African Plains exhibit at Whipsnade Park

[Plates 55–57]

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Early in 1970 The Zoological Society of London completed negotiations with the Natal Parks Board in South Africa to acquire a herd of 20 White rhinoceros *Ceratotherium simum* from the Umfolozi and Hluhluwe Game Reserves. At the same time San Diego Zoo took a similar herd for the Wild Animal Park then being developed at Escondido, California. At this stage the species, rescued from the brink of extinction at the beginning of the century, had not yet been bred in captivity outside Africa. In line with current thinking, the intention in establishing two such substantial herds in these well dispersed exotic locations was to make provision for reproduction to continue should the native rhinoceros population once again fall under threat from some unforeseen disaster.

In the Whipsnade Development Plan of 1969 a large part of the original farmland on which the zoo stood had been designated for a Plains exhibit, and the unexpected advent of so many large African animals fitted well into the overall concept. An area was selected which, it was hoped, would provide an enclosure large enough to give the White rhinos full scope for their naturally gregarious behaviour, and eventually allow room to run other compatible African species with them. At this time also a group of railway enthusiasts made a proposal to run a narrow gauge railway at Whipsnade, and it was decided to route this through the new enclosure without any barrier between track and animals. The brief was agreed in February 1970. This allowed little time for design and construction, as the animals were due to arrive in August and would need shelter before the coming winter. It was decided that, providing the main enclosure and a holding yard were completed in the five months available, the animals could use their travelling crates as shelters until the house was ready towards the end of the year.

OUTDOOR ENCLOSURES (Plate 55)

The original enclosure covers about 9 ha and was designed as an 'L' shape to fit the existing road and neighbouring paddocks, and to provide good access and viewing for visitors (Fig. 1). Most of the internal angle of the 'L' has a dry moat barrier which provides an uninterrupted view over the whole enclosure, particularly from a promontory at the corner. The wall of the moat is 205 cm high and about 365 m long, and is formed from over 1500 old timber railway sleepers set on end at an angle of 60° (see Wears, p. 276 this volume). To date there have been no problems with this moat, and despite the absence of a rail or planted barrier on top, visitors have not been tempted to climb or jump down into the enclosure.

The remaining boundary consists of a post-and-wire cable fence, 900 m long, chosen because it was economic to build and would blend into the surrounding countryside. Based on the fence used successfully in the South African reserves, it is 152 cm high, and consists of 15 × 15 cm pressure-treated timber posts, 236 cm long and set 66 cm into the ground in concrete. The posts are 247 cm apart and are drilled to allow six 9 mm diameter galvanised stranded wire cables to run horizontally through them. The cables each have a breaking strain of over 5 tonnes and were fixed in unbroken 46 m lengths and then tensioned; the tension posts are braced. At first the cables were kept in line by two 50 × 25 mm vertical timber droppers between each pair of posts, but the rhinos broke these and it was subsequently found that the tension in the cables alone was sufficient to keep them in position. As the animals are so heavy (an adult ♂ can weigh around 2 tonnes), they tend to break the timber posts if they hit them – partly, we suspect, because the timber, which had been in short supply at the time the fence was erected, is of an inferior quality. With the cables passing through them, the posts are difficult to replace, but there seems to be no better method of connecting the two.To reduce the likelihood of breakages near angles, it is intended to change the corner posts to steel,

