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Is there a visitor effect on Abyssinian Ground Hornbills (*Bucorvus abyssinicus*), Papuan Wreathed Hornbills (*Aceros plicatus*), Wrinkled Hornbills (*Aceros corrugatus*) and Toco Toucans (*Ramphastos toco*) in a captive zoo environment?

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Appendix 1: Detail on species.

Abyssinian Ground Hornbill (*Bucorvus abyssinicus*)

The Abyssinian Ground Hornbill ranges from West Africa (Gambia, Nigeria, and Somalia) to East Africa (Uganda and central Kenya) (Falzone 1989).

Both males and females are generally black, with white primaries, and have a cylindrical casque which is open at the front. It also has a patch at the base of the upper mandible which is yellow-red in colour. The differences between the male and the female is that the male has a red patch on the blue bare skin around the eyes, throat and neck (Photograph 1 and 2), whilst the female does not have a red patch; the skin is just all blue (Photograph 3). The bare skin of the juveniles is blue-grey in colour, but will turn blue by the end of their first year (Mackworth-Praed & Grant 1970; Fry et al. 1988).

They are ground dwelling birds, preferring open grassland, bush and thin woodland habitat, though they do take to the air to find a roost. They feed upon insects, small mammals, lizards and other birds in the wild (Anon 2006a). When it comes to food, they are opportunistic and will often carry food around with them for hours before eating it. They will take food items when they find them, even if they have no intention of eating it then (Falzone 1989). Food in captivity is usually dead, day-old chicks and adult mice (Penny 1975).

Abyssinian Ground Hornbills are difficult to breed in captivity (Falzone 1989). However Paignton Zoo Environmental Park® has been successful with the breeding of this species (Anon 2006a). Mating displays become more frequent in April- the start of the nesting seasons, with displays such as beak slapping being observed. When a clutch is laid, it will usually consist of two beige eggs (71 x 51mm) which are laid about five days apart. The incubation period lasts for about 37-39 days (Falzone 1989).

The Abyssinian Ground Hornbill is a very active bird in captivity, and will exhibit various natural behaviours including foraging (Photograph 2), sunning (providing the weather is right), flying, running and nesting. The animals are destructive and will pull apart and dig up plants and other items in their enclosures. This destructiveness provides an issue when designing enclosures, due to trying to find a compromise that meets the requirements of the bird but is also attractive to the public. Research has shown that this bird is popular with the public (Falzone 1989).



Photograph 1: Abyssinian Ground Hornbill 1 (Male)



Photograph 2: Abyssinian Ground Hornbill 2 (Male)



Photograph 3: Abyssinian Ground Hornbill 3 (Female)

Papuan Wreathed Hornbill (*Aceros plicatus*)

The Papuan Wreathed Hornbill or Blyth's Hornbill (Gregson 2001) is found in the lowland forest of Papuan New Guinea and the surrounding areas (Orenstein 1976). It can be seen flying high above the treetops in large groups when on its way to roost (Anon 2006b). The female is about 75cm and the male is 90 cm in length. The wild diet is fruit (Anon 2006b) but the diet in captivity can be anything from fruit mix, mealworms, mice, cooked mince beef and boiled eggs (Gregson 2001).

The male has a black and white tail, the head and neck are golden in colour and the bill is a dull white colour. The bare skin on the face is bluish green (Photograph 5). The female is mostly all black with a white tail, has fewer folds in her casque than the male does, and her bill is shorter (Photograph 4) (Anon 2006b).

The Papuan Wreathed Hornbill usually breeds in February (Anon 2006b), but it is an irregular breeder in captivity (Gregson 2001). They are a sensitive species to change, and will take a while to form pairs with younger males susceptible to 'bullying' by older females (Gregson 2001). If they are successful, they nest usually in a hollow in a tree, and produce 1-2 white eggs (Anon 2006b). Paignton Zoo Environmental Park® had the first successful breeding of Papuan Wreathed Hornbills in Great Britain and Ireland (Gregson 2001; Anon 2006b).



