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Living on the edge

Wetlands and birds in a changing Sahel

Leo Zwarts Rob G. Bijlsma Jan van der Kamp Eddy Wymenga

KNNV Publishing



Montagu's Harrier

Circus pygargus

Christiane Trierweiler & Ben J. Koks



To talk of Montagu's Harriers, or Monties as they are known by harrier aficionados, is to conjure up farmland, protection and volunteers; or, in the case of The Netherlands, waving cereals, flowering oilseed rape and butterfly-covered lucerne. 'Empty' quarters which are not empty at all, but the remote corners of a small country otherwise packed with human beings. The protection of nests demands unfailing dedication on the part of both farmers and volunteers. Hundreds of people have helped us over the years and are immortalised in our hall of fame, or in the names of those Monties which carry satellite transmitters (www.grauwekiekendief.nl). A special place in our hearts is reserved for Rudi Drent. After his retirement as an animal ecologist at the Centre for Ecological and Evolutionary Studies (Groningen University), he continued to supervise our Monty research. Rudi was the ideal sparring partner, keeping sight of the larger picture amidst a multitude of details, pointing out promising avenues for further research and honing the data to perfection. His death on 9 September 2008 was a shock to all of us.

Breeding areas

Montagu's Harriers have a wide but patchy distribution across Europe, extending eastwards to the Caspian lowlands, Kazakhstan and the upper Yenisey at 93°E. The latest estimate of the European population, including Russia, stands at 35 000-65 000 pairs, with stable or slightly increasing numbers in the 1990s (BirdLife International 2004a, but see below).

Wintering areas

On the Indian subcontinent, notably NW India, large roosts have been found, containing several thousand individuals (Clarke 1996a, 1998). These birds are most likely to come from the eastern breeding grounds. The latter population may also, at least partly, winter in eastern and southern Africa, given the vast migration of Montagu's Harriers observed in Georgia during early autumn 2008 (B. Verhelst unpubl.), and the average migration directions attributed to birds recovered along the Dnepr, Don and east of the Volga (Mihelsons & Haraszthy 1985). If this interpretation is correct, the Sahel from Chad/Ni-

geria eastwards and eastern and southeastern Africa are a melting pot of Montagu's Harriers breeding from Fennoscandia (10°E) eastwards to at least 55°E. Three birds ringed in spring and autumn at Dzjambul in southern Kazakhstan (45°50'N, 71°25'E) were recovered in western Asia at distances of 674, 1209 and 1594 km to the NE-NNE (Mihelsons & Haraszthy 1985); these birds may have wintered in India, probably circumventing the impressive Tien Shan mountain range on the way.

In Kenya, the species is considered to be a fairly common visitor to the grasslands and other open habitats in the highlands and in the southeast (Lewis & Pomeroy 1989). Many birds venture further south into the semi-deserts, grasslands, savannas, pans and fallow lands of Tanzania and the eastern half of southern Africa, albeit in ever lower numbers the farther south they fly (Brown *et al.* 1982, Harrison *et al.* 1997). However, the birds from Europe are confined overwhelmingly to the narrow band of the Sahel in W Africa.

Migration strategies

By 2008, after almost a century of bird ringing, the EURING files contained 46 African recoveries of Montagu's Harriers ringed in Eu-



Fig. 180 European ringing locations of Montagu's Harriers recovered in Africa (n=47) and Malta (n=2), including 15 south of the Sahara. From: EURING and García & Arroyo (1998). The Montagu's Harrier ringed as a juvenile near Lippstadt, Germany by W. Prunte on 4 July 1970, and shot in the Dassa-Zoumé district in Benin in February 1971 (indicated by the arrow), is one of several reported well south of the wintering grounds in the western Sahel. The letter reporting the bird is a fine example of the many obstacles which have to be assailed in order to get the report onto the ringing centre's desk; no wonder that many rings from birds taken in Africa are never reported. From: Vogelwarte Helgoland, Wilhemshaven.



To capture adult Montagu's Harriers, we use a stuffed Northern Goshawk and a wide-meshed mistnet positioned close to the nest. This female (Karen) was captured near Ballum in Denmark in July 2008, and turned out to have been ringed during migration as a first calendar-year in the Czech Republic in 2000. Interestingly, two of our satellite-tracked females travelled from western Europe via the Czech Republic during their outward migration (Fig. 181).

rope (Fig. 180). The picture emerging from these recoveries is one of migratory connectivity: birds from The Netherlands, Britain, France and Spain mostly ended up in the western part of the Sahel, birds from northern Germany and Sweden converged in the central Sahel. Notable exceptions occur, however, showing that birds from western Europe may find their way to the central Sahel (Fig. 180).

From the information derived from satellite telemetry, radar studies and visual observations in the Central Mediterranean, our

Our Monty activities encompassed Europe from The Netherlands in the west to Belarus in the east. Raptorophiles, like Dmitri Vintchevski (holding bird leaflet and translating information from the farmer's couple in western Belarus), have been very helpful in directing us to habitats of Montagu's Harriers in their countries.

perception of the migration of Montagu's Harriers has changed substantially from that provided by the ring recovery analysis by García & Arroyo (1998).

Autumn Pre-migratory movements, following brood failure or shortly after the chicks have fledged, may occupy up to 73 days before

Ringed nestling Montagu's Harriers in western Europe is usually a social event, involving the farmer and his family (here proudly holding 'their' chicks), local birdwatchers and coordinators (represented by Lars Maltha Rasmussen of the Dansk Ornitologisk Forening) and 'Monties' (represented by Ben Koks and Aletta Buiskool from The Netherlands). This nest on arable land near Skærbæk in Denmark held five chicks, an above-average number. (July 2008).



This second calendar-year male Montagu's Harrier, photographed near Khelcom, Senegal, on 3 February 2008 (left), and again on the same spot on 28 January 2009 (right), was ringed and wing-tagged as a nestling near Deux-Sèvres, in western France, in 2007. The bird was one of the 1524 nestlings tagged in France in 2007, as part of a large European effort to improve our knowledge of dispersal and migration (www.busards.com).

fore true migration commences (own data, Limiñana *et al.* 2008). During pre-migratory movements, unless blocked by large stretches of open water, Spanish birds dispersed on random headings, short-hopping between sites that abound in food. They may also frequent

Catching Montagu's Harriers is but one activity, releasing them safely after taking measurements and fitting them with ring(s), tags or transmitter is the next step in a cascade of events related to the life of an individual bird, as illustrated by this colour-ringed adult male released by Assia Kraan, a volunteer from The Netherlands. Tagging and colour-ringing are used in the hope of increasing the number of sightings, something much more desirable than simply hoping for a recovery (which is usually synonymous with a dead bird). This beauty of a male was ringed near Cuxhaven, Germany (July 2008).



conspecifics' breeding haunts up to 500-1100 km away (Trierweiler *et al.* 2007a, Limiñana *et al.* 2008). The latter behaviour may function as prospecting for next year's choice of breeding site, it may be due to wind drift or it may simply involve a brief return to the natal site.

