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PEREGRINE FALCON POPULATIONS

THEIR MANAGEMENT AND RECOVERY

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31 The Status and Biology of the Peregrine in the Afrotropical Region

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The African Peregrine (*F. p. minor*) is resident over much of the Afrotropical region, the area south of the Sahara. Its biology and status are comparatively poorly known, but recent studies (Hustler 1983, Tarboton 1984, Tarboton and Allan 1984) provide much useful new data. I review this and other information to provide a modern account of the Peregrine's basic biology and to examine those factors which limit its numbers and distribution in Africa.

A high proportion of published data on African Peregrines should be treated with caution. Few observers have distinguished nonbreeding *F. p. minor* from migrant *F. p. calidus* from the northern Palearctic, and Peregrines may be confused with Northern Hobbys and resident, particularly juvenile, Lanner Falcons.

BASIC BIOLOGY

Morphology. — African Peregrines are one of the smallest races; males weigh about 500 g and females 700-750 g. They are very dark, especially dorsally and on the head. Structural proportions are similar to those of other Peregrines. Sympatric Lanner Falcons are similar in size, but African Peregrines have relatively shorter wings and tails, larger feet and bulkier bodies.

Distribution and Status. — Although Peregrines may be seen anywhere in the Afrotropics, their breeding distribution is discontinuous. Most of Africa is rolling savanna woodland and forest, or to a lesser extent grassland and desert, which generally lack high cliffs with vertical faces 50 m or more in height. Peregrines only breed along deeply incised river valleys and escarpments, on isolated inselbergs and in the few mountain ranges. In southern Africa, for example, the majority of Peregrine breeding sites are in the southwestern Cape Mountains, on isolated hills in Botswana and Namibia, in deep river

valleys in the east, along the escarpment in the Transvaal, and in river valleys, on inselbergs, and in the eastern highlands of Zimbabwe. Elsewhere in Africa, breeding populations are known or probably exist in the Ethiopian highlands, isolated mountains in East Africa, inselbergs in Zambia, Malawi, Mozambique, the Ruwenzori Mountains, and on isolated mountains in Angola and West Africa. Several authors (e.g., Steyn 1982, Tarboton and Allan 1984, Thomson 1984a) reported that most breeding sites overlook extensive woodland and are close to rivers or dams.

While widespread, the zones occupied by breeding pairs probably comprise less than 5% of the total area in the Afrotropics. The Peregrine is therefore uncommon, although in certain areas it is probably as abundant as anywhere in the world. Between four and eight pairs breed in 620 km² in the Matopos National Park (MacDonald and Gargett 1984). In the Transvaal, four pairs averaged 6.4 km between their nest sites (Tarboton and Allan 1984) and in Kenya, L. H. Brown found eight pairs in 3200 km² (Cade 1969a). Zimbabwe probably has more resident pairs than any other region, and Thomson (1984a) estimates 200 pairs. The Transvaal, however, is the only large area to be intensively surveyed. Tarboton and Allan (1984) found 14 eyries and estimated a total population of 20-40 pairs in 286,000 km². Considering the comparative suitability of habitats in the Transvaal and elsewhere in Africa, extrapolation leads to a rough estimate of 1000-2000 pairs for the Afrotropical region. Most optimal habitats are remote and seldom visited by ornithologists, and even less likely to be surveyed. For example, there are probably 500-1000 bird watchers in the Transvaal, yet no positive breeding record existed for the area prior to Tarboton and Allan's intensive survey. Furthermore, Peregrines in Africa appear to be rather unobtrusive, especially compared with Lanners. The pair at a nest site I often visit is usually hard to find, yet a nearby pair of Lanners can be readily seen.