Photograph 4: Papuan Wreathed Hornbill (Female) (Lindgren no date).



Photograph 5: Papuan Wreathed Hornbill (Male) (Gil & Madre no date).

Wrinkled Hornbill (*Aceros corrugatus*)

The Wrinkled Hornbill is found in the coastal, lowland forests of Malaysia, Borneo, Thailand and Sumatra (Walters 1980; Collar & Andrew 1988 in Sigler & Myers 1991). It is also seen in swamp forests up to 1000m. It is a shy bird that feeds on figs in the upper canopy, in groups or by itself (MacKinnon & Phillipps 2001).

It is a medium sized bird of about 75cm in length. It is black and white, but has a short, buckled casque, that is red in colour. The male has a white neck (Photograph 6), whilst the bare skin on the females' neck is bluish in colour (MacKinnon & Phillipps 2001).



Photograph 6: Wrinkled Hornbill 1 (Male)

Toco Toucan (*Ramphastos toco*)

The Toco Toucan is a canopy dwelling frugivore that operates in wide home ranges (Terborgh et al. 1990; Graham 2001; Galetti et al. 2000) across Brazil (Ragusa-Netto 2006) and North-East to Central South America (Burnie 2001). The bird inhabits both semi and closed habitat, and can also be found in patanal wetlands (del Hoyo et al. 1997 in Ragusa-Netto 2006).

The Toco Toucan is the largest of the toucan species and is about 53-60cm in length, with a bright orange bill about 19cm long. It is also distinguished by a black oval shape on the end of the bill, a white rump and a red undertail- males and females are very alike in appearance (Photograph 7). This bird is more unsociable than other toucan species and will locally migrate during some winters (Burnie 2001).

They like to nest in earth banks, termite nests (Burnie 2001), cavities and holes in trees and will produce 2-4 dull white eggs. Incubation will occur for 16-18 days and will be carried out by both parents (Fowler & Cubas 2001).

This bird is popular in captivity due to its exotic looks and its playful nature. Captive toucans tend to be aggressive and so, when attempting to breed individuals, pair formation and bonding is very important (Fowler & Cubas 2001).



Photograph 7: One of the two Toco Toucans (sex unknown).

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Appendix 2

Partitioned diagrams used for zoning the enclosures.

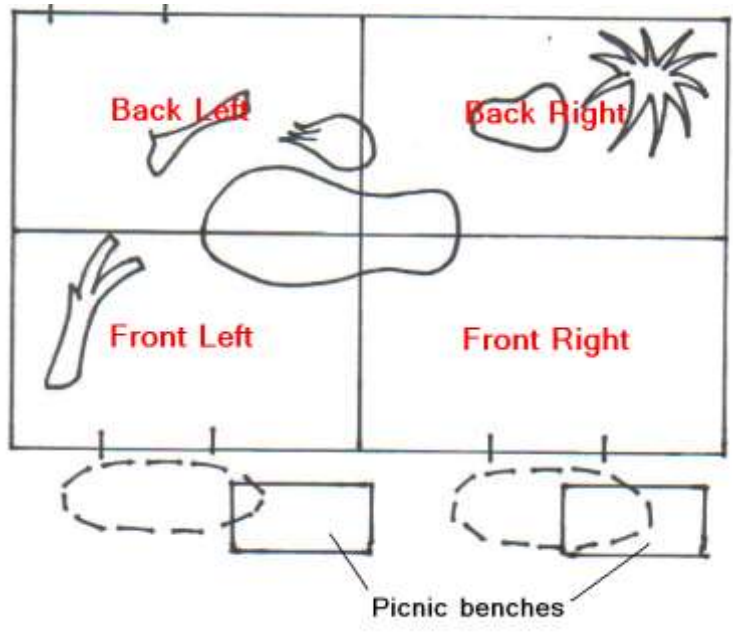


Diagram 1. A partitioned representative map, divided into 4 zones for the Abyssinian Ground Hornbill 1 enclosure.