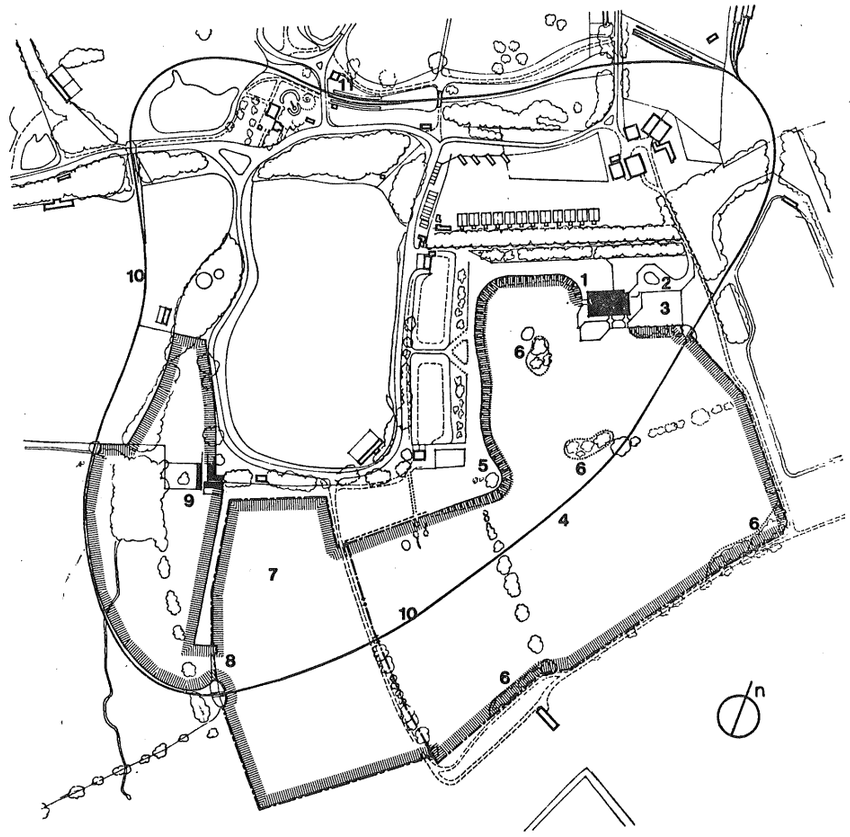

Fig 1. African Plains exhibit at Whipsnade Park. 1. White rhinoceros indoor quarters (house); 2. vehicle access; 3. holding yard; 4. 1970 enclosure (9 ha); 5. visitor viewing; 6. 1978 tree planting; 7. 1973 enclosure extension (3.9 ha); 8. creep; 9. 1974 building for zebra and ostrich; 10. railway track; 11. railway station.

braced on the outside by tie rods set into concrete. Metal gates, 309 cm wide with vertical bars (similar to those used inside the house), are set in the fence to allow the staff vehicle access to the paddock. To keep visitors out of range of the rhinos' horns, wherever the fence can be closely approached from the outside, a 40 × 120 mm timber rail has been fitted at some 140 cm distance and 69 cm above ground.

In 1973 a further paddock of 3·9 ha was added to the west of the enclosure by constructing a new 580 m long fence on three sides; the original western boundary fence forms the fourth side. Two gates permit control of animal movements between the two areas. Even with the additional space the grass was very heavily grazed and could barely survive when in 1975 the herd was at its maximum of 26 animals. The number has since been reduced to 14 (2.12), with a noticeable improvement in the appearance of the grass. Mature trees and some smaller hedgerow trees already growing in the enclosure have not been molested, but early on the rhinos browsed and killed most of the bushes. In 1971 they broke through horizontal timber rail barriers and destroyed newly planted trees. Another tree planting attempt is being made, this time using barriers of upright 20 cm diameter timber posts 168 cm long, set 75 cm into the ground in weak concrete at 60 cm intervals; it is thought that, as