Tarboton and Allan's (1984) study over five years is the only systematic survey in Africa. There are thus no comparative data to judge whether the population has changed in recent times. Comparatively few museum specimens were obtained during the heyday of collecting and old regional literature describes the species as rare or uncommon, suggesting that numbers today are similar to those 100 or more years ago. Peregrines may have declined in areas subjected to heavy pesticide contamination since relatively high residues and eggshell thinning have been recorded (Peakall and Kiff 1979, Mendelsohn et al. Chapter 43). Tarboton and Allan (1984) and Thomson (1984a) suggested that clearing of woodlands for crop cultivation has caused the local disappearance of breeding Peregrines, but further information is lacking.

Breeding. — Recorded eyries have been on vertical cliffs, on the structurally similar Kariba Dam wall in Zimbabwe/Zambia, and on a building in Nairobi, Kenya. One nest in a tree in Zimbabwe might have belonged to a Lanner (Steyn 1982), a species that regularly uses old vulture and eagle nests. Most occupied cliffs are particularly tall, and usually higher than surrounding ones. The average cliff height for 14 Transvaal nests was 150 m (range 60-300 m, Tarboton and Allan 1984). Other recorded cliff heights are 30 m (Hustler 1983), 60 m (C. Green SAOS NRC (Southern African Ornithological Society nest records)), 130 m (A.C. Kemp SAOS NRC) and 130 m (pers. obs.). Most, if not all, nest sites in Africa are particularly sheltered, presumably from rain and direct sun. The sites are usually on ledges below large overhanging rocks or deep within potholes or large horizontal cavities, and contrast with the exposed sites often used by Peregrines in the northern hemisphere (Ratcliffe 1980). Old sheltered nests of the Black Stork, African White-necked Crow and Verreaux's Eagle are also often used (Steyn 1982).

In southern Africa, eggs are laid in July ($n=4$), August ($n=7$) and September ($n=2$), much the same period described for East Africa: June to October, with 11 of 16 records in August (Brown et al. 1982), but see Thomsett (Chapter 30). Most authors mention clutches of 2-4 eggs, but four-egg clutches are evidently rare, as I can find no positive record of one. From various published descriptions of nests and SAOS NRCs, there are two records of two eggs and 12 of three eggs in southern Africa, giving a mean clutch size of 2.6 eggs, which is exactly the same as the mean of 10 clutches in East Africa (Brown et al. 1982). Brood sizes in southern Africa were: one young ($n=4$), two young ($n=7$) and three young ($n=8$) ($\bar{x}=2.2$ young per site). I have not seen any reliable measurements of incubation, nestling, or post-nestling periods in the wild, but these are variously estimated to be 31, 35-45, and up to 120 days, respectively (Condy 1973, Brown et al. 1982, Steyn 1982, Hustler 1983).

Three observers recorded eagles either attempting to or probably killing young Peregrines (Hallamore 1972, Hustler 1983, Brooke SAOS NRC). These involved Tawny Eagles, Wahlberg's Eagles and Verreaux's Eagles. While these might be isolated occurrences, they could indicate fairly frequent nestling predation, bearing in mind the paucity of published observations of young Peregrines. Chacma baboons (*Papio ursinus*) frequently clamber around cliffs and readily consume the contents of a nest; both Hustler (1983) and Hallamore (1972) mention interactions or potential predation.

At the only two nests studied intensively (Hustler 1983, Tarboton 1984), the males shared one-third or more of the incubation during daylight, and at one nest the female hunted for herself during the five days of observed incubation. The male fed the female at the other nest.

Hunting and Food. — Observations on hunting have been largely limited to those made around breeding cliffs near wooded areas. Most hunts started from a position high above the potential prey with the falcon then flying and stooping toward a flying bird. High cliff perches and trees above the rock face provided suitable positions from which to scan for prey, but the Peregrines launched most attacks (especially those away from breeding cliffs) while soaring. In woodland areas birds flying above trees or across clearings were attacked, but trees allowed flying prey to gain quick cover. Both Hustler (1983) and Tarboton (1984) recorded apparent "flush" hunting, in which falcons frequently alighted at different spots on a cliff to pursue birds flushed from the area. Neither observer saw prey captured using this method, however. Hallamore (1972) described Peregrines making daily visits to particular areas with aggregations of doves and weavers. They flew in low with the apparent chance of snatching vulnerable prey. Condy (1973) recorded attacks on Red-billed Quelea flocks flying across a river.