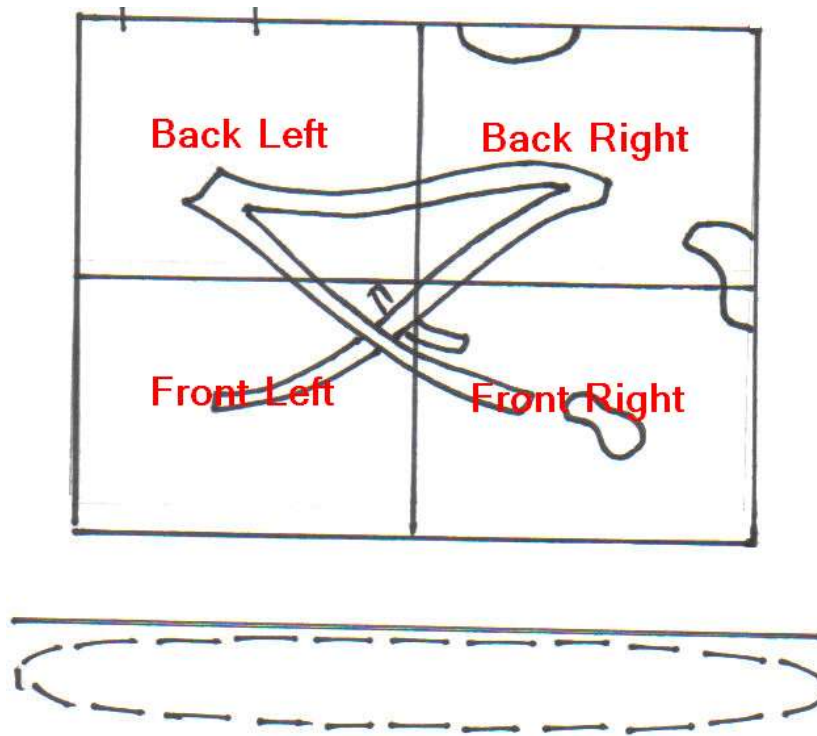


Diagram 2. A partitioned representative map, divided into 4 zones for the Abyssinian Ground Hornbill 3 enclosure.