In general, autumn migration follows broad parallel bands in an arc between SW and S. Despite some overlap, western birds winter on average in western Africa and eastern birds do so further east (Fig. 181; Limiñana *et al.* 2007). The previous idea that in order to cross the Mediterranean Sea, Montagu's Harriers converge at suitable short sea crossings, such as the Strait of Gibraltar, the numerous central Mediterranean islands, or the Near East (García & Arroyo 1998), is not substantiated by the course of satellite-tracked birds, nor is it apparent from radar studies in southern Spain (Meyer *et al.* 2003) and visual observations in the central Mediterranean (Panuccio *et al.* 2005). Radar observations from the southern coast of Spain, 25 km east of Malaga in autumn 1996, showed that 74% of the Montagu's Harriers continued their southbound flight without hesitation upon reaching the coastline. The Mediterranean Sea here is only 150 km wide, which in autumn would take about 4 hours to cross at an average ground speed of 11.6 m per second, or 42 km/h (Meyer *et al.* 2003). The extremely low wing loading of 2.05 (body mass in kg/wing area in m² = 0.300/0.1463), the lowest recorded among the 36 raptor species so far measured (Bruderer & Boldt 2001), and the high aspect ratio of the slender wings allow Montagu's Harriers to alternate between soaring, gliding and flapping-and-gliding flight and to migrate in less than favourable thermal and wind conditions (Spaar & Bruderer 1997). That Montagu's Harriers are able to make long sea crossings is proved from our satellite-tracked birds (see Fig 181, birds crossing the Gulf of



Biscay and the eastern Mediterranean near Greece and Crete). During autumn migration, the average daily distance covered by our satellite-tracked birds was 153 km, a very similar distance

to those of other long-distance raptor migrants. ¹ One of our males made a nonstop flight from The Netherlands to northern Spain in 2006, showing that nocturnal flights are possible. Montagu's Harri-

It is 5 May 2009. Female Cathryn has returned to her breeding grounds near Nieuw Scheemda in the northern Netherlands. She is some bird. First captured in 2004, when her nest failed during a spell of inclement weather, she was outfitted with a transmitter in 2006 when at least in her fifth calendar year. Since then, we have been able to closely track her whereabouts. In 2006 and 2008, it took her only 20 respectively 25 days to reach the wintering grounds, about twice as fast as the average Montagu's Harrier. In 2006-2008, she started her return migration like clockwork, *i.e.* around 19 March. Her site fidelity is also outstanding, both in Senegal and The Netherlands. Her consecutive breeding sites since 2006 were 0 km, 2.3 km and 3.5 km apart. In Senegal, she frequents the vicinity of M'bour, the mega-roost of Montagu's Harriers, which was located by tracking down the positions obtained via Cathryn's satellite transmitter. The year 2009 will prove to be a challenge: she picked a winter wheat field as her breeding site, again close to Nieuw Scheemda. However, Common Vole numbers are in a trough, and her breeding success will depend on the bird-hunting skills of her partner.

ers presumably speed up when crossing the Sahara; an adult female tracked in 2005 averaged 623 km in a day when crossing the Sahara (Trierweiler *et al.* 2007a). The satellite-tracked Spanish Montagu's Harriers apparently followed a different strategy, as their daily speed dropped considerably after the first stage of desert crossing in Morocco (more than 450 km in a day). These birds took up to two weeks to complete the remaining 1000-1500 km to the wintering grounds, with average daily distances ranging between 93 and 219 km; they

did not fly at night (Limiñana *et al.* 2007). This strategy would imply feeding along the way, but how this could be accomplished in the Sahara is difficult to envisage.

Spring So far, most satellite-tracks have shown clearly that eastern European birds winter to the east of western European birds, with some overlap in Mali and Niger, and little movement along the length of the Sahel during the northern winter, with the possible