African Peregrines feed mostly on birds, although bats (Finch-Davies and Kemp 1982) and termite alates (Hallamore 1972) have been recorded occasionally. Hustler (1983) and Tarboton (1984) provided the only systematic lists of prey attacked or found at eyries. They recorded at least 45 species in a total of 162 items, ranging in weight from 15-600 g with an average of 127 g. Both samples were from areas with extensive surrounding woodlands, so arboreal and other birds dependent on woodland predominated, making up 66.7% of prey numbers or 67.2% of prey weight (Table 1). Most terrestrial species that occurred in open country spent a good deal of their time in woodland, returning there for shelter or to their nests. Doves, pigeons and francolins were the most important taxonomic groups preyed upon, comprising 40.1% of prey numbers and 66.1% of prey weight (Table 2). These groups also provided most of the large prey (>150g): 8 francolins (500-600 g) and 12 pigeons and large doves (250-340 g). The majority (n=45) of doves were relatively small *Streptopelia* spp. weighing 100-150 g, but these contributed to a high proportion of the diet, both by number and weight (Figure 1). The few large birds (>300 g) also formed a significant part of the total prey.

DISCUSSION

Comparative Ecology. — Clutch size should vary latitudinally, but clutches in equatorial East Africa were very similar in size to those in temperate southern Africa. For this whole region, the mean clutch size

TABLE 1. Habitat preferences of 162 birds recorded as prey of Peregrines by Hustler (1983) and Tarboton (1984).

Habitat (no. of species)	No. of birds (%)	% prey by weight
Woodland – terrestrial (10)	68 (42.0)	53.7
Woodland – arboreal (18)	40 (24.7)	13.5
Open ground – terrestrial (5)	25 (15.4)	21.0
Cliffs (3)	12 (7.4)	8.8
Aerial insectivores (9)	17 (10.5)	3.0
Total	162	

TABLE 2. Taxonomic groups of birds recorded as prey of Peregrines by Hustler (1983) and Tarboton (1984).

Family or group (no. of species)	No. of birds (%)	% prey by weight
Columbidae – pigeons (6)	57 (35.2)	45.6
Phasianidae – francolins (2)	8 (4.9)	20.5
Sturnidae – starlings (3)	23 (14.2)	11.5
Coraciidae – rollers (3)	3 (1.9)	1.6
Hirundinidae – swallows (2)	4 (2.5)	0.4
Apodidae – swifts (5)	11 (6.8)	1.9
Other passerines (8)	28 (17.3)	5.0
Near passerines[a] (13)	25 (15.4)	10.3
Other non-passerines[b] (3)	3 (1.9)	3.1

[a] Cuckoos, woodpeckers, hoopoes, kingfishers, bee-eaters, parrots, etc.
[b] Plovers, goshawks, egrets.

of 2.6 eggs (n=24 clutches) is small compared with averages ranging from 2.8 eggs (Victoria, Australia) to 3.8 eggs (British Columbia, Canada) (Pruett-Jones et al. 1981a). The only areas with average clutches of less than three eggs are in very different parts of the world: northern Alaska (72°N) (Cade 1960), Australia (Victoria) (36°-38°S), and Africa (0°-30°S), although ecological conditions which determine clutch size might be similar.

Peak laying in August in southern Africa is slightly earlier than the peak September laying period in Victoria, Australia (Pruett-Jones et al. 1981a). This might be attributed to the slightly higher latitude (36°-38°S) of Victoria, in the same way that laying occurs later at higher latitudes in the northern hemisphere. However, Peregrines in East Africa and southern Africa have similar breeding schedules, most eggs being laid in August, suggesting that latitude is not as relevant in determining laying dates as it is elsewhere (but see Thomsett Chapter