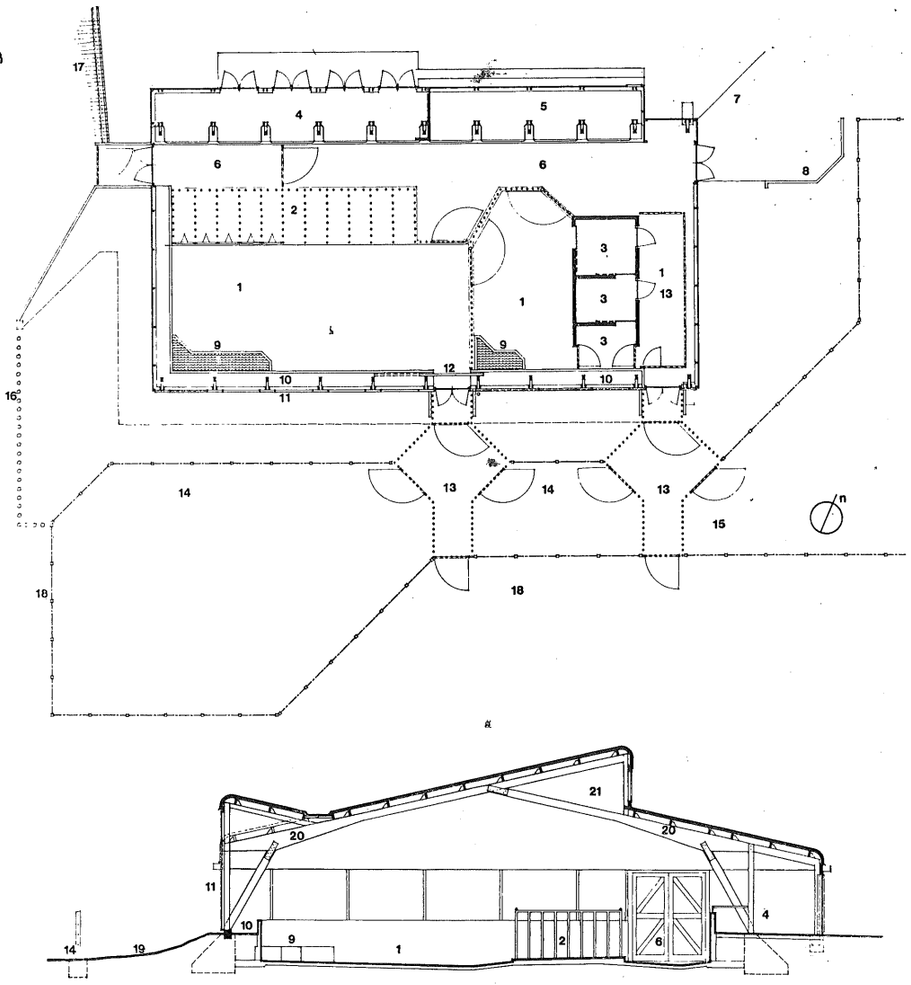

Fig. 2. Ground plan and section of the White rhinoceros *Ceratotherium simum* house at Whipsnade Park. 1. indoor pens; 2. feeding stalls; 3. loose boxes; 4. viewing gallery; 5. hay store; 6. tractor service passage; 7. vehicle access; 8. dung heap; 9. drinking water troughs; 10. keeper raised walk; 11. south window; 12. movable barrier; 13. race; 14. outdoor compounds; 15. holding yard; 16. log post barrier; 17. enclosure moat wall; 18. main outdoor enclosure; 19. earth bank; 20. structural frame; 21. windows and ventilators.

there is no horizontal member which the rhinos can lever up with their horns, this may be more effective. The only other additions to the enclosure have been a small pond and wallow, and a windbreak. Most of the animals have not interfered with the railway, nor do they seem to have been affected by it; only rarely does a rhino obstruct a train, and in any case the train's slow speed allows ample time for the driver to stop.

Since 1975 Brindled gnu *Connochaetes taurinus* and ostrich *Struthio camelus* have also been kept in the enclosures, and in this large area there has been no conflict among the three species. The barriers too have been satisfactory. It is intended to add

Common zebra *Equus burchelli*; both they and the ostrich also have a separate house and paddock (completed in October 1974) which they can reach by a 'creep' in the boundary fence through which the rhinos cannot pass.