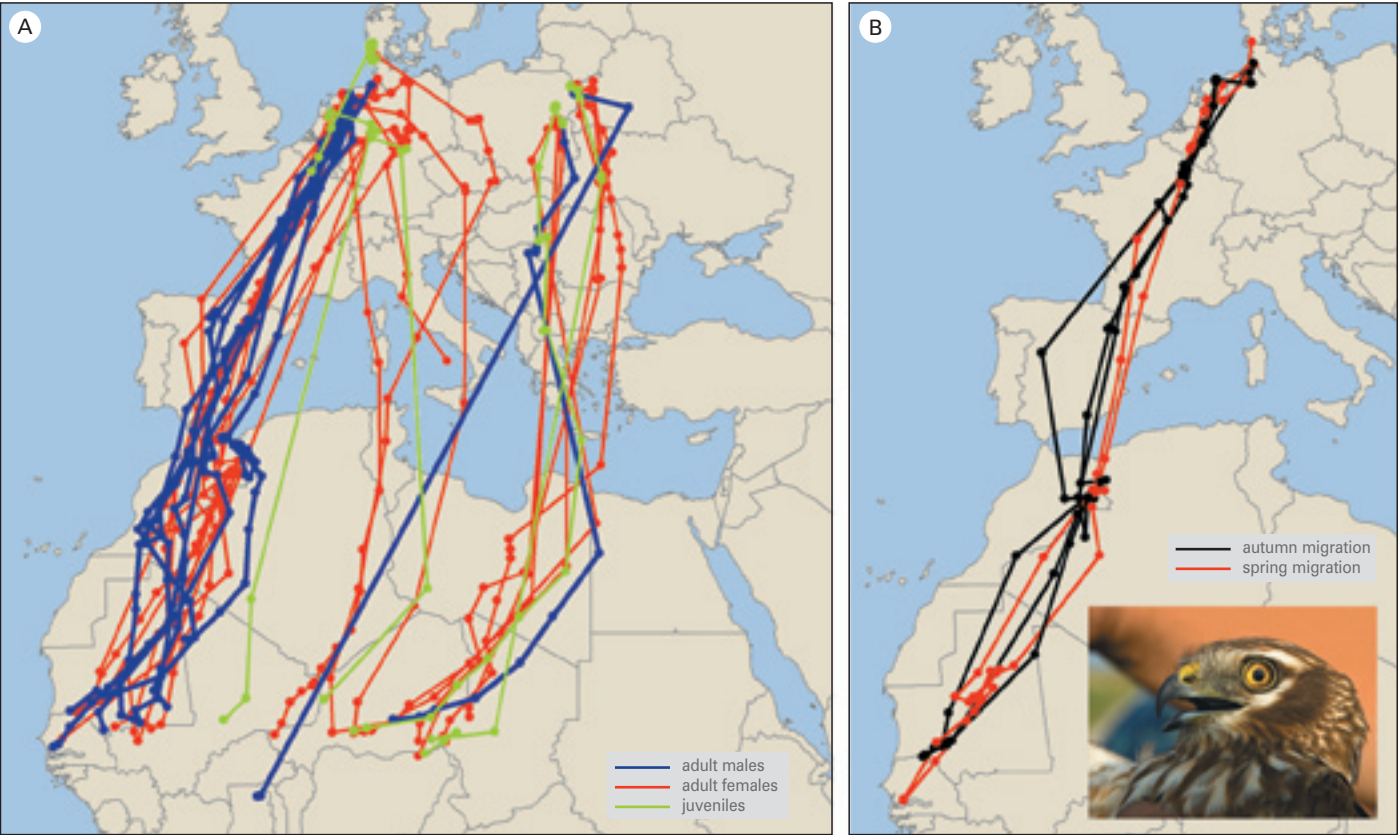


Fig. 181 (A) Representation of 34 flight paths of 25 satellite-tracked Montagu's Harriers during autumn migration in 2005-2008, showing birds from The Netherlands (10), Germany (5), Denmark (2), Poland (4) and Belarus (5); from Dutch Montagu's Harrier Foundation, Vogelwarte Helgoland, University of Groningen and Deutsche Bundesstiftung Umwelt. (B) Successive migratory routes in autumn 2006-2008 and spring 2007-2008, based on satellite telemetry of Merel, a female Montagu's Harrier named after 11-year old Merel Schothorst, our youngest Monty helper in The Netherlands. Lines represent the shortest distances between successive recorded positions (small dots) and not necessarily the actual route (Trierweiler *et al.* 2007a, 2008).

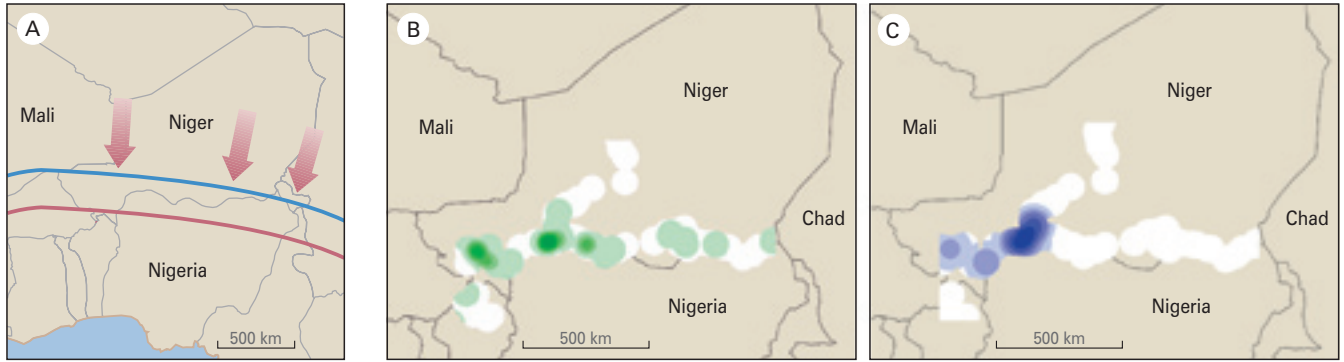


Fig. 182 (A) Schematic representation of winter movements of Montagu's Harriers in the central Sahel. Arrows show the incoming routes of Montagu's Harriers in autumn (based on satellite telemetry). The blue line represents the latitude with the highest concentrations during the early dry season (October-December), and the red line the southward shift in conjunction with the advancing dry season (mostly in January-March), based on data from satellite telemetry and field observations. Adapted from: Trierweiler *et al.* 2008. (B) Relative abundance of grasshoppers in prey transects and (C) of Montagu's Harriers on road transects in southern Niger and northern Benin in January-February 2007, represented as kernel densities; high colour tones reflect high densities (Trierweiler *et al.* 2007b).



A line transect in the magnificent landscape near Hombori, Mali, produced five Montagu’s Harriers in second calendar-year plumage, 1 Pallid Harrier and some 100 Fox Kestrels in January 2008. This combination of avian predators is a clear indication that grasshoppers abound in the area.

exception of birds in the central Sahel (see below). Once settled in the Sahel, many birds remain there or reasonably close nearby (a

The satellite transmitter of Montagu’s Harrier ‘Franz’, tagged in The Netherlands, produced such detailed coordinates that this roost near Mopti, Mali, could be located in January 2008; a careful survey yielded some 70 pellets.



few hundred km) for the rest of the winter. Eurasian Marsh Harriers were found to perform a small clockwise circular loop movement in West Africa, notably so between the latitudes of 20°N and 35°N, with the loop narrowing going northwards until it intercepted the autumn route in northern Spain (Klaassen *et al.* 2008b). In West Africa, the widest separation between autumn and spring routes was at 20°N, amounting to slightly more than 400 km. None of the Swedish Marsh Harriers showed any inclination to make the spring crossing of the Mediterranean in the central section (Cap Bon-Sicily), which accords with the spring migration of Eurasian Marsh Harriers which have wintered in West Africa following a more westerly flyway than in autumn (Klaassen *et al.* 2008b). So far, our NW-European Montagu’s Harriers also refrained from using the central Mediterranean corridor on their return migration (www.grauwekiekendief.nl). Instead they retraced their outward route, except in West Africa, where they drifted slightly to the east or west of the autumn track. In spring 2008, eastern European birds, having wintered in the central Sahel, performed a clockwise loop which took them to the central Mediterranean on return migration. This loop was unrelated to locust movements; the Montagu’s Harriers had been more or less sedentary in their wintering quarters where they fed mostly on resident grasshoppers (migratory locusts are prominent in the diet only during



Melanistic male (left, March 2008) and a bird with a Spanish ring (right, January 2009) near temporary pool at Khelcom, Senegal. Among the 1000 or so Montagu’s Harriers on the roost near Dara (Khelcom), 30 melanistic birds were present.