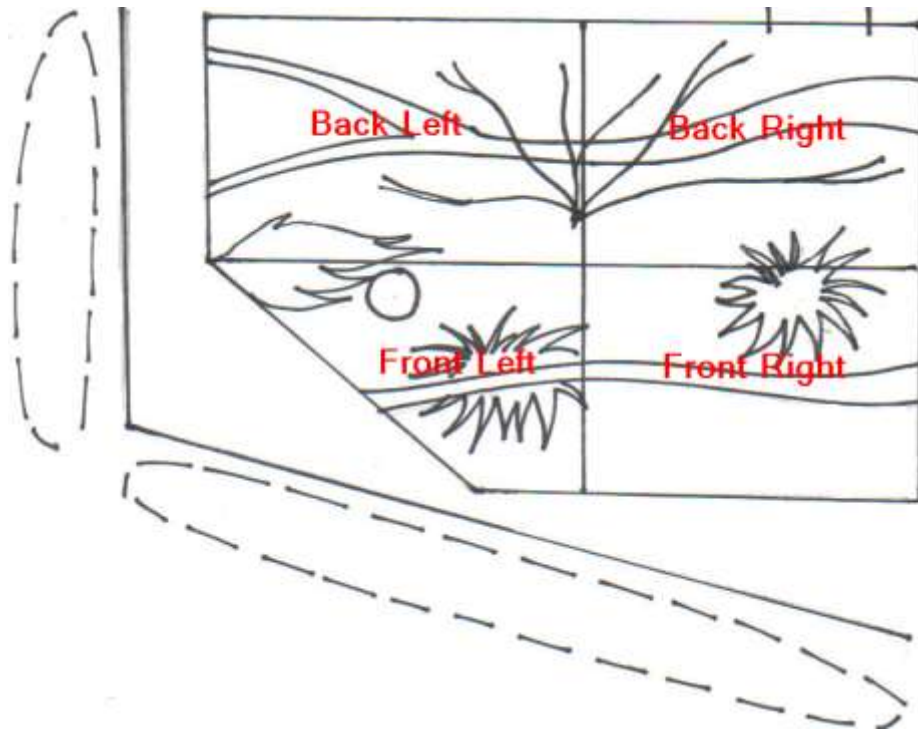
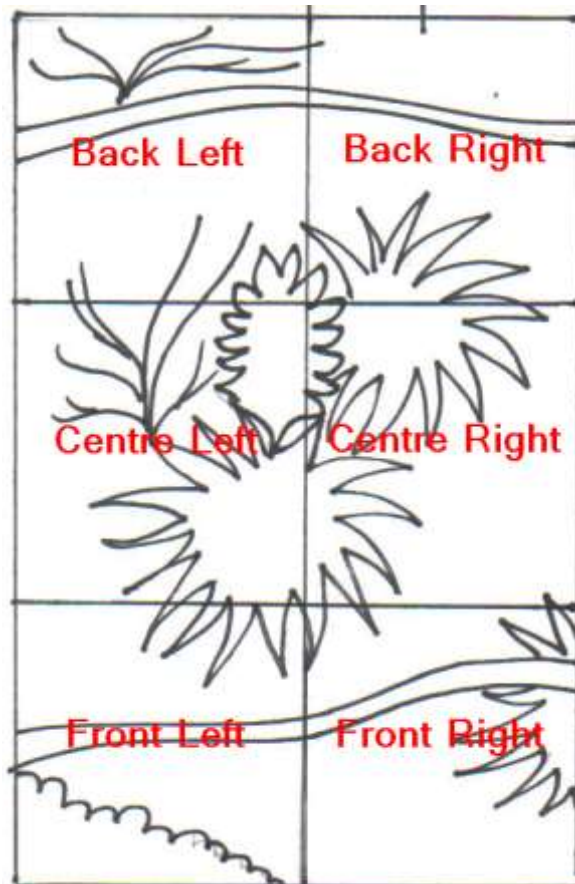


Diagram 3. A partitioned representative map, divided into 4 zones for the Papuan Wreathed Hornbill 1 enclosure.



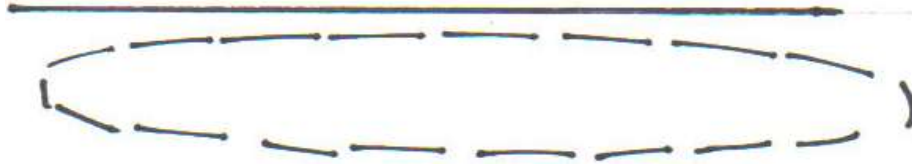


Diagram 4. A partitioned representative map, divided into 6 zones for the Papuan Wreathed Hornbill 2 enclosure.

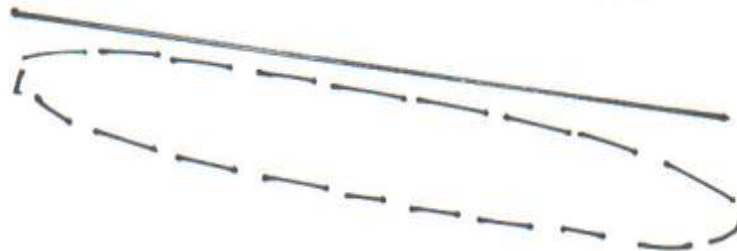
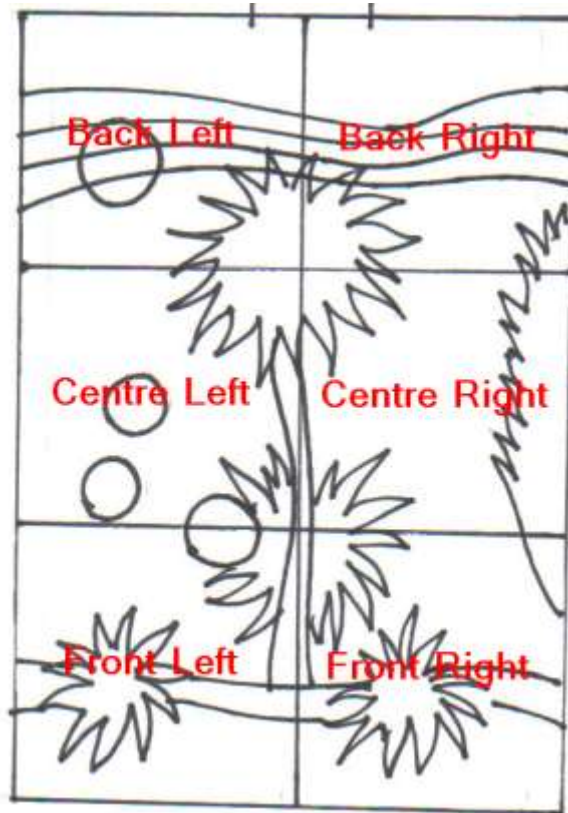


Diagram 5. A partitioned representative map, divided into 6 zones for the Wrinkled Hornbill 1 enclosure.

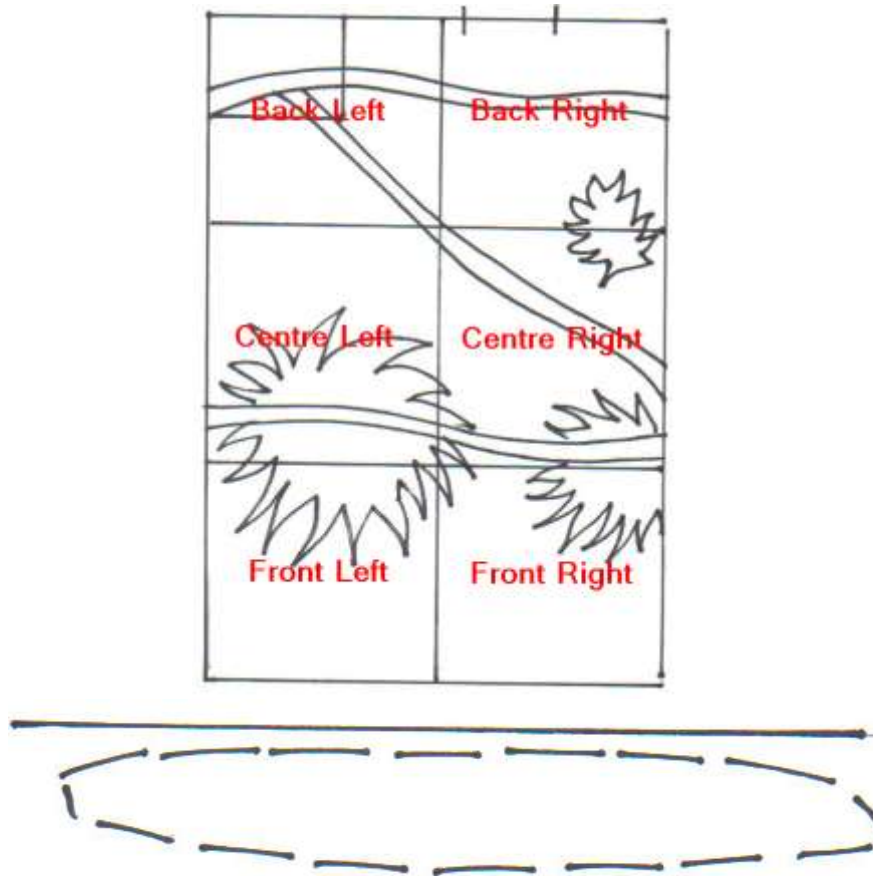


Diagram 6. A partitioned representative map, divided into 6 zones for the Wrinkled Hornbills 2 and 3 enclosure.

DIAGRAMS ARE NOT TO SCALE

Key:

