of Zoos

Zoos have been around for a long time. In the past displays of exotic animals were used to demonstrate the status of their owners and to provide entertainment. Little attention was paid to the appalling conditions of the animals due to the lack of knowledge or concern for their welfare. Today people are more discerning and are concerned if animals are seen sitting listlessly in concrete cages or behind iron bars. These facts, together with increased knowledge and awareness of the growing number of endangered species, has led to a change of emphasis, and today it is argued that a zoo has four roles (Cherfas 1984; Jamieson 1983).

(i) Entertainment - it is argued that a certain amount of entertainment is necessary to attract the public.

(ii) An educational facility - aiming to build up an awareness in the general public of other species, their biology and ecology and of the needs for conservation.

(iii) Conservation - species in the wild may become endangered due to human activity. Zoos aim to provide a captive population as a safety net where animals can breed and, eventually re-introduced into the wild when conditions are favourable. There have been several successes: the Arabian oryx, Pere David's deer, the European bison - and there are captive breeding programmes underway for other animals like the scimitar horned oryx and the black and white rhinoceroses.

(iv) A research facility - where it is easier and cheaper to study the range of biological disciplines - physiology, genetics, anatomy, and behaviour. However most research projects conducted in zoos look at animal husbandry i.e. improving the captive conditions.

Questions have arisen about the justification of keeping animals in captivity (Fox 1984; Jamieson 1983). This debate has, in some cases, resulted in a polarisation of attitudes which is not helpful. However, what is of concern are the conditions of captivity and whether or not zoos fulfill their roles. Answers to these questions will help resolve the debate. The discussions here are primarily concerned with polar bears, but many of the points can be extended to other species.

2. The General Effects of Captivity

The behaviour of an animal is related to its survival in the wild, thus when it is enclosed in an artificial environment, this relationship is disrupted (Keulen-Kromhout 1978). The effect of captivity varies and depends on the age, sex and species of the animal (whether it is a neophilic species - constantly exploring, or neophobic - a specialist that is relatively easily satisfied), its wild habitat, the type of enclosure and the conditions of captivity. The effect will also vary within species depending on whether they were wild caught or captive bred (Meyer-Holzapfel 1968; Morris 1964; Stevenson 1983).

The captive environment may lack stimulation for exploratory activity leaving the animal inactive and under-aroused - bored, or the enclosure may provide too much stimulation so the animals is over-aroused and stressed (Stevenson 1983). Meyer-Holzapfel (1968) has summarised the various behavioural effects of captivity as follows:

1. Abnormal escape reactions - in the wild the drive to escape supersedes other behaviours as it is vital for survival. When caught animals may rush around madly and even injure themselves, or they may retreat in a state of stupor.

2. Food refusal - some animals have to be force-fed.

3. Abnormal aggression - can occur at the approach of feeding time or may result from the impossibility of escaping from visitors and from attacks or threats by socially dominant species. It may also occur when an animal is prevented from getting close to a companion from which it has been separated or in over-crowded enclosures.

4. Stereotyped behaviours - have three parts (Odberg 1978): the movements are identical, they are repeated regularly and have no obvious function. The behaviour may be pacing in a straight line or circle, or staying in one place and rocking or head-weaving. A combination of several factors may cause stereotypic behaviour(Stevenson 1983): early rearing deprivation, a small sparse cage environment, a lack of complexity in the environment (for instance a substrate in which an animal can dig,) proximity to other groups or the public, and other factors causing stress. Stereotypic pacing often results in animals that patrol in the wild, or it may start out as an escape movement that cannot be carried through so it is repeated until fixed in a persistent characteristics pattern (Morris 1964). Stereotypic behaviour may also be related to the body's production of endorphins which are naturally produced anaesthetics. It has been shown that stereotypic behaviour in farm animals stimulated the production of endorphins (Cronin G.M. and Wiepkema P.R. 1984 an Analysis of Stereotyped Behaviour in Tethered Sows. Ann. Rec. Vet. 15 (2) 263-270.

5. Displacement reactions - occur when an animal is prevented from carrying out is instinctive response to a stimulus and it indulges in a behaviour that is irrelevant to the stimulus. For instance animals that are denied food may turn to scratching and preening.