outbreaks; see below). Furthermore, any significant movement associated with grasshopper supply occurred along a north-south axis (as displayed by satellite-tracked Montagu’s Harriers; Trierweiler *et al.* 2008), following the retreating Intertropical Convergence Zone (ITCZ). Whether a clockwise loop migration is consistent across years has yet to be proven. The suggestion by Klaassen *et al.* (2008b) that the clockwise loop migration of Eurasian Marsh Harriers in West Africa is influenced by the wind patterns in spring (predominantly from eastern sectors, and stronger in spring than in autumn; see also Chapter 42), may also hold for Montagu’s Harriers (but see tracks of female ‘Merel’ at Fig. 181). In the central Mediterranean, visible migration of Montagu’s Harriers in spring is more conspicuous than in autumn (unlike at Gibraltar, where migration intensity in both periods is about the same; Tables 3 & 4 in Finlayson 1992), but counts here are very small in comparison to the total volume of Montagu’s Harrier migration (Panuccio *et al.* 2005). If this seasonal pattern indeed exists in the central Mediterranean, it must then involve Montagu’s Harriers from northern and – especially – eastern Europe, which enter Africa via the eastern and central Mediterranean and return via a clockwise loop in spring. Indeed, five birds ringed at Cap Bon, Tunisia, in spring, were recovered in Hungary, Bulgaria (2), Ukraine and the Voronezh region (SW Russia), having taken directions between NNE and ENE (recovered in the same year, or up to six years later; Mihelons & Haraszthy 1985).

Fidelity to wintering sites

During the northern winter, many European Montagu’s Harriers, presumably the majority, are confined to the Sahel and northern

Sudan zone (Fig. 181), but until recently next to nothing was known about their temporal distribution and movements within the wintering quarters. The predominance of insects in Montagu’s Harrier diets would suggest a dynamic distribution related not only to outbreaks of locusts and grasshoppers but also to seasonality and movements of local grasshopper species triggered by the cyclic position of the ITCZ (see Chapter 2). In other words, birds may be forced to exploit different sections of the Sahel and northern Sudan zone each year and to perform seasonal movements within years (as suggested by Thiollay 1978c).

Between-year movements Three tagged birds, which were followed for three consecutive seasons, returned to the same spots in Mali and Senegal (see Fig. 181 for an adult female). This sample is, of course, too small to conclude that fidelity to the wintering site is the norm for this species in Africa. On the population level, the high migratory connectivity demonstrated by ring recoveries and satellite telemetry of birds from western Europe strongly indicates the fidelity of Montagu’s Harriers to restricted parts of the Sahelian and adjoining Sudan zones (García & Arroyo 1998, our data). A similar conclusion was derived from the ringing data of Eurasian Marsh Harriers (Chapter 25), a species for which satellite telemetry hinted at a stronger site fidelity to stopover and wintering areas than to breeding grounds (Strandberg *et al.* 2008a).

Within-year movements The first results from our tagged birds indicate that upon arrival at the wintering quarters the birds remain for several weeks or months within a few km of the places where they first settle. A gradual southward shift begins as the dry season progresses, over some 200-250 km, a distance that bears testimony



Montagu's Harriers may form pre-roost gatherings on the ground, from which the birds depart collectively when the time has come to approach the actual roost site. (Fatick, Senegal, February 2008).

to several factors: the narrowness of the Sahel belt, the increasingly desiccating conditions in the Sahel that start in September and end with the first rains in May, and the change in abundance of birds and grasshoppers in conjunction with the southward shifting 'green belt' (Fig. 182A, see also Chapter 14, Jones 1999). This process would explain the Montagu's Harriers' movements into the adjacent Sudan vegetation zone.

Habitat use ²

Montagu's Harriers in Africa are essentially birds of dry ground that is sparsely covered by trees. During road transect surveys in West Africa from 1967 to 1973, Thiollay (1977) found clear latitudinal gradients for the presence and density of Montagu's Harriers. Examples from his data are: absence of the species in the forested regions around 6°N in the Ivory Coast; near-absence in the well-wooded Guinean zone (0.02 birds/100 km); low densities in the wooded savanna of the Sudan zone (between 9.30°N and 14.30°N: 0.72-1.17 birds/100 km); the highest densities in the Sahel (which included the inundation zones of the Niger and Senegal: 0.79-3.11 birds/100 km; dry savanna is preferred over wet floodplains – see Chapter 25 for niche differentiation between harriers in the Inner Niger Delta); and, lastly, densities rapidly declined to zero in the northern Sahel close to the Sahara (near 20°N).

Within the Sahel, densities showed large variations, supposedly in relation to prey abundance (Orthoptera) and habitat. Our road counts in Niger in 2006-2007 revealed that large stretches of land were devoid of Montagu's Harriers; line transects often failed to come up with any grasshoppers there. Montagu's Harriers were most com-

monly encountered where grasshoppers were abundant (Fig. 182c).

In Niger, Mali and Senegal, Montagu's Harriers avoided severely degraded habitats (few remaining trees or shrubs and overgrazed), and regions with high tree cover, but favoured slightly degraded shrubland and cropland. The latter habitats, often having retained elements of more natural habitats, had the highest bird and grasshopper densities, a finding in concurrence with bird densities in northern Nigeria (Hulme 2007). In Niger, tiger bush is an important natural habitat for Montagu's Harriers, but such a patterned vegetation community, with alternating bands of trees and shrubs separated by bare ground or low herb cover (resembling the stripes on a tiger), is rapidly giving way to cultivation. The widespread replace-

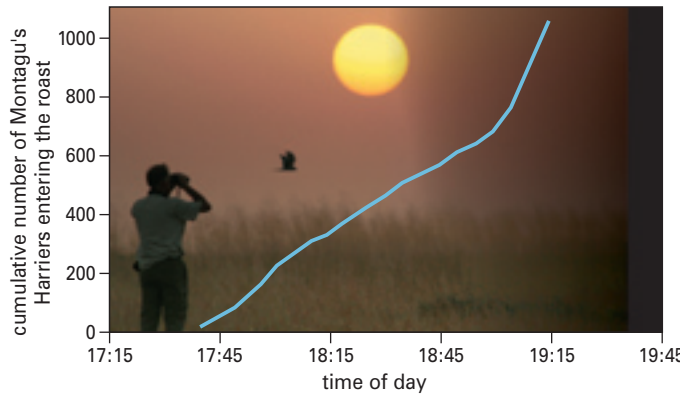


Fig. 183 Cumulative number of Montagu's Harriers entering the roost near Darou Khoudouss, Senegal, on 3 February 2008 until 19:14 (local time); sunset by 18:32, civil twilight by 18:56, nautical twilight by 19:23.

ment of natural habitats by a mixture of degraded natural habitats (fewer trees, more scrubland, and low herb layer) and cultivated land (with some shrubs and trees) may have favoured Montagu's Harriers. However, such a modified landscape is not a steady state. Ongoing cultivation and human population pressure result in severe and irreversible degradation. Tree and shrub loss and impoverished bird and insect life are in evidence over much of the Sahel nowadays, a circumstance that has negatively influenced almost the entire raptor community in Mali, Niger and Burkina Faso, with Montagu's Harriers particularly affected (Thiollay 2006a, 2006c).

Roosts as treasure-troves ^{3, 4}

Daytime roosts During the hottest part of the day, many Montagu's Harriers retreat into the shade of trees or shrubs, either singly or in small flocks. One such roost we accidentally encountered in January 2007 near Birni N'Konni in Niger. Around 14:00, we spotted twelve Montagu's Harriers, each in a different shrub without undergrowth, on the slope leading to a plateau. Underneath some shrubs, we found pellets and faeces, but in such small numbers that we suspected the site was used only during daylight. In February 2008, another typical daytime roost was found near Kaolack in Senegal, close to a salt lake. The day had been very hot, and we were desperately in search of some shade. Our bias towards shade-bringing bushes revealed an adult female Montagu's Harrier standing on bare ground in a small patch of shade beneath a shrub. This site produced some 20 prey remains of the grasshopper *Ornithacris cavroisi* and also some freshly-plucked Yellow Wagtail feathers. Because the only raptor species we observed here were Montagu's Harriers, we feel it safe to assume that the prey remains had indeed been left by this raptor.

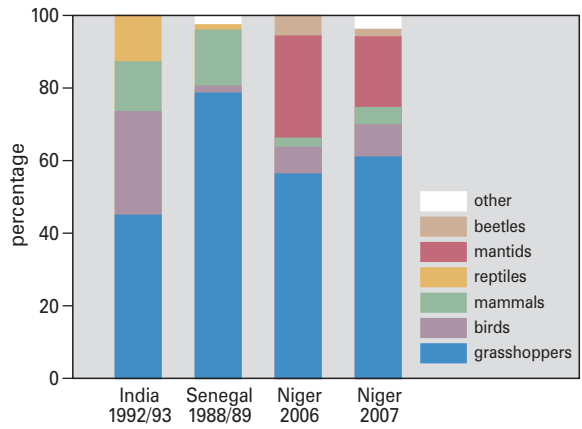


Fig. 184 Frequency distribution of prey categories in pellets of Montagu's Harriers in Gujarat, NW India (n=134 pellets; Clarke 1993), in Senegal (n=113; Cormier & Baillon 1991), and in Niger (n=41 in 2006, n=28 in 2007; Koks *et al.* 2006, Trierweiler *et al.* 2007b).

Night roosts The conventional way to find roosts is to watch for Montagu's Harriers flying in steady, straight lines before sunrise or just after sunset (Fig. 183). Usually, more than one bird will display this 'atypical' flight behaviour, not at all representative of that of foraging birds. The latter adopt a more roaming flight mode, meandering in low quartering searches across the terrain, switching direction and stalling frequently. Roost flights head clearly to or from a particular spot. However, to find the roosts one needs a number of well-spaced observers, preferably in contact with each other (walkie-talkie), to plot the general directions of the roost flight. Roosts can then be located either by triangulation of the extrapolated flight paths or by following the birds. This approach to finding roosts is most likely to be successful when roosts are large (the more harriers observed, the greater the chances of encountering roost flights).

By tracking our transmitter-carrying Montagu's Harriers, using the most up-to-date positions received each day, we were able to locate roosts in a completely different way that often pointed us towards areas which we would not otherwise have visited, because the logistic problems would have seemed too daunting. Furthermore, from the telemetry we detected that some birds, like an adult Polish female residing east of Niamey, Niger, daily switched between roost sites, some of which we managed to reach; at one such site we found the remains of a freshly-eaten grasshopper *O. cavroisi*. A tagged juvenile female, from The Netherlands, led us to find, near Niamey, a 700 ha plateau containing a roost of 2 or 3 Montagu's Harriers. A particularly spectacular discovery near Mopti, Mali, was a roost containing some 30 Montagu's and 5 Eurasian Marsh Harriers in a well-wooded agricultural area dominated by tall grasses, not exactly the type of habitat where we would have expected to find Montagu's Harriers. At some telemetry-indicated locations, we found pellets before we had actually seen a single Harrier, but on 24 January 2008,



The relatively small grasshopper *Acorypha clara* was the main prey of Montagu's Harriers, Cattle Egrets, Lesser Kestrels, Wheatears and Woodchat Shrikes in central Senegal in February 2008.



The presence of predators, like Golden Jackals *Canis aureus*, may be one of the reasons why harriers prefer to roost in tall grasses (as found for Eurasian Marsh Harriers in India; Verma & Prakash 2007), or – when resting or drinking during daytime like this male Montagu's Harrier – prefer an unobstructed view. (Khelcom, Senegal, March 2008).

between 18:50 and 19:40, we recorded Montagu's Harriers heading inwards from every direction. Around 19:30, 'Franz', a seventh calendar-year male, came into view, the satellite transmitter clearly visible on his back. To watch this Dutch bird, whose nest in a field of lucerne we had successfully protected in the preceding summer, in a Malinese setting, made us feel we had received an accolade for our fieldwork. As a bonus, at this site we were able to collect 70 pellets, whose contents of small mammals and reptiles, passerine eggs and a few small grasshoppers were not that different from the average pellets in an average year in NW-Europe.

Satellite-generated data revealed the positions of three roosts in Senegal; two contained 'only' 100-200 birds, but the third was enormous in comparison. The existence of this mega-roost was first detected by Wim Mullié in the evening of 25 November 2006. Although its exact location remained hidden, 500-1000 birds were observed near Darou Khoudoss, just before sunset, flying to a roost. The surroundings of this site were revisited in the evening of 2 February 2008, when a pre-roost gathering of 90 birds on bare farmland was noted. Although the light was failing quickly, the actual roost was conservatively estimated as holding about 1000 birds. Between 17:40 and 19:10 on the next day we counted more than 1000 birds

(Fig. 183). At 19:14 it was almost dark, but, as luck would have it, all the birds began to mill around again just before darkness prevented any further observations; at this time we noted 300 more birds on the side of a hill not yet surveyed. Our totals came to 1300 Montagu's Harriers and a few Marsh Harriers; perhaps 1500 birds might have been present. We could not be any more precise, because birds were still entering the roost moments before complete darkness descended and we had to leave the area for security reasons.