INDOOR ACCOMMODATION (Plates 56, 57)

Indoor quarters for the White rhinos needed to be constructed rapidly, to be strong, easily worked by keeper staff, and to require little maintenance. They were designed to hold about 20 animals, but with the capacity for future extension (Fig. 2). The simple internal requirements and the need to prevent rhinos from coming in contact with the structure determined the use of a single span frame. The interior is divided into two pens one of which contains feeding stalls ranged along in front of a visitors' viewing gallery. Three loose boxes provide for animals needing attention or with young, although at times six boxes would have been useful. The building is 38 m long × 21 m wide. The ridge is 7·3 m above the floor, allowing sufficient natural ventilation but keeping the roof line below the tops of surrounding trees. The viewing gallery is 100 cm above the animal area, so that visitors may look down on the animals feeding, and also look through the large south window at the outdoor enclosure. This gallery, which runs along the length of the building, was found unnecessarily large for public use and has since been partitioned off to form a hay store. The store was originally intended as part of a future extension, now unlikely to be built – a reminder that all essential facilities are best included in the first stage of design.

As 20 rhinos may produce up to a tonne of dung a day, it was planned to use tractors for cleaning and servicing. The internal layout had therefore to be designed so that vehicles could move and turn freely. The system has worked well, although tractors are not used as frequently as had been expected as the straw and dung are now allowed to build up into a 'deep litter' during the winter, with the top layer only removed about once every four weeks. The two internal pens measure 21 × 9 m and 12·5 × 7 m, the larger with 11 feeding stalls along the side facing the public, five of these having drop-down gates to hold the animals when necessary. Both pens have water troughs 121 cm wide × 38 cm deep, which gives the animals enough room to drink with their horns nearly horizontal. The pen and stall fences and gates are all 167 cm high, made from 6·3 cm diameter galvanised steel tubes with uprights at 38 cm intervals. The tubes have been bent by these heavy animals, and it is thought that their wall thickness may not be sufficient; probably tubes of 7·6 cm diameter should have been specified. Movable fence units can be used to form a race or small pens beside the loose boxes when required.

The floor of the animal areas is 15·2 cm thick reinforced concrete laid to drain down fairly steep slopes to gulleys, which is essential when a deep litter system is in use. The loose boxes, as they are under the main roof, are open topped, with walls of reinforced 23 cm concrete blocks. The largest, 4·1 × 3·8 m, has provision for the collection of urine for research purposes, while the remaining two each measure 4·1 × 3·0 m. The building is not heated, but its good insulation and the body heat generated by the animals ensure that the temperature rarely falls below 4°C in the winter. To allow the rhinos freedom of movement, the two doors leading to the outside enclosure are usually left open, a hinged panel being fitted across the top of the opening to reduce heat loss. Lighting is from three high-level floodlights indoors, and one outside to illuminate the yards.

The main structure consists of 11 laminated redwood timber frames at 366 cm intervals, each spanning 18·3 m with a 230 cm cantilever over the visitors' gallery. The frames are set on concrete foundation blocks projecting 91 cm above the ground; a reinforced concrete block wall was built inside them and the space behind filled with earth. This system prevents the rhinos from damaging either the structure or the main outside walls, and provides a safe raised walk for the keepers. The building is covered with glass fibre insulated corrugated asbestos sheeting on the roof and walls above door height, fixed to pressure treated timber purlins. Below the asbestos the walls are constructed from 6·3 cm thick double-tongued timber boards, fixed direct to the main structural frames and treated with a preservative stain. Doors are also made of timber and stained.

When moving between house and enclosure the rhinos pass through one of two 152 cm high tubular steel fenced 'races'. Once within a race,

the animals can be diverted into either of two compounds to the south of the building, or into the holding yard to the east. The latter measures about 50 × 30 m, while the two other compounds are 26 × 18 m and 12 × 7 m respectively. All are enclosed by a post-and-cable fence similar to that around the main enclosure. A low timber barrier by the fence separating yards from enclosure was intended to stop animals sparring through the fence, but appeared to be unnecessary and when broken was not replaced. The compound floors are 15·2 cm reinforced concrete and drained; the holding yard is large enough to be left grassed.

An access road to the building was required in time for the animals' delivery. As they were to arrive in large crates on 18 m long low-loader transporter vehicles and were to be unloaded by crane, a particularly large turning area was laid out beside the holding yard into which the rhinos were first to be released. This also proved valuable later, whenever animals have been moved to other zoos. For speed and economy the road and turning area were constructed in 15·2 cm thick weak concrete, using large aggregate. When building work was complete, they were surfaced with tarmac.