6. Self-mutilation - scratching, gnawing and preening can result in wounds or even tails or parts of limbs being gnawed away. This may be caused by an abnormal sensitivity of the skin due to diet, lack of circulation, parasites or eczema. Skin problems (paresthesia) may also result from stress or other reasons that are not fully understood.

7. Abnormal sexual behaviour - such as hyper-sexual activity, masturbation and substitute sexual objects.

8. Apathy - occurs particularly when social animals are separated from companions by death or from some other reason.

9. Abnormal mother-infant relations - may be due to physiological disturbances for instance when little or no milk is produced there is a reduction of parental care. This often occurs in young females after the first parturition; they may also be afraid of their young. The mothers appear indifferent to their young, refusing to lick them, walking over them and sometimes driving them away if they try to suck. New born animals may be neglected if there is no effective stimulus for the mother and they die of starvation and cold, or mothers may come into heat again giving birth and then stop caring for their young. These may be serious problems as in captivity mating often occurs earlier and more frequently than in wild.

If disturbed some mothers injure their young as they are dragged about in an attempt to find seclusion. Eating the young occurs where the mother does not break off after licking the offspring clean and eating the embryonic membranes and placenta (Lorenz 1950).

10. Prolonged infantile behaviour and regression - juvenile food begging may remain for longer periods and some half-grown mammals still rush to their mothers for protection. Crippled or injured individuals may elicit the maternal feeding behaviour which is not unusual in the wild though it is more common that injured individuals will be attacked and killed.

All types of abnormal behaviour will not be seen in every species in all zoos - there is interspecific variation; nor is the behaviour necessarily present in all individuals of a particular species. Some behaviours are present in the wild and in captivity, others are adaptive to the captive environment e.g. pacing in a patroling animal (Morris 1964).

In polar bears stereotypic behaviour in the form of pacing and head-weaving, and abnormal mother-infant relations such as eating the young have often been reported. Incidents of aggression are not uncommon such as in the case of the Toronto female at Chester which had to be destroyed as it was felt it would be impossible to introduce a new bear into the enclosure. It is possible that the skin problems reported at Chessington, Chester, Edinburgh and Belfast could be attributed to a nervous response to captivity - there are no reports of such skin complaints in the wild animals - however oil in the diet appears to be a major contributory factor (Stevenson, pers. comm).

3. Stereotypic Behaviour in Polar Bears

Stereotypic pacing and head-weaving was seen in the bears at Bristol, Chester, Dudley, Edinburgh, Glasgow and Dublin (table 2; plates 1,2,3,8,5 and 7). The degree of stereotypy appears to be related to the length of time in captivity, as in the case of the bears at Bristol, Dudley and Chester. But the conditions of confinement of Misha, prior to being bought by Bristol Zoo has resulted in such bad stereotypic behaviour and aggression that the animal cannot be seen on display (Greed, pers, comm).

The wild caught Dublin male, despite only five years in captivity, demonstrates a marked stereotypic pacing. The wild caught Edinburgh female shows no pacing, but has been captive for only two years, however males are reported to demonstrate more severe stereotypic behaviour than females (Keulen-Kromhout 1978).

The findings here are similar to those reported by Keulen-Kromhout (1978) in a survey of 46 polar bears in 58 zoos.

Keulen-Kromhout also reported that stereotypic behaviour is most marked in small enclosures and those where boulders and terraces form a large part of the display. The smallest enclosure in Britain and Ireland are Dublin, Bristol, Dudley and Glasgow (Chessington and Edinburgh are building extensions) and Bristol, Glasgow, Chessington and Edinburgh has steps, rocks or raised areas as a major part of their displays. This supports the conclusion that for polar bears a large level enclosure with an occasional raised lookout position is the most suitable.

Stereotypic behaviour is often fixated and little can be done to remove it once established, however increasing the activity of the animals will decrease the incidence of stereotypy. Installing a machine in a polar bear enclosure which allowed the animals to deliver fish ad lib, some of which went into the pool, is reported to have reached the male's chronic stereotypic behaviour and helped him maintain adequate weight (Markowitz et al 1978).

Plate 8: the polar bears at Edinburgh zoo. The upper bear paced along the terrace; the other bear swam following an oval pathway and throwing his head back at the far side.