Until recently, in Africa, the largest roosts mentioned have not usually exceeded 70-160 birds for Senegal (Arroyo & King 1995, Rodwell *et al.* 1996) and well over 200 birds for Kenya (predominantly Montagu's Harriers; Meinertzhagen 1956). An apparent exception was the count on 8 February 1989 recorded for a roost in the area of M'Bour and Joal (delta of Sine Saloum, Senegal) of 800-1000 Montagu's Harriers; this large number was associated with an outbreak of Desert Locusts *Schistocerca gregaria* (Cormier & Baillon 1991). In February 2008, Montagu's Harriers on the Darou Khoudouss roost profited from an abundant supply of the medium-sized *Acorypha clara* (highest densities of 3-5 individuals/m²); pellets contained this grasshopper species almost exclusively; in March, the larger *O. cravoisi* became the predominant item in the diet of Montagu's Harriers (Fig. 123; Chapter 14).

Since at least the mid-1980s in the Indian subcontinent, even larger roosts of Montagu's Harriers have been recorded by Clarke (1996), who found up to 2000 birds in Bhavnagar District in NW India. This roost was estimated as holding some 3000 harriers on 6 December 1997; 15-25% comprised Pallid Harriers and a few Eurasian Marsh Harriers, but the great majority were Montagu's Harriers (Clarke *et al.* 1998).

The role of resident grasshoppers

Both the general literature and the few real data collected in the field suggest that the locusts *Locusta migratoria* and *Schistocerca gregaria* are of crucial importance as food for acridivorous birds, including Montagu's Harriers (Brown 1970, Thiollay 1978c, Cormier & Baillon 1991, see also Chapter 14). These locust species are certainly abundant in some years at some sites, but the available evidence clearly shows that resident grasshopper species are of far greater importance to Montagu's Harriers, especially because their cumulative availability, usually in high numbers, is more stable within seasons and across years, thus representing a reliable food source for acridivorous species. The infrequent outbreaks of migratory locusts provide a stark contrast in annual availability, for, characteristically, locusts remain in very low numbers or are absent during the extensive periods of recession or remission. Furthermore, the frequency of such outbreaks has been much reduced since 1965 (Fig. 114), often occurring outside the window of presence of Palearctic migrants. Indeed the highest frequency of *S. gregaria* in the Sahel occurs from July until December; Chapter 14).

In Niger, both in 2006 and 2007, the most frequently consumed prey were Orthoptera, mostly comprising the resident grasshopper species *O. cavroisi*, but, surprisingly, mantids did form a large share of prey numbers (Fig. 184). Birds and mammals were insignificant in terms of numbers, but, individually weighing much more than a single grasshopper, were obviously more important in terms of biomass. A high frequency of *O. cavroisi* in Montagu's Harrier pellets was also recorded in 2008 (Niger, Senegal; analyses not yet fully completed), attesting to the importance of medium-sized (3-7 cm) and large (>7 cm) resident grasshopper species for Montagu's Harriers (and other acridivorous bird species, such as White Storks; Brouwer *et al.* 2003).

Montagu's Harriers wintering in the central and western Sahel have proved to be quite versatile in their choice of prey. In February 2008, for example, we found large differences in prey choice between regions, presumably reflecting local variations in food supply. Pellets collected in Niger, Mali and Senegal contained small insects (termites, beetles), small, medium-sized and large Orthoptera, rodents, passerines, eggs and reptiles (see also Fig. 123).

Our data suggest an interpretation that is a far cry from the notion of a diet predominated by locusts. Just as in NW India (Fig. 184), the Montagu's Harriers in the Sahel make do with whatever

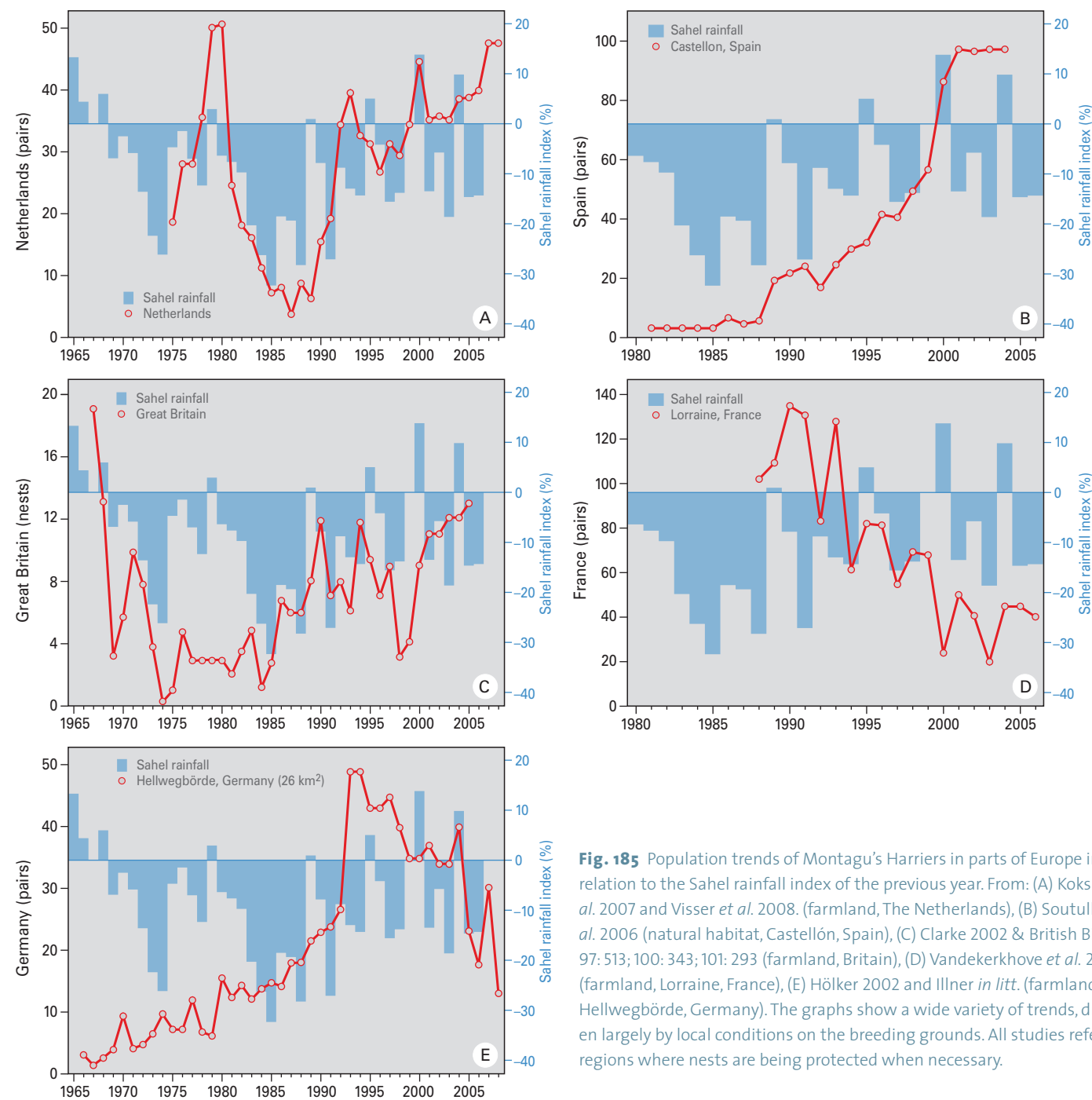
is available.⁵ On the breeding grounds in Europe, Montagu's Harriers also forage on an assortment of prey species, predominantly passerines in Britain (Clarke 2002), voles and passerines in The Netherlands (Koks *et al.* 2007) and France (Millon *et al.* 2002) and birds and insects in Spain (Sánchez-Zapata & Calvo 1998). However, between-year differences are substantial, in Europe as well as in Africa. The predominance of locusts in the diet of Montagu's Harriers in Senegal in 1988/1989 perhaps reflected a dietary exception rather than the rule; even then, despite the abundance of locusts in the outbreak that year, rodents remained an important food source (Fig. 184). Clearly, the story of the importance of locusts to acridivorous bird species in Africa needs revising to account for the dietary prominence of resident grasshopper species (see also Chapter 14, for an elaboration on this issue) and alternative prey.