The planned timing was achieved, and the enclosure, holding yard and access road were all ready when the convoy of transporters arrived on 5 August 1970. The rhinos began occupying the indoor quarters on 20 October, and everything was completed by 18 December, ten months after the brief had been received.

Manuscript submitted 20 July 1978

Moats and ditches at London and Whipsnade Zoos

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Previous editions of the *Yearbook* have contained several articles dealing with the various types of barrier used round zoo animal enclosures. The merits and defects of the various systems have been discussed and the philosophy behind their design promulgated, the general principles being particularly well covered in the article dealing with the moated and fenced enclosures at Frankfurt Zoo (Scherpner, 1971).

Rather than cover the same ground we have confined our attention to a review of the moats and ditches used as barriers at Whipsnade and London Zoo, some of which have been in use for many years while others have still to be fully tested. As the older buildings are demolished many of the original barriers have disappeared, but the information represented by their overall dimensions can still provide a useful guide to the jumping and climbing abilities of the animals which have been contained by them. Before starting this review we would point out that the details and dimensions of any barrier must be examined within the framework of the other features of the particular enclosure and the climate of the country concerned. Growing trees and shrubs may provide a way out of an enclosure, and when water freezes, or snow falls, the deepest moat is no longer a barrier.

BEARS

The oldest moats at London are those in front of the bear enclosures on the Mappin Terraces, which were inspired by Carl Hagenbeck's scenic panorama at Hamburg and completed in 1914. The Terraces have been successful in containing the animals, although for most of them the bare concrete surfaces are now no longer considered a suitable habitat.

There are two widths of moat, the smaller being 335 cm wide with a vertical wall of 320 cm on the public side and 350 cm on the animal side (Fig. 1a). An 83 cm high concrete wall with a 30 cm rail on top runs between the public walkway and the moat; the enclosure level is some 137 cm above the level of this walkway. The larger moat is 396 cm wide, 320 cm high on the public side and generally 380 cm on the animal side (Fig. 1), although some sections of this wall are only 308 cm high. The average height of the wall surrounding the enclosure is 320 cm. The wider moats were intended to serve as barriers to the Polar bears *Thalarctos maritimus*, although these animals have also been exhibited in the other enclosures. Other bears which have been kept include the Eurasian brown bear *Ursus arctos*, the American black bear *Euarctos americanus*, the Spectacled bear *Tremarctos ornatus*, and the Asiatic black bear *Selenarctos thibetanus*. The moats are also used as runs when transferring animals between enclosures.

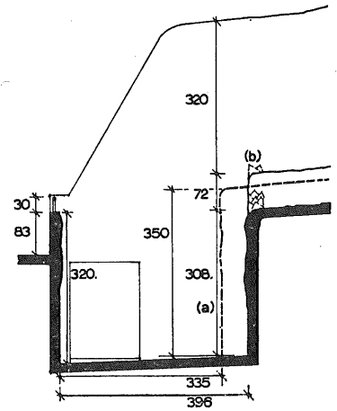


Fig. 1. Moat to bear enclosures (London, 1914): heavy line shows width of moat for Polar bears; broken line (a) shows moats for Brown and American and Asiatic black bears; (b) sharp stones added to discourage begging.

The row of angular stones (Fig. 1b), laid along the top of the wall on the enclosure side, is the only addition to the original design. This rather unsightly feature was added when the zoo banned the feeding of animals by the public. It was found that visitors could not resist the rows of begging bears sitting along the edge of the moat, and the stones were added to discourage this practice.