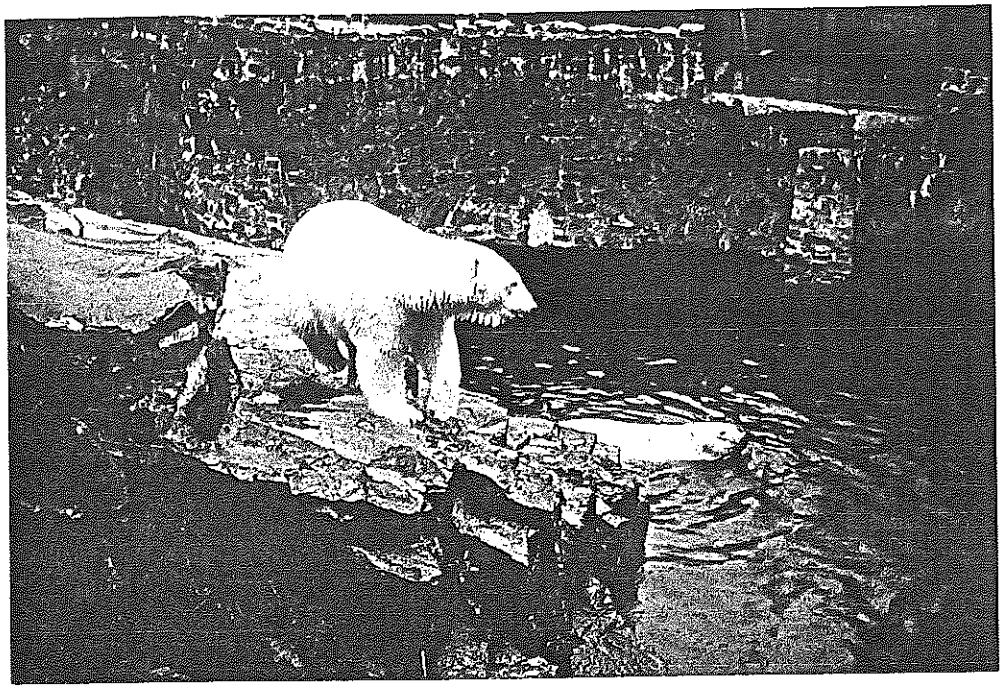


Table 2: The Polar Bears, their age, length of time in captivity, their enclosures and an assessment of the degree of stereotypic behaviour.

Zoo	Number of Bears	Place of Birth	Age (yrs)	Time at the zoo (yrs)	Approx. area[1] of enclosure (sq.m)	Time in captivity (yrs.)	Degree of stereotypy[2]
Bristol	Nina ♀	Copenhagen	27	26		27yrs	xxx
	Janina ♀	Bristol	11	11	360	11 yrs	xx
	Misha ♂	?Circus[3]	?	6			Severe[4]
Chessington	Bonnie ♀	Karlsruhe	4	3.5	625	4yrs	0
	Clyde ♂	Karlsruhe	4	3.5		4yrs	x
Chester	Sabrina ♀	Bristol	19	1.5	1200	19	xx
	Amos ♂	Moscow	20	1.5		20	not seen
Dudley	Pipiluk ♂	Whipsnade	20	1	320	20	xxx
	Mosha ♀	Moscow	21	1		21	xxx
Edinburgh	Barney ♂	Whipsnade	9	8	1200	9	xx
	Mercedes ♀	Wild	?	2		2	0
Flamingo Land	Possibly ♂ & ♀	NO INFORMATION SUPPLIED			1100		0 0
Glasgow	♂	NO INFORMATION SUPPLIED			700		xx
	♀						xx
Belfast	Dudley ♂	Dudley	?[5]	?[6]	3200	?	0
	Wash ♀	In captivity	5			5	Both ♀ in
	Tumble ♀	Canada	5			5	maternity denss
Dublin	♂	Wild born	?	5	310	5+	xxx
	♀	in Canada	?	5		5+	x

1. The areas are rough approximations by eye
2 xxx - obvious stereotypic behaviour
xx - moderate stereotypic behaviour
x - possible stereotypic behaviour
3 Misha may have been wild born, but it is not known
4 Misha has severe stereotypic behaviour according to Mr Greed (director)
5 Dudley was born sometime after 1966
6 Belfast's three bears have been in the new enclosure for 8 months

Other animals have benefited from the development of complex environments with moving objects and food hunting arrangements. These exhibits enable animals to carry out some of their wild activities, although the development of unnatural acts to obtain food should be avoided, and care should be taken to adopt activities that suit the natural behaviour of the species (Hutchings et al 1978).