Population change

Wintering conditions That Montagu's Harriers wintering in the Sahel have been in decline is shown by a comparison of road counts in Mali, Burkina Faso and Niger in 1969-1973 and 2003-2004 (down by 74% for unprotected areas and National Parks combined; Thiollay 2006a). The same effect had earlier been suggested for East Africa: "I have little doubt that some disaster has stricken the population that used to come to East Africa", wrote Leslie Brown (1970). Some support for that view for southern Africa may also be gleaned from observations in the Transvaal's Nyl River floodplain, where Tarboton & Allan (1984) recorded eight birds in 1959-1970, but none in 1975-1981. The information collated by Clarke (1996b) seems to suggest that – at least in East Africa – numbers since then may have recovered to some extent. However, according to Simon Thomsett (in litt.): "Brown's large roosts are no more." In southern Africa, the species is now relatively rare throughout the region except in Botswana, where it is fairly common in the north (Harrison *et al.* 1997).

How numerous Montagu's Harriers may once have been in East Africa, is apparent from the casual observations of Meinertzhagen (1956) in Kenya. ⁶ On 17 January 1956, he recorded 17 harriers (predominantly Montagu's) during a motor journey of 200 miles between Isiolo and Marsabit (5.3 birds/100 km), and another 11 individuals in February on another 140-mile motor journey in the Rift Valley (4.9/ birds/100 km). In the Sahel, such densities have rarely been encountered, and, if so, only in the very best habitats and many decades ago (Thiollay 1977). Our own road counts, for example, in southern Niger in January and February 2006 and 2007, yielded provisional densities of 0.43 (4172 km) and 0.52 birds/100 km (4950 km) respectively. The road counts by Thiollay (2006a) in the western Sahel in 2003-2004 produced between 0.7 and 0.9 Montagu's Harriers per 100 km.

The trends of European populations wintering in the western Sahel fluctuate independently of rainfall in the Sahel (Fig. 185), the variable affecting green vegetation and therefore the food supply



of Montagu's Harriers. The trends of the Dutch Montagu's Harriers suggest an effect of rainfall in the Sahel on numbers, but this is an artefact of conditions on the breeding grounds (see below). Also, we were unable to replicate the significant positive correlation between the number of Montagu's Harrier nests found in Britain and the West African rainfall anomaly (Clarke 2002), using a longer time series and the relative change in breeding numbers from one year to

Fig. 185 Population trends of Montagu's Harriers in parts of Europe in relation to the Sahel rainfall index of the previous year. From: (A) Koks *et al.* 2007 and Visser *et al.* 2008. (farmland, The Netherlands), (B) Soutullo *et al.* 2006 (natural habitat, Castellón, Spain), (C) Clarke 2002 & British Birds 97: 513; 100: 343; 101: 293 (farmland, Britain), (D) Vandekerckhove *et al.* 2007 (farmland, Lorraine, France), (E) Hölker 2002 and Illner *in litt.* (farmland, Heliwegbörde, Germany). The graphs show a wide variety of trends, driven largely by local conditions on the breeding grounds. All studies refer to regions where nests are being protected when necessary.

the next. Despite large-scale habitat degradation in the Sahel (Thiollay 2006a, 2007) and elsewhere in Africa (Fishpool & Evans 2001), we have little evidence that the ups and downs in Europe are, as yet, triggered by such events. This may change with ongoing habitat loss.

Breeding conditions Montagu's Harriers are among the best-studied raptor species in Europe. Many of these studies started only in the



A male Montagu's Harrier quartering the windswept farmland of Groningen in the northern Netherlands, with the village of Noordbroek in the background (5 May 2009). In past years, our radio-tagged birds have shown that hunting is far from random, the birds showing a preference for set-aside and recently mowed fields where voles are more abundant and visible than in the surrounding farmland.

1970s or even later (examples in Fig. 186). Statements based on short-term trends (such as an increase in 1970-1990; BirdLife International 2004a, see Box 27 in Chapter 44) can be quite misleading when not viewed against the backdrop of historical data. In The Netherlands, for example, the population was estimated at 500-1000 pairs in the first half of the 20th century, but this had declined to a handful of pairs by the late 1980s (Bijlsma 1993); the subsequent increase to more than 40 pairs in the 2000s is a reminder that this recovery – heartening in itself – still represents only a small fraction of a once large population. The all-time dip in the Dutch population accidentally coincided with the Great Drought in the Sahel (1980s). A closer look at the data, however, reveals that the trends in The Netherlands are driven by local conditions. For example, the embankment of Zuidelijk Flevoland in 1968 created good breeding habitat and high food abundance, resulting in peak numbers around 1980, but the cultivation of that area in subsequent years caused loss of habitat, with a consequent steep decline of Montagu's Harriers to near-extinction in the early 1990s. However, a sudden upsurge in numbers came after fallow land had been introduced as a measure to counter overproduction in agriculture (part of the European Common Agricultural Policy; Pain & Pienkowski 1997). The ensuing increase in The Netherlands was actively assisted by nest protection and agri-environmental schemes in farmland (Koks & Visser 2002, Trierweiler *et al.* 2008).