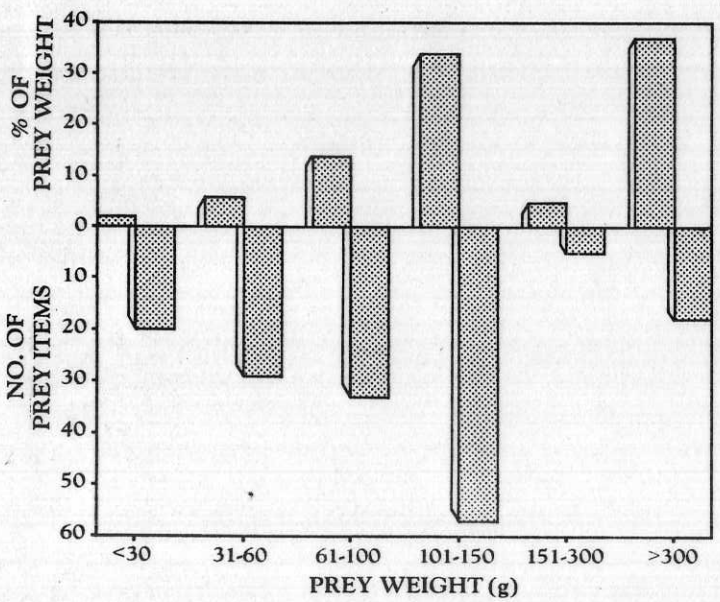

FIGURE 1. Importance by weight (top) and frequency (bottom) of prey items of different sizes in the diet of Peregrine Falcons at two nests in southern Africa. Data from Hustler (1983) and Tarboton (1984).

30 for Kenya). The August laying period is during the dry part of the year, but by the time young falcons are present, rains have usually fallen and much of their avian prey is breeding. Futhermore, millions of migrant birds from the Palearctic arrive in Africa from October onwards, providing a new food supply for young falcons present at that time.

Throughout the world, optimal nest sites for Peregrines are on sheltered ledges or in holes on tall cliffs (Hickey and Anderson 1969, Ratcliffe 1980, Pruett-Jones et al. 1981a). All unequivocal Peregrine breeding sites in Africa have been on cliffs, most of which are higher than 100 m. Compared with cliffs used by Peregrines elsewhere (Hickey 1942, Cade 1960, Ratcliffe 1980, Pruett-Jones et al. 1981a), African sites are particularly high, although in many parts of the world there are fewer really tall cliffs available. However, the value of nesting on tall cliffs may be enhanced in Africa where primate predators, especially baboons, are abundant.

Pruett-Jones et al. (1981a) showed that protected nest sites with little horizontal and vertical exposure were more successful than less sheltered ones in Australia. While no measurements of exposure for African sites have been made, the general impression is that nests are placed in particularly protected positions where they would seldom, if ever, be exposed to direct sunlight. In the hot climate over much of Africa, this would protect incubating females and nestlings from potentially lethal overheating (Beecham and Kochert 1975). Tarboton and Allan (1984) found that eyries in southern Africa did not face west, the aspect most exposed to sun at the hottest period of the day. In cool climates, by contrast, eyries are often exposed to the sun, presumably for extra heating (Ratcliffe 1980).

From the analysis of remains found at two eyries, average prey weight was 126 g. Although other prey analyses might show a somewhat different result, it seems likely that prey in Africa is smaller on average than elsewhere. For example, average prey weights in various parts of Europe range between 217-398 g (Cramp and Simmons 1980). While small passerines of less than 50 g make up a significant proportion of prey throughout the range of the Peregrine, high average prey weights in most areas are the result of frequent predation on pigeons, ducks, grouse, large waders, gulls and terns, petrels, ptarmigan, parrots, etc. Many of these birds are associated with water and open country, but at the two African sites, prey in these taxonomic and ecological groups were either comparatively insignificant or absent (Tables 1 and 2). Furthermore, most doves and pigeons killed were relatively small (<150 g). In contrast, the feral pigeon and its allies, which weigh 400 g or more, form a substantial part of the Peregrine's diet in many other regions.

