10 What Constitutes an Aquatic Mammal?

Paul Leyhausen

SUMMARY

The Aquatic Ape hypothesis claims, among other things, to provide a better explanation of human near-nakedness than any other proffered so far. Morgan (1972, 1984), for instance, has stated cursorily that during evolution all aquatic mammals tend to lose their pelt and become hairless.

About half of the mammalian orders have produced at least one aquatic or semi-aquatic species. The members of two orders have lost their terrestrial faculties completely and are unable to leave the water even temporarily: the Cetacea and the Sirenia. These have indeed lost almost all their body hair. Of those mammalian species which spend a great deal of their time in the water but are not permanently bound to it, only the hippopotamuses and the Great Indian rhinoceros have lost almost all their hair. But the vast majority, from platypus and water-opossum to polar bear and elephant seal, have not only retained their pelt but have greatly improved it, with the result that many of them have been, and some still are, threatened with extinction because of their valuable fur. This includes even those who come to shore only for the business of reproduction but lead a pelagic life for the rest of the year.

But perhaps the pre-hominid ape who took to the water to escape predation by the leopard, as Morgan has graphically described, had, like the extant anthropoid apes, already lost the soft underlayer of wool so essential to a protective fur. Did he, then, shed the coarse covering hair as well, since it was now useless? But mammals like the capybara, whose case is similar, did not.

Mammals who spend a considerable proportion of their life in the water, even tropical water, have to safeguard themselves against losing body heat too rapidly. They are characterised by a shortening of the limbs, and also of the tail where it is not used as a means of propulsion. The need for this safeguard is greater, the smaller the animal.

In short, a closer look at aquatic and semi-aquatic mammals does not support the Aquatic Ape hypothesis; nor does this become any more plausible when we consider that, at the time when the epic flight from the impact of over-powerful terrestrial predators to the shores of the Indian Ocean is supposed to have taken place, these same shores were still infested by *Crocodylus porosus* and its likes.

THE HYPOTHESIS

The Aquatic Ape hypothesis mainly rests on three sets of arguments:

(1) Reasoning purporting to show why the 'traditional' explanations of human hairlessness and bipedalism are unsatisfactory.
(2) The assumption that the loss of body hair had already occurred in the prehominid stage of human evolution.
(3) Claims that bipedalism could easily be acquired by an ape wading in shallow water, and that nakedness is of advantage to an aquatic or, rather, semi-aquatic mammal.

TESTING THE HYPOTHESIS

This chapter is primarily concerned with some aspects of argument (3), but a few remarks on (1) and (2) will be made first.

1 Morgan (1972) argued that anthropoid apes, when on the ground, prefer quadrupedal locomotion because their bipedal walk is ungainly and slow. But chimpanzees are able to run very fast on two legs, though perhaps not for any great distance (Leyhausen, 1954). However, the more extreme brachiators, the gibbons, must have acquired bipedalism while in the trees: very often they swing off a branch, land feet-first on another, and run along it for a while before launching themselves again into brachiatory swings. Often they walk along a branch on their hind legs, while simultaneously stabilising themselves by pro-forma brachiation with their hands along a branch extending over their heads. Now, gibbons have not developed knuckle-walking to the same perfection as did gorillas and chimpanzees, and when down on the forest floor they are able to run much faster bipedally than quadrupedally. Although there has been some discussion of the possibility that man bypassed brachiation in the course of his evolution, there can be no serious doubt that some of our prehuman ancestors were knuckle-walkers. This is a method of locomotion solely adopted by brachiators coming down to earth again – the gorilla and the chimpanzee in particular. The gibbon example may even point to the possibility that some early prehominids were more advanced brachiators than the immediate ancestors of chimpanzees and gorillas. However this may be, the gibbons show that bipedal locomotion in a brachiator need not be slow. Their case also casts doubt on the so far undisputed tenet that bipedalism must have evolved on the ground. It may well have started in the trees.

2 Etchings of human forms on reindeer antlers seem to show that even as late as the Aurignacian the body of palaeolithic man was well covered with terminal hair. Morgan quotes Hardy (1960): 'on the human body the vestigial hairs follow precisely the lines that would be followed by the flow of water over a swimming body'. This is incorrect (Figure 10.1). At the very top of the shoulders, where they strike against the onflowing water, the hairs strain against the current, thus offering maximum resistance to it. No aquatic mammal shows a similar flow of the hair. The human pattern is indeed unique even among primates, apes included. In all aquatic mammals the hair runs straight and even down from the head, over the neck and shoulders and along the body, and nowhere does it turn against the direction of the water flowing along the swimming body (Leyhausen, 1969).