In many regions in Europe, natural breeding habitats have disap-

peared, forcing Montagu's Harriers into farmland where, because of their late laying date, the onset of the cereal and lucerne harvests threaten nest survival (Corbacho *et al.* 1999). Nest protection is imperative to prevent large-scale nest failure, particularly so in western Europe, where the timing of the cereal harvest has much advanced, *e.g.* by about two weeks in Lorraine, France, between 1988 and 2006 (Vandekerckhove *et al.* 2007) and by a month in The Netherlands between 1968 and 2008 (Bijlsma 2006c, unpubl.). Without nest protection in farmland, reproductive output cannot sustain existing population levels in farmland populations (Koks & Visser 2002, Millon *et al.* 2002, Vandekerckhove *et al.* 2007). On average, 60% of the farmland nests would be destroyed in the absence of nest protection; typical estimates range from 41% to 98% in 14 regions in France, Portugal and Spain (Arroyo *et al.* 2002, Millon *et al.* 2002).

The human effort involved in nest protection throughout Europe is enormous. In France, for example, 40-50 groups in 60 districts have been active in nest protection each year; the combined effort safeguarded 11 000 nests from destruction, enabling 22 000 nestlings to fledge in 1976-2001 (Pacteau 2003). This massive involvement is estimated to cover between 7.5% and 17% of the French Montagu's Harrier population annually, but is apparently insufficient to stop the negative population trend in much of France (Pacteau 2003, Thiollay & Bretagnolle 2004).

Even in the tiny Dutch farmland population (16-48 pairs in 1990-

2008), whose nests are protected each year when necessary, nest protection and habitat improvement only just sustain a more or less stable population (Koks & Visser 2002). Colour-ringing has shown some exchange between breeding clusters in The Netherlands and northern and eastern Germany (Visser *et al.* 2008). Pre-migratory dispersal may be one of the mechanisms by which potential breeding habitats over a wide vicinity are being explored and tested (Limiñana *et al.* 2007, Trierweiler *et al.* 2007a). Food abundance, in particular of Common Voles *Microtus arvalis* (in Britain: Field Vole *M. agrestis*) and small passerines, may then serve as the trigger for settlement (Salamolard *et al.* 2000, Arroyo *et al.* 2007, Koks *et al.* 2007). The scarcity of formerly common prey species in Europe’s industrialised farmland strains the already precarious status of European Montagu’s Harriers. Nest protection should therefore be merged with improvement of harrier habitat in farmland (Millon *et al.* 2002, Koks *et al.* 2007), in addition to the preservation of natural breeding habitats, where reproductive output is – at least in Spain - better than in farmland (Limiñana *et al.* 2006).

Conclusion

The increase of Montagu’s Harriers recorded in Europe between 1970 and 1990 represents only a small recovery from losses incurred earlier in the 20th century. Destruction of natural breeding habitats, and a subsequent shift to breeding in farmland, has had an overriding influence on the fortunes of this species in the 20th century. Harvesting often prevents pairs breeding in cropland from successfully raising chicks, unless nests are being protected. Modern farming has also had a devastating impact on prey abundance (notably voles and passerines). Without habitat improvement, nest protection in farmland cannot reverse negative trends.

Montagu’s Harriers winter mostly in the Sahel, where the east-west distribution largely mirrors the longitudinal distribution of the breeding grounds. During that period they may be forced southwards by the desiccating conditions of the Sahel into the southern Sahel or northern Sudan zone. Their main food comprises many resident grasshopper species (with different phenologies and occurring in local outbreaks), which remain a reliable food source throughout the dry season, a diet complemented by passerines, mantids and small mammals; outbreaks of migratory locusts are but a rare dry-season opportunistic food source. Large harrier assemblages may occur wherever small mammals, resident grasshoppers or locusts abound. The present habitat degradation in the Sahel is likely to increase in extent, but for the time being may favour resident grasshopper species and hence Montagu’s Harriers. The impact of Sahel rainfall and habitat degradation on Montagu’s Harriers is overridden by the much greater land changes which have occurred in Europe in the 20th century.

Endnotes

- 1 Many medium-sized and large raptor species have now been tracked by satellite, providing information on migration speeds relative to sex, age and season (see table). On average, birds attain higher speeds during the return migration (but see Swainson’s Hawk below), adults move faster than juveniles and immatures, and speeds over deserts are higher than over more hospitable land (European Honey Buzzard, Short-toed Eagle, Eurasian Marsh Harrier). Body weight is expressed in grammes (averaged for male and female; Dunning 1993). Distance relates to the one-way distance between breeding and wintering grounds in km (based on tracked birds), origin to the breeding site. Daily migration distances (in km) are given for the entire southbound or northbound migration period (including stopovers), with number of tracked birds in brackets. Notice that Wahlberg’s Eagle is the only species which was tagged in the southern hemisphere, and for which the outward migration is to the north.
- 2 Inspired by the work of Jean-Marc Thiollay in West Africa, we adopted the method of road transects to detect spatial and temporal variations in abundance of Montagu’s Harriers. Travelling at a maximum of 60 km/h, we counted all raptors systematically along roads, dirt roads and tracks while estimating the distance of each raptor from the road (Trierweiler *et al.* 2007b). Whenever a Montagu’s Harrier was seen, we stopped to check whether there was more than one bird, but if so, they were not included in the road count itself. Since starting in SW Niger in the northern winter of 2005/2006, we have covered more than 15 000 km of road transects in Niger, Mali and Senegal. We also used the road counts to record habitat types (every 5 km) and habitat degradation (scored thus: no, little or much, the categories related to pre-determined values for the extent of undergrowth, erosion and tree-felling). In addition, we collected data on prey densities by walking line transects at least 30 m long, recording birds (species and numbers, within 20 m on either side), active burrows of small mammals (rodents, burrows <3 and >3 cm diameter, within 1.5 m on either side), reptiles (within 1.5 m on either side) and grasshoppers (lengths <3 cm, 3-7 cm or >7 cm, within 1.5 m on either side). Samples of grasshoppers were collected on the spot, to be identified at a later date and to be used as references. We used these data to calculate relative prey densities. Between 2006 and 2008, we collected data from more than 1100 prey transects (Trierweiler *et al.* 2007b, unpubl.).
- 3 ‘Roost’ is used here in the sense of any place where one or more individuals spend time resting or loafing, at night or during daylight.
- 4 Finding roosts, and by doing so, finding pellets, is essential when investigating the diet of Montagu’s Harriers in the wintering areas. Large roosts (hundreds of birds) are