Limiting Factors. — Several authors (Cade 1969a, Finch-Davies and Kemp 1983, Tarboton 1984, Thomson 1984a) have attempted to explain the rarity of Peregrines in Africa. Their explanations made one or more of the following points: nest sites are in short supply, Peregrines are competitively excluded by Lanners, or there is a shortage of appropriate food.

Since there are few tall cliffs in many large areas of Africa, the idea that nest sites are limited has apparent merit. However, nest sites per se cannot limit Peregrine nesting distribution in Africa because there are many low cliffs and old stick nests in trees which could, as in some other parts of the world (Ratcliffe 1980), be used for breeding. Nevertheless, the preferential selection throughout the world of very tall cliffs suggests that, as optimal sites, these might be the only viable nest sites in Africa. If this is true, one would expect nesting pairs to be densely clumped in areas with many tall cliffs. This prediction is not upheld because even where densities are comparatively high, they are

much lower than in some other regions where pairs nest less than 1 km from neighbors (Cramp and Simmons 1980).

A similar argument can be used to test the idea that Peregrines are excluded from marginal sites by Lanners. Tarboton (1984) suggested that Lanners, which feed on a greater variety of prey and use many different kinds of nests, are competitively superior where Peregrines do not have the advantages of hunting from very tall cliffs. Aggressive interactions between these species certainly occur (pers. obs.), as they do between conspecifics and other competitors for cliff space, such as Verreaux's Eagles and the Jackal Buzzard. While aggression and the simple presence of nesting falcons may exclude other birds from the immediate vicinity of nests, it should not prevent nesting further, say more than 500 m, away. If anything, conspecific competition should be more intense than interspecific contests, yet pairs of Lanners have nested within 200 m of each other (Tarboton and Allan 1984). Neighboring pairs of Peregrines and Lanners have been found 400 and 1000 m apart (Brown et al. 1982, pers. obs.). Such close proximity between nests is rare, indicating that the availability of nest sites is not a general limiting factor.

Lanners also feed substantially on birds, so there might be some competition for food between the species. To my knowledge, no quantitative analysis of Lanner prey has been done, but they also feed on insects, rodents, lizards, and birds on the ground (Steyn 1982). The two falcons therefore exploit a somewhat different spectrum of prey.

The data suggest that African Peregrines have smaller prey available to them than elsewhere in the world, and their small body size might be attributable to this situation. Many groups of large birds that are important prey in other regions are either poorly represented in Africa or not generally accessible to breeding Peregrines. For example, there are no ptarmigan and grouse, few large parrots, and there are few substantial bodies of water with ducks, waders, gulls and terns. Large doves and pigeons are also relatively uncommon, and over much of Africa feral pigeons are restricted to urban areas, there being few racing pigeon fanciers. As substitutes for these groups, there are large woodland hornbills, rollers and some starlings, but few are ever sufficiently abundant to be dependable sources of food. The hunting of Peregrines, therefore, seems to be more opportunistic than in many other regions, and a general shortage of optimal-sized prey and poor feeding conditions may be a major factor limiting their numbers.

If African Peregrines are largely limited by low prey numbers, they should be restricted to areas in which they can hunt most efficiently. This might help explain their dependence on tall cliffs from which they have an advantage of seeing and stooping at prey. The elevation of a tall cliff may also be more important in woodland areas, since a low

cliff only 50 m high would provide a limited vantage point over a 10-30 m high canopy.

The association between Peregrines and woodlands might simply be that most cliffs and permanent water (see below) are in areas with high rainfall. Brown et al. (1982) suggest that woodlands have higher bird densities than open steppes and deserts, so greater availability of food might further contribute to the relative abundance of Peregrines in woodland. The suggested disappearance of Peregrines from areas cleared of woodlands (Tarboton and Allan 1984, Thomson 1984a) could be due to changes in prey populations or the use of pesticides on land cleared for cultivation.