Figure 10.2 presents a reconstruction of what human hair would have looked like at a stage of hominid evolution when it still covered the body more or less completely. It shows the owner (a) in a calm and (b) in

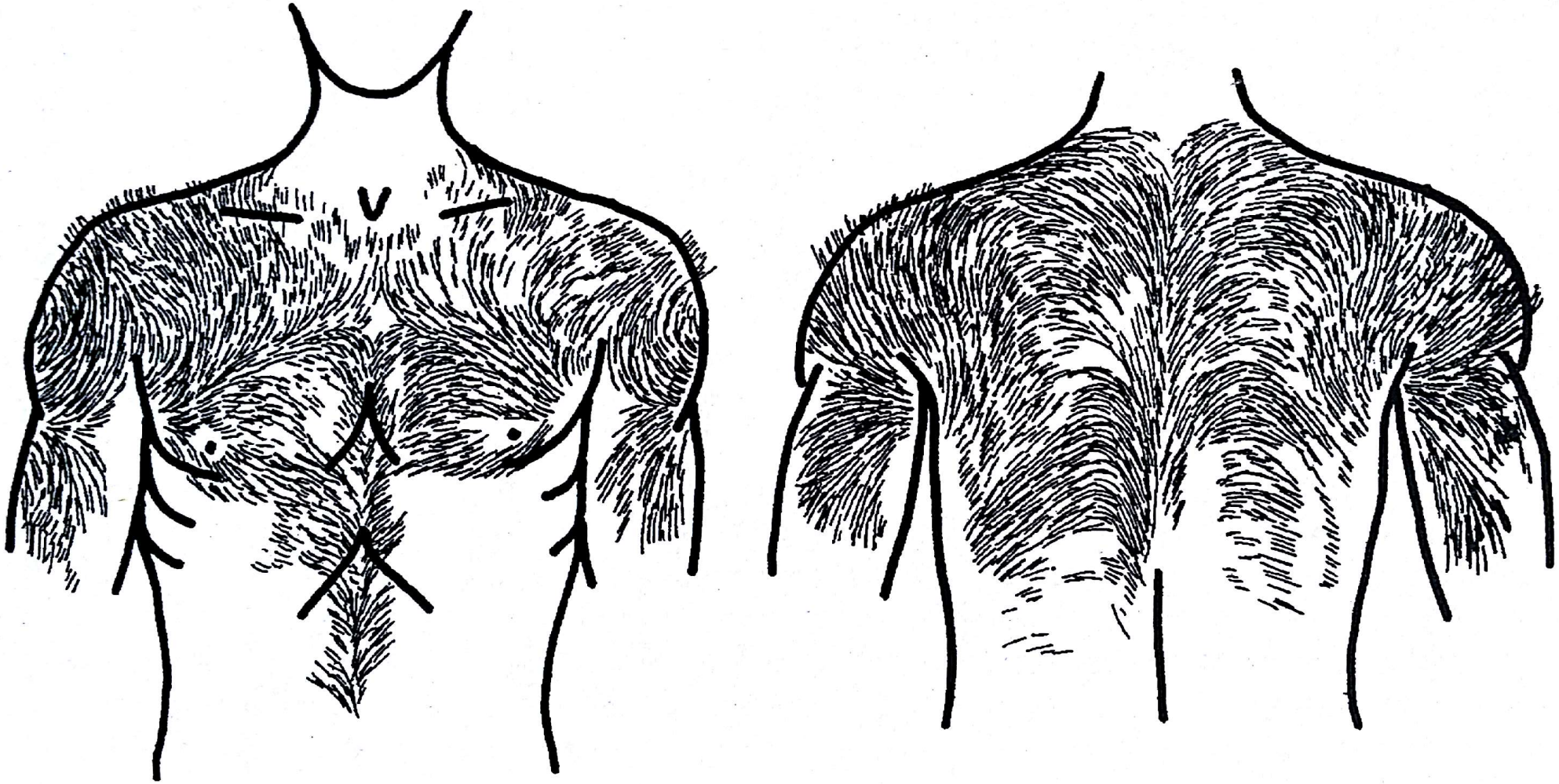

Figure 10.1 Flow of 'hairstreams' on the human body (n > 10,000).
The hair appears to rise from the armpit up to shoulders and neck, makes a U-turn and runs down the middle of the back. While there is considerable variation and asymmetry on the chest, there is none on the arms, shoulders and neck. This suggests a strong selection pressure that has prevented any noticeable degree of variation in those areas which determine the contour of the body.