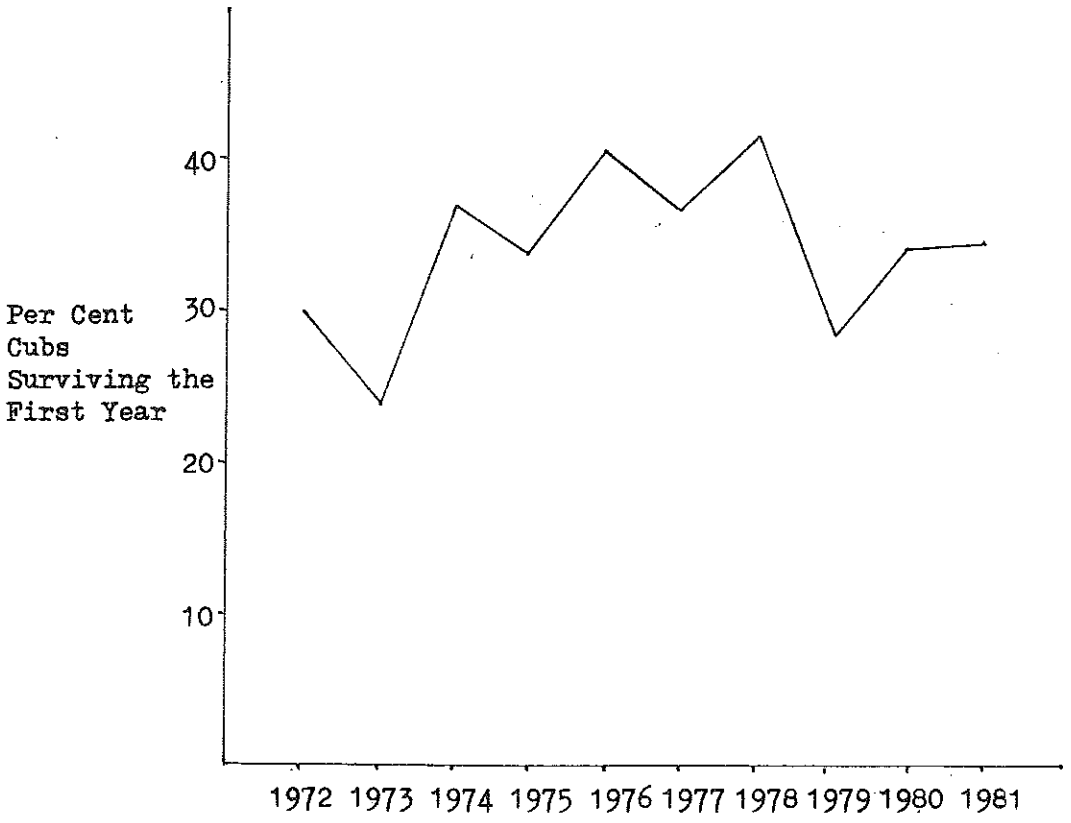
4. Captive Breeding of Polar Bears

Improving the chances of successful breeding and rearing is a difficult problem. It is generally agreed that several conditions are necessary: isolation in a dark and small area, strictly no disturbance either by sound or odour, and a period of fasting to approximate to the condition in the wild (Nunley 1977). World-wide, the survival of polar bear cubs beyond the first year varies around a mean of 34 per cent (figure 10) according to figures from the International Zoo Yearbooks (Anon 1974 - 1984). This is probably much higher than the true survivability of captive born cubs (Dr. Bertram agreed). According to the International Species Inventory System (ISIS - Anon 1985) of the total bears held in captivity, 44 per cent are captive born (ISIS covers major North American and some European zoos), 34 per cent are wild born; 11 cubs were born in the 12 months to June 1985, while the total number of bears held is 168.

Whichever figure is arrived at it is clear that the survival in captivity is lower than that reported for the wild where the annual survival of cubs prior to weaning is between 70 and 90 per cent (DeMaster and Stirling 1981).