The frequency with which Peregrines bathe, and presumably drink, is well known (Cade 1960), although few authors bother to comment on this habit. There are even two references to bathing (Hallamore 1972, Hustler 1983) in the limited literature on African Peregrines, suggesting that bathing is regular in this population as well. Much of Africa has little permanent water, and if there is a need to drink and bathe regularly, this might be a strong limiting factor. Lanners occur commonly in arid areas of southwestern Africa, and I know of no record of this species drinking or bathing. The abundance of Lanners and the absence of Peregrines in these areas could therefore be attributable to the latter's greater dependence on water. In Arizona, where the annual rainfall at Peregrine nest sites was only about 350-400 mm, Ellis (1982) found that most (35 of 48) nesting cliffs were within 5 km of a permanent stream or pond.

The absence of Peregrines from arid areas, both in Africa and elsewhere (Cade 1982), could also be related to higher temperatures in these regions. The apparent requirement for shaded nests suggests that excessive heat limits their activities. While many stick nests in trees may be unsuitable because of direct exposure to sunlight, nests in trees used by Peregrines in Australia are often well shaded (P. Olsen pers. comm.).

Conservation. — The status of the Peregrine has apparently not changed dramatically during the past 100-200 years, although some decline may have occurred as a result of pesticide poisoning (Mendelsohn et al. Chapter 43) and the clearing of woodlands. In some parts of the world, numbers have increased in response to the introduction of feral pigeons and the European Starling (White et al. 1981). In Africa, however, comparable environmental changes have been insignificant and probably have had no beneficial effect on numbers.

While populations might have been relatively stable so far, it seems likely that numbers will decline in the next few decades. Environmental degradation owing to rapid human population growth, agricultural development and the use of pesticides is inevitable. The chemicals that

caused severe declines in the northern hemisphere during the 1950s and 1960s (Newton 1979) are now being applied in Africa, probably in large quantities. Woodlands are cut down to make way for crops and for firewood. The rate of human population growth is higher than elsewhere. African Peregrines have already been bred in captivity (Hartley 1983, Thomson 1984b), so this method of preservation and perhaps the continued existence of a few pairs in the remotest areas are probably the only prospect for continued survival in the next 100 years.

32 | *The Genus* Falco *in Arabia*

Joseph B. Platt

The Peregrine Falcon is one of 40 Falconiformes recorded on the Arabian Peninsula (Table 1). This region is roughly the size of the western United States. It stretches from latitude 13°N-30°N and longitude 35°E-60°E. Within these 3.2 million km² are habitats ranging from barren deserts of dunes to 3000-m high mountain ranges covered with Mediterranean evergreen forests. Jordan and Iraq form the northern boundary while the waters of the Red Sea, Arabian Sea and Arabian Gulf delimit the remaining borders.

Knowledge about the avian community of Arabia is almost solely dependent on Europeans who have birdwatched as a hobby during their work assignments there. Thus, data are clumped around areas where expatriates are employed; the more distant wilderness settings are poorly understood. The Arabs have a heritage closely tied to the land and its wildlife, but their relationship is more as participants than as observers. Species that provide for their needs are well-known; others are of little consequence. Falcons are a significant group. Because of their usefulness as trained hunters, Arabs have learned the falcons' ways and can provide information about their migration, but virtually nothing about the raptors breeding in their midst.

The zoogeography of the Arabian Peninsula is unique in that the region is at the meeting of three zoogeographical realms — the Ethiopian, Oriental and Palearctic. Each of these contribute to the makeup of the bird populations of the Arabian avifauna. Southwest Arabia contains several peripheral breeding populations of African species: Helmeted Guineafowl, Abyssinian Roller and Dark Chanting Goshawk.

To the east, the Oriental realm finds expression in the avifauna of Oman and Musandam Peninsula. Breeding species included the Indian Silverbill, Purple Sunbird, and Indian Roller.

About 515 species of birds have been recorded on the Peninsula; perhaps 100 breed (Gallagher and Woodcock 1980, Jennings 1981a, 1981b). Similarly, of the 40 diurnal raptors recorded, only 17 are breeding species. Ten falcons occur, but little is known about either