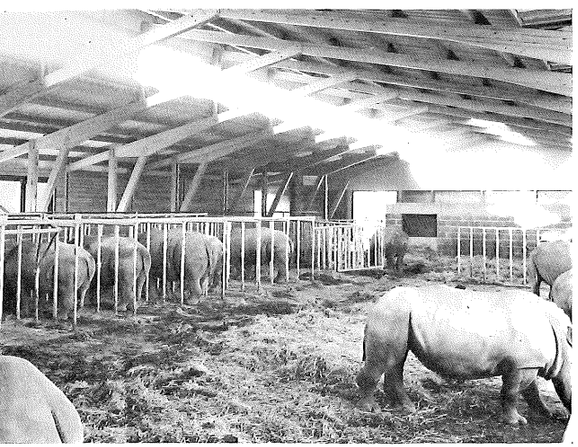
GIANT PANDA

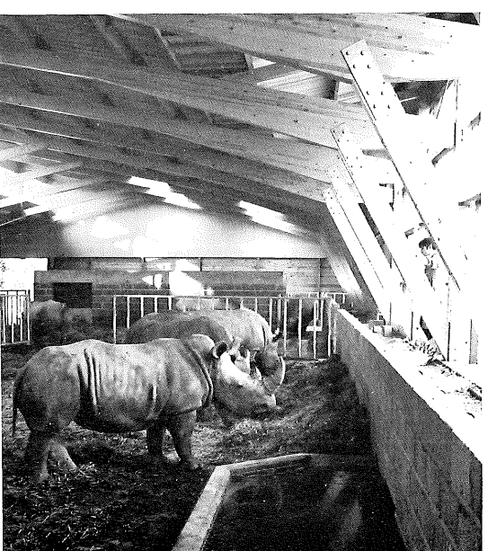
Giant pandas *Ailuropoda melanoleuca* have been kept at London Zoo for many years, the earlier specimens housed in existing structures, including the old Lion House. The first exhibit designed specifically for this animal was constructed in 1949 and consisted of a 13 m diameter circular enclosure with concrete block walls some 205 cm high. In 1959 a new and larger enclosure approximately 13 × 19·8 m was constructed for the ♀ panda 'Chi-Chi'. This had a 274 cm high artificial rock wall at the back with 203 cm walls round the sides, formed from standard precast concrete retaining wall units with an *in situ* concrete ring beam round the top to keep the units in line. Later, in connection with efforts to provide breeding facilities for Chi-Chi and Moscow Zoo's 'An-An' (Brambell, 1974), the old rhinoceros enclosures were adapted. The tops of the existing concrete retaining walls were cut back at ground level and a new vertical brick wall built on top (Fig. 2a), giving a total height of 240 cm on the animal side and 100 cm on the public side. A rail was run along the top of this wall to discourage children from sitting on it and the additional height stopped any physical contact between public and pandas. A dividing fence, 243 cm high, ran between the two enclosures, the bottom two-thirds of which were covered with mesh to allow some contact between the two animals, with vertical plywood panels along the top to stop them climbing over.

The present panda pair 'Chia-Chia' and 'Ching Ching' are housed in temporary quarters in the Sobell Pavilions, in a section originally intended for small and medium sized monkeys. The enclosures are surrounded by a light mesh, only 3·25 mm in diameter with an aperture of 100 × 40 mm. The pandas have shown remarkable climbing abilities and have fully exploited the facilities provided in this building (Toovey & Brambell, 1976), using the original climbing frames and the additional ladders and posts added for their benefit. In view of the Giant panda's now proven climbing ability, it must be assumed that the walls in earlier enclosures were successful only because of their smooth surfaces.

RHINOCEROSES

Several types of moat have been used round the various rhinoceros enclosures at London, the first of which was constructed in 1958 and was the one which was later adapted for pandas. In its original form it consisted of precast concrete retaining wall units set in the ground to form a wall 175 cm high with a mesh panel on top to protect the public (Fig. 2). The enclosure itself was grassed except for the bottom of the slope