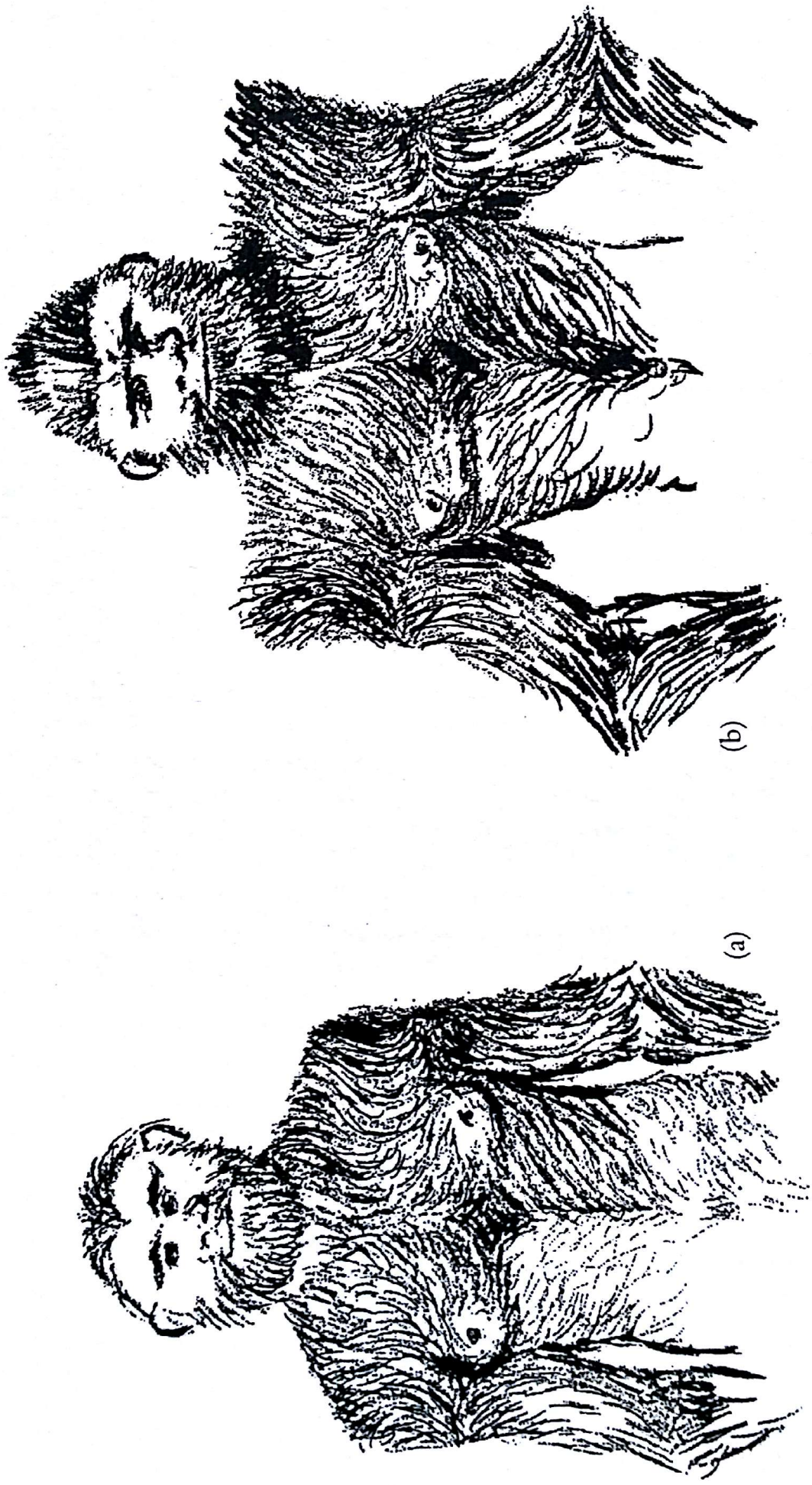

Figure 10.2 Hypothetical reconstruction of early hominid hair cover and the effect of pilo-erection.
(a) Individual in calm and friendly attitude; (b) same individual in a threatening, slightly aggressive posture.

an excited mood. It must be assumed that in this – Cro-Magnon type – man the pilo-erector muscles were still working perfectly well. The erected hair forms a sharp angle over the shoulder. To this day, humans possess an innate releasing mechanism which reacts to the contour that the human shoulder-line would assume if the hair were still present and the pilo-erector muscles still working. Long before man – probably as late as the end of the Palaeolithic – became practically hairless, the receding hair had been gradually replaced by adornments and clothing designed to mimic the contour that the erected shoulder hair would have presented (Leyhausen, 1969, 1983), thus satisfying the need for stimulation of the still extant releasing mechanism. A cursory look at modern fashion will prove that it still does so. There is no way in which the releasing mechanism could have survived several million years after the signal structure (the 'releaser') to which it is geared had become extinct. It could not have rested idle while the ape was already naked and the human not yet ready to meet the need of the releasing mechanism with substitutes formed out of adornments and clothing.

3 But let us now consider aquatic mammals. We can perceive roughly four groupings of mammals that spend at least a considerable proportion of their time in the water.

(i) There are two orders, the Cetacea and the Sirenia, whose members stay in the water all the time and are indeed unable to move on dry land. They are also hairless, and protect themselves against heat loss by a thick layer of subcutaneous blubber. To do this effectively they are almost all very large, and the smallest species live in warm tropical waters (fresh water dolphins). These animals meet, in an ideal manner, the criteria for aquatic mammals named by Morgan. Unfortunately, they represent a way of life which even the most ardent aquatic ape partisan does not claim for that ape. Their adaptations cannot provide us with arguments in favour of the Aquatic Ape hypothesis.

(ii) The pinnipeds, animals which spend most of their time in the water, have reduced their limbs to short rudders and to fin-like organs, are unable to move fast on dry ground, and come to shore only to rest and reproduce. Some species live on the high seas for most of the year, and come to dry land only for a relatively short period to give birth and mate and rear the young to some degree of independence. Some pinniped species are very bulky (walrus, elephant seal) and many have considerable layers of subcutaneous blubber. But not a single one has lost its pelt, and a number of them are famous for their fur and are severely hunted for it. It is therefore a well justified conclusion that an aquatic mammal that spends some proportion of its time ashore cannot do without a pelt, especially when it has to contend with climatic conditions where extreme heat may change rapidly to extreme cold, and the reverse.

(iii) Mammals adapted to swimming and diving which spend considerable time in the water for the purposes of foraging and self-protection constitute by far the most numerous group, containing members of six orders: monotremes, marsupials, rodents, insectivores, carnivores and ungulates. However, since all these animals also spend considerable time out of the water and are well able to run and jump, they should be described as semi-aquatic rather than aquatic. With one exception, all are well covered with hair. Many of them are famous fur-bearers, such as beaver, nutria, desman and the otter species. They have common adaptations for aquatic life, such as nostrils and ears which can be closed against the water, and short limbs with webbed feet.

The one exception mentioned above is the two hippopotamus species. Because of its habit of wallowing for hours in the warm waters of its habitat, the great Indian rhinoceros could also be described as semi-aquatic, although it rather belongs to group (iv) below. But the other rhinoceros species and the elephants are also hairless, and with the best of wills could not be described as even semi-aquatic, although they like bathing. The conclusion that all this suggests is that it is bulk and not their way of life which forces some mammals to do away with hair, because otherwise, under conditions of tropical temperatures, they would become overheated.

On the other hand, a minimum bulk is evidently required if an animal wants to replace by a layer of subcutaneous blubber the thermic insulation provided by a pelt. In a small body the ratio of surface to capacity is too unfavourable. A water-shrew or other small semi-aquatic mammal would therefore need a proportionally thicker coating of blubber than a whale to protect it from dangerous heat loss. But even a relatively thin pelt whose dense underwool is packed in tightly by terminal hair will effectively keep water from the skin. The air enclosed by the underwool is a most efficient heat insulator. In short, no aquatic or semi-aquatic mammal of small to medium body size could afford to shed its pelt, although many of them acquired subcutaneous fat as an additional means of keeping warm. The importance of the pelt to these animals is also evidenced by the fact that they all devote a great proportion of the time spent out of the water to grooming activities.

Everything which protrudes from the body, such as long ears, limbs and tails, presents a relatively excessive surface and is therefore detrimental to the maintenance of body temperature in a cooling medium. All aquatic mammals therefore have small external ears, or have lost them completely. They have short, thickset limbs, and those which do not use their tail as a rudder or propeller usually have a vestigial one or none at all.

(iv) A fourth group comprises mammals which do not really live in the water, but which take to it readily to escape either from the heat of the

day or from all too persistent parasitic insects; examples are the water-buffalo and the Indian rhinoceros. Others flee to the water when threatened by their enemies, as do, for instance, the capybara and some antelopes (Sitatunga, Mrs Gray's antelope) and deer (Père David's deer, swamp deer). To all these animals the water means a refuge, but not really a way of life. They are often adapted to life in swamps and wetlands, and swim well, but avoid diving and too long sojourns in the water. It must be borne in mind that almost all mammals are able to swim well.

Let us now consider our hypothetical aquatic ape. Clearly, any comparisons with groups (i) and (ii) are out of the question. His aquatic adaptations could never have gone as far as those found in these two orders.

The way of life that Morgan and others depict as the aquatic ape's daily routine would classify him along with the group (iii) mammals. However, ape and human alike are lacking any of the structural adaptations common to these. Human ears are comparatively large and richly provided with blood vessels. The nostrils cannot be closed, and it is only the air pressure of well filled lungs which prevents the water from entering. Primates cannot dive with empty lungs. This is what many aquatic and semi-aquatic mammals do when they wish to sink deep quickly. No mammal which spends a considerable proportion of its daily routine moving around in the water has limb–body proportions even remotely approaching those found in apes and humans. This last fact alone would prove that the fictitious ape could at best have belonged to category (iv). That human babies are natural swimmers and divers and that older children and adults can be trained to do even better is no argument. There are several macaque and baboon species whose members are excellent swimmers and divers. That does not make them 'aquatic monkeys'.

The alleged physiological adaptations of humans to an aquatic life likewise do not stand up to scrutiny. That the heartbeat of divers slows down somewhat is not to be wondered at. It does so in any mammal when the chest is compressed so that pressure is brought to bear on its contents, notably the heart. Thus the heartbeat also slows down a little when you turn on to your left side in your sleep (unless you have situs inversus) instead of lying on your back or right side: the weight of the right lung and other internal organs inside the chest then rests, in part at least, on the heart, and that suffices to depress the heart rate just a little. The human skin is in no way adapted to being soaked in water for long periods, and has to be protected against osmotic pressure by covering it thickly with grease, as cross-Channel swimmers used to do, or by divers' suits. In any case, our survey lends no support whatever to the idea that human near-hairlessness could be due to an ancestral ape adapting to a

semi-aquatic way of life. No even remotely comparable semi-aquatic mammal is hairless.

Last but not least: the Aquatic Ape hypothesis claims that at least one of the main factors driving our ancestral ape to the sea was pressure from leopards and other large predators. Leopards, the argument goes, are cats, and shun even shallow waters, and sharks do not enter them. The shallow coastal waters of East Africa, then, provided safety from all and sundry hazards. But as far as we know the shores of the Indian Ocean have always been infested by large crocodilians. Until fairly recent times, the range of the largest of extant crocodiles, the salt-water crocodile (*Crocodylus porosus*), extended westward to the African coast, and the indigenous Nile crocodile (*Crocodylus niloticus*) is by no means shy of salt water and was therefore able to colonise all the offshore islands, including Madagascar. Probably there were also other large crocodilians around, which are now extinct. They would all have gobbled up naked apes, particularly the babies, like geckos picking up insects that gather around a ceiling light. If I were a naked ape the size of a gibbon or slightly taller I should by far prefer to face the leopard.

In short, available evidence shows:

(1) Bipedal walk evolved in a brachiator, not in a wader in shallow water.
(2) Early hominids – even early *Homo sapiens* – were still fully covered by at least their terminal hair.
(3) No aquatic or semi-aquatic mammal of about the size of the hypothetical aquatic ape is naked.

Conclusion: there never was an aquatic ape.

REFERENCES

Hardy, A., 1960, Was man more aquatic in the past? *New Scientist*, 7, 642–5.
Leyhausen, P., 1954, *Pan troglodytes* – Zweifüßergang [*Pan troglodytes* – Bipedal walking and running]. Film No. E7, Göttingen: Scientific Film Institute.
Leyhausen, P., 1969, Experimental analysis of a human releasing mechanism. (*XIth International Ethological Conference*, Rennes (France), 2–10 Sept, 1969.)
Leyhausen, P., 1983, Kleidung: Schutzhülle, Selbstdarstellung, Ausdrucksmittel [Clothing: protective covering, self-projection, means of expression]. In *Menschliches Verhalten*, ed. B. Sitter (Freiburg: Universitätsverlag), 137–52.
Morgan, E., 1972, *The Descent of Woman* (London: Souvenir Press).
Morgan, E., 1982, *The Aquatic Ape* (London: Souvenir Press).

For more detailed information on aquatic mammals see:

Grzimek, B. (ed). 1987 (vol. 4), 1988 (vols 1, 2, 3, 5), *Grzimeks Enzyklopädie: Säugetiere* (Munich: Kindler Verlag; English edition in preparation).
Walker, E.P., 1964, *Mammals of the World*, 3 vols (Baltimore: Johns Hopkins Press).
Weber, M., 1927, *Die Säugetiere* (The Mammals) (Jena: Gustav Fischer Verlag).