Keulen-Kromhout (1978) showed that the size and shape of the maternity dens are extremely important and demonstrated that, on average, most artificial dens are over twice the depth and width, over three times the height and over four times the area of natural dens.

Figure 10: Graph showing the percentage of captive bred polar bear cubs surviving the first year - figures taken from the international Zoo Yearbooks (Anon 1974 - 1984).



Only Leningrad and Rhenen Zoos had dens that approached the dimensions of those in the wild; neither had any form of heating but polar bears were reported to breed well at both zoos. Other zoos have adopted the idea of building a naturalistic maternity den (Wemmer 1974; Nunley 1977).

The polar bear enclosure at Belfast has a maternity den shaped like an igloo with a tunnel entrance. Both females are enclosed at present and it remains to be seen if they have any cubs (Martin pers. comm).

As pregnant, semi-hibernating bears should not be disturbed by human interference, it is difficult to keep an eye on the animals to ensure they are well, with the disastrous consequences that occurred at Edinburgh. Tulsa Zoo has incorporated a closed circuit television camera and infra-red lights to keep a watch on the bear without disturbance. (Nunley 1977). This is an expensive arrangement and it may be argued that the bears have bred without such equipment - but perhaps there may be greater success if cameras and lights were used to reduce disturbance to a minimum.

Other factors may also be important such as temperature, suggested by Dr. Bertram of London Zoo. The figures in table 3 were worked out from the International Zoo Yearbooks (Anon 1979 - 1982, 1984) and a Readers Digest Atlas (1967). They are rough approximations but they demonstrate a tendency for a correlation between temperature and breeding success - the lower the winter temperature, the more chance of successful breeding. This deserves more detailed investigation with accurate figures for breeding success and failure and records of the local monthly temperatures from September to March. In table 3 success is defined as a zoo that succeeded in breeding at least one cub although in many cases other cubs died; failure is when all the cubs died.

Table 3: The Correlation Between Breeding Success and Ambient Temperature

YEAR	NO. OF SUCCESSES	MEAN TEMP* OCT.	JAN	NO. OF FAILURES	MEAN TEMP* OCT	JAN.
1977	18	9.1	-0.8	15	10	1.5
1978	15	10.3	0.4	14	8.8	-1.5
1979	11	9.0	-0.4	20	8.6	-0.8
1980	16	8.6	-2.8	16	10.7	6.2
1981	14	7.2	-4.7	18	10.6	1.7
MEANS	14.8	8.8	-1.7	16.6	9.7	0.6

*Temperature is measured in degrees centigrade converted from farenheit.

There are several exceptions when zoos in warm areas such as San Diego have succeeded in breeding bears, but as a general trend the figures are significant.

If temperature is an important characteristic in breeding polar bears then it must be asked whether Britian or any area where there are relatively high temperatures, are suitable for attempting to breed the animals. Temperature is likely to be important for initiating the onset of semi-hibernation and perhaps it may signal the implantation of the embryo in the womb. The influence of temperature on breeding success requires further investigation..

5. Education and Captive Polar Bears

Public education is regarded as an important role for zoos (Cherfas 1984; Jamieson 1983; Thomas and Downing 1961). The public must be informed about the animals to appreciate them aesthetically and as part of the overall ecosystem. Some 'education' is difficult to assess and is probably better described as an awareness - the shape, colour, size - that is built up in people watching the animals.

Yet much of the awareness centres around knowledge of the animal. Species such as polar bears have a very specialised life cycle in a harsh environment and details of this life cycle and how the animal copes with the environment should be available in an understandable form where the animal's are exhibited.

The Life Cycle of Polar Bears

The notes below are mostly taken from DeMaster and Stirling (1981) and Davids and Guravich (1983). Much of this information should be available with the animals, although there is neither space nor would it be of great use, to put it all in a long written text.

1. Physical Characteristics

   The fur varies from white, yellow to grey and almost brown depending on the season; the skin, nose and lips are black. Adult males may grow to two and a half metres long and weigh between 330 and 800 kilograms; females grow to two metres and weigh between 150 and 300 kilograms.

2. Distribution

   Polar bears are circumpolar, the southern limit being determined by the distribution of the ice pack. In some areas the bears migrate north and south in relation to the southern edge of the drifting ice. Bears in Hudson Bay migrate inland and endure the warmer weather by digging caves or pits into the permafrost. The pelt and blubber are used for insulation - the bears accumulate large amounts of subcutaneous fat which varies from five to ten centimetres thick. Adult females are particularly fat prior to denning.

3. Reproduction

Mating occurs from February to June but there is a delay before the embryo is implanted into the womb; therefore the gestation period is between 195 and 265 days. The average litter size in the wild is less than two (between 1.58 and 1.87), but there are geographic differences in the litter sizes, dates of denning and emerging from the den. There are also geographic differences in the weaning age, some are repprted at 17 to 18 months though it is usually 24 to 28 months.

Females may reach sexual maturity at three and a half years but the average age of starting to reproduce is between six and seven years. The peak reproductive period is between ten and 19 years and the average time between litters is over three and a half years. Males can breed between three and 19 years, but it is unlikely that they mate before six years old. The cubs weigh over half a kilogram at birth and ten to 15 kilograms when they emerge from the dens in March and April.

The bears live between ten and 30 years. The adult mortality is between eight and 16 per cent, the subadult mortality between three and 16 per cent and the annual mortality of cubs prior to weaning is between ten and 30 per cent.

4. Ecology

Polar bears feed on ringed, bearded, harp and hooded seals, especially the young and new born, and scavenge on whale and walrus carcasses. When seals are not available they will eat small mammals like lemmings, birds eggs and vegetation. Much of the wild population of bears is infested with the nematode Trichinella spiralis, which is probably contracted through eating infected seals.

The population has been estimated as low as 10,000 but recent reports have doubled this figure with the result that there is increasing pressure to resume commercial hunting. However, there are increasing threats from tourism and industrialisation of the Arctic. People in helicopters and motorised vehicles chase bears which can be fatal as the animals overheat very quickly when forced to run (Anon 1984, 1985 Øritsland et al 1974).

The bears' habitat is periodically active ice where wind and currents cause movements and fracturing of the ice followed by refreezing.

5. Behaviour

The cubs stay with their mothers until at least two and a half years old, during which time they learn all their hunting and survival skills. Grooming, with washing bouts of up to 30 minutes is an important activity after feeding. The animals are most active in the first third of the day and least in the last third. Adult females with the young are not subordinate to any other sex or class, however adult females with cubs of the year avoid interaction with adult males.

Maternity dens are dug in October and range from single chambers with short tunnels to complex structures with several chambers and tunnels. Temporary shelters are built in the snow during bad weather, and dens are dug in the earth in the summer and fall.

How Can This Information be Presented in Zoos?

Signs are almost as important in the context of education as the animals themselves and for the every-day visitors these, and the guidebook, are the only sources of information. (Most zoos covered in this survey had educational facilities for organised parties). According to Thomas et al (1961) signs should be:

attractively presented an in colour
correct
concise - covering the important points
about the animal.
legible and easy to read within the viewers'
distance
semi-permanent.

Only the signs at Chester and Belfast could be said to satisfy the first requirement. Most of the information given in all the signs is usually correct as far as it goes, although there are mistakes such as Dublin reporting that cubs are born naked, or Belfast saying the den is roomy - (maternity dens fit closely the contours of the mother (Uspenski and Kistchinski 1970). None of the signs gave much information on the present threat to the animals. Only Dudley mentioned the modern threat of mineral exploitation of the area, although in some cases the information was given in the guidebook. Generally I feel that the information given in the guidebooks and on the notices is limited. Admittedly there is limited space and with many exhibits to see the visitor will not read a mass of written information, but perhaps more efforts should be made in this direction.

One particular problem with signs noticed in this survey, is that few people bother to read them, although they will take the guidebook home and may read it further; it is also likely that it may be kept as a mini-reference book. But voice-over tapes and videos will help overcome this problem. These techniques are expensive and appear more in the larger zoos in the USA and perhaps most British Institutions find them beyond their budget.

But there are other ways to put the information across. Sizes such as two metres or weights like 300 kilograms are difficult to appreciate. A life-size model bear, standing up and on all fours to show the huge fur-covered feet, would tell the size of the animal more than any number of words. Weights should be related to known things e.g. 300 kilograms, which is almost the same as four people. A model den would get over the size of the dens, which is surprisingly small, and built to conserve heat.

The zoo or animal should not be seen in isolation, wildlife does not work in this way. The animals should be put into the general picture or ecosystem. Edinburgh Zoo's collaborative programmes with other organisations is an important step along these lines.

Little can be learnt about the animal's behaviour by watching the bears in the present exhibits in Britain and Ireland. Limited details can only be obtained from the signs or guidebooks. Perhaps by giving displays where polar bears can catch fish under water would improve this - but in the natural world the bears rarely catch fish under water, seals are ambused by their breathing holes, or stalked across the ice.

An unsolicited comment from one individual when discussing the recent BBC Natural History series called The Kingdom of the Ice Bear was "I never realised just how big and powerful the animals are, well I mean I've seen them in zoos, but it is just not the same". To justify keeping the animals in captivity for an educational value, more must be able to be put over than can be gained by watching videos and films.

6. Conservation of Polar Bears

It is an indictment on the so-called 'progress of humanity' that many wild areas are threatened to the extent that it is felt necessary to remove plants and animals for safe-keeping. Captive breeding programmes have saved some animals from extinction and successes have been achieved with re-introducing species to the wild once the environment was protected. But is there a conservation argument to support the maintenance of a captive population of polar bears?

To my knowledge none of the successful re-introduction programmes from zoos involve carnivorous animals, although some, like the big cats, breed well in captivity. There is an inherent difficulty in introducing canivores to the wild - they have to be taught to hunt and kill their food. Polar bear cubs are entirely reliant on their mothers for the first two and a half years of their life, during which time they learn all the techniques for survival. Cubs orphaned at less than two years old have a very low chance of survival (DeMaster and Stirling 1981). By comparison, introducing grazing herbivores is likely to be much simpler.

If captive populations are to be maintained in preparation for re-introducing them to the wild then research should be going on to discover how such introductions could be carried out. It would be tragic if we waited until it was necessary and find that it could not be done.

The problem with polar bears is exacerbated as captive breeding is so difficult; it is rare to find a second generation of captive bred bears (Keulen-Kromhout 1978). In addition, despite the fact that polar bears breed more often in captivity, the survival rate of cubs is less than in the wild.

The protection of polar bears has been successful through conservation areas and a ban on commercial hunting especially by trophy hunters (Anon 1985). This method of conservation is the best and perhaps the only way to protect the species.

However protecting single species is not true conservation as each is linked with its environment. Catastrophes are, however, difficult to predict, although it is possible to point to probable threats with the experience of past disasters. But there are areas on the planet where the environment is fragile and unique and perhaps we should not even risk the possibility of an incident that would inflict irreparable damage. Such areas would include the Arctic and Antarctic among others.

In the Arctic a relatively small number of animals and plants have evolved to cope with the harsh environment and each relies on the other as part of a complex web - an effect on one will be felt throughout the system. Human disturbance reduces the seal population which in turn effects the bears; pollution reduces the Arctic population generally. The native Inuit (Eskimos) are also part of the Arctic ecosystem that rely on the polar bears (Davids and Guravich 1983; Salisbury and Miles 1985).

But if it was felt necessary that a captive population of polar bears should be maintained in order to provide a last resort protection for the species, then perhaps more success would be achieved if the population was maintained in the native countries, i.e. USSR, Norway, Canada, USA and Greenland, where the conditions are more suitable to successful breeding and from where it may be easier to carry out re-introductions to the wild.

Even better, there should be more areas that are designated as "no-go" to humans, such as on Svalbard where research and monitoring can go on with a "captive" population providing the necessary information for real conservation.

7. Research in Zoos

Most research projects carried out in zoos are looking at animal husbandry - that is improving the captive conditions. More often this is on a trial and error basis with - hopefully - the zoos learning from past mistakes (Wortman et al 1974). But a major part of research should be in communicating the results to other institutions so that mistakes are not repeated. There is a growing awareness of the need for co-operation in this way, but there are still areas where it is lacking. In this survey it was found that zoos with particular problems such as the skin complaints of some bears were unaware that other bears in other zoos had suffered similar complaints and had been cured. In addition different institutions did not know of the tragedy at Edinburgh where the females died while in their maternity dens or about the mistake at Bristol when Janina was released from her maternity den too early. There is room for an improvement in communication of such important information if the zoos are to maintain their captive populations as an efficient safety net.

8. Reserves and Conservation - A Warning!

Exploitation of the environment has led to a need to protect endangered species in reserves and safe places where they can breed under complete protection. Being realistic, past experience tells us that where profit is to be made, we cannot rely on industry or governments to hold back and consider the environment. But reserves should not provide a carte blanche to developments

outside special areas, otherwise we will have preserved species and examples of habitats and not conserved the environment.

9. Conclusions

This survey has collected information on the captive polar bears in Britian and Ireland. Some zoo personnel feel that perhaps these animals do not react well to captivity; Bristol and Glasgow will not be replacing their bears once the present animals die.

Only Belfast and possibly Chester zoos have enclosures that approach the type of exhibit recommended by Keulen-Kromhout (1978) as suitable for polar bears. This is a large flat area with an occasional raised look-out platform. Belfast has a naturalistic exhibit and much thought, money and effort have gone into providing the best conditions. It remains to be seen whether even this effort is sufficient to maintain the animals in an environment where stereotypic behaviour does not develop.

Edinburgh and Chessington zoos are building extensions to improveand enlarge their present enclosures.

The enclosure at Dublin is small and needs improving. The Flamingo Land enclosure needs to be moved away from the noise of the fairground machines, requires cleaning and a good pool. Signs and an informative guide are also required.

Do the Zoos fulfill their Role with Respect to Polar Bears?

1. Entertainment

Active animals attract the public. Polar bears will provide a stimulus when they can be seen jumping in the water, swimming or playing, but if they are lounging

around or pacing repetitively, people will not stay to watch them for long. In the present exhibits the polar bears spend much, if not most, of their time pacing or lounging. London zoo's prospective exhibit could improve this situation, but perhaps more work is required to provide activities for the bears in the other enclosures.

2. Education

Just by seeing a polar bear a person will have some kind of awareness of the animal, but much more is necessary for an over-all appreciation. Information on notices and in guidebooks goes some way towards improving the educational value of the exhibits although Flamingo Land pays little attention to this part of their displays. More could be done to improve the educational value of the displays in all the zoos with models and possibly tape recordings.

3. Conservation

The poor breeding success of polar bears in Britain and Ireland, together with the possible need for a lower temperature to ensure successful breeding, leads to the conclusion that maintaining a captive population in Britain and Ireland is not helping conservation and may be a drain on either the wild or the total captive population. If zoos are to continue attempting to breed the animals more effort is required in the design of maternity dens to ensure suitable conditions. For instance the use of cameras and lights should be considered to ensure surveillance with minimal disturbance. However, even with this equipment, in urban zoos there is always the threat of the sudden loud noise or disturbance that could be disastrous.

4. Research

Most research carried out in zoos is looking into animal husbandry. Obviously the new exhibit at Belfast is the result of increased knowledge of the conditions necessary for keeping polar bears. However, there is a need to improve the communication of information between zoos to avoid the repetition of mistakes.

The Captive Conditions

Most of the exhibits had polar bears that demonstrated a degree of stereotypic behaviour. Only time will tell whether the animals in the new enclosure at Belfast will eventually develop stereotypic behaviour. London zoo has a new exhibit planned which will incorporate activities for the bears that may help to stop the development of stereotypic behaviour, though once again the time in the enclosure will prove the success or otherwise of such exhibits.

It can always be said that more could be done to make improvements, but with limited resources there must be priorities. Improving the basic conditions of captivity is difficult, but perhaps the minimum requirements should be that:

1. The bears do not develop stereotypic behaviour
2. The bears should have a breeding success comparable with that in the wild.

Obviously improvements cost money and zoos in Britain and Ireland do not have similar resources to those for example, in the USA.

If the resources are not available, perhaps it would be more beneficial if the animals were not kept and the money then saved could be diverted to improving the conditions of other species. Possibly zoos should now be aiming at fewer important exhibits where the best conditions are provided; where there are successful breeding and research programmes, and where the public generally will learn more about wild life.

Addendum

The polar bears at Belfast Zoo that have been enclosed in maternity dens had not succeeded in breeding by the second week in January 1986. It looks as though the females will be released from their dens in the near future without cubs.

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