55–57. Exterior and interior views of the White Rhinoceros House at Whipsnade Park, part of the African Plains Exhibit which currently displays 14 White rhinoceros *Ceratotherium simum*, as well as Brindled gnu *Connochaetes taurinus* and ostrich *Struthio camelus*. Visitors on the raised gallery out of range of the camera look down upon the animals feeding in their stalls and out through the large south window (seen in the top photograph) to the outside enclosure. The detail (*bottom*) shows the simple single span structure, each of the 11 laminated redwood timber frames spanning 18.3 m .They are set in concrete foundation blocks with a reinforced concrete block wall built inside so that the heavy rhinos do not come into contact with the building's structure. This also provides a safe walk for keepers. The two drinking troughs give the animals room to drink with their horns nearly horizontal. The horizontal timber rail barrier protecting the young trees in the exterior view has since been replaced by a fence of upright posts which the rhinos are less likely to break through (see pp. 270–274).
Pat Hunt

ENGLISH/LOCAL NAME	SCIENTIFIC NAME	QUANTITY
Sweet potato	*Ipomoea batatas*	leaves 12 kg daily tubers 3 kg daily
Long beans	*Vigna sinensis*	1 kg daily
Tomatoes	*Solanum lycopersicum*	3 daily
Cucumber	*Cucumis sativus*	2 (small) daily
Carrots	*Daucus carota*	2 daily
Telurak	*Ipomoea alba*	leaves handful daily
Kacang pedang	*Dolichos* sp	leaves handful daily
Acacia	*Acacia auriculeaformis*	leaves given on the branch daily
Rambutan	*Nephilium* sp	young leaves only occasionally
Nangka	*Artocarpus integra*	young leaves only occasionally
Banana	*Musa* sp	leaves once weekly
Other grass-like plants	*Paspalum commersonii* *Axonopus compressus* *Commelina nudiflora*	growing in enclosure

Note: Kangkung leaves *Ipomoea reptans*, which are preferred by primates, bears and other ungulates in the Zoo, cause diarrhoea if fed to the serows. This does not occur if the twigs only, which they also like, are given.

Table 1. Diet for two Sumatran serows *Capricornis sumatraensis* **at Jakarta Zoo.**

rare and shy Sumatran serow, the occasional successful hunt is an unfortunate encouragement to further hunting, for it is said that the meat is tastier than the goat meat usually available to the villagers.

DIET

During the period that the animals were held, while the Zoo obtained the licence to own and transport them, they had been fed on sweet potato leaves. Grass was also given but they accepted only small amounts. On their arrival at the Zoo, we offered them sweet potato leaves, grass and the ready mixed, dried food supplements which we give to ungulates, such as mouse deer *Tragulus* sp, Kuhl's deer *Cervus kuhlii*, Indian muntjac *Muntiacus muntjac*, anoa *Anoa depressicornis* and babirusa *Babyrousa babyrussa*.

The ♀ was rather thin but the young ♂ was in good condition. They ate scarcely at all during the first night, probably because of the stress of transport and the strangeness of the new quarters, but during the following 15-day quarantine, they accepted, in order of preference, sweet potato and its leaves, beans, tomatoes, cucumbers, and carrots. After release into their 750 m² outdoor enclosure, they also began to feed on the grasses and other plants growing there (Table 1).

VETERINARY CARE

When the animals arrived, the ♀ was unable to use her right hind leg, possibly because of an injury caused during transportation. She was nervous and difficult to examine and as there was no obvious external injury, she was left alone and recovered in five days.

A month later, she developed an abscess under her left eye and we attempted to administer four capsules of Ampicillin 250 mg/day. However, as these were mixed with the ungulate supplement which neither of the animals liked, the oral medication was not successful. With the aid of a stick we succeeded in applying Ichtyol ointment to the abscess. When it finally broke, the animal, although kicking and biting, was given 2 ml Terramycin combined with 1 ml Neuroboran and 1 ml liver extract i.m. This was followed by 2 ml Terramycin each day for the next three days and an injection of 1,200,000 i.u. Penadur LA every five days. After 11 days the abscess was almost completely healed.

During the same period faecal samples showed larvae of an unidentified nematode and both animals were given one Vermox pill twice a day for three days. Sometime later a further infestation of the worm larvae was successfully treated with Ascaridyl tablet no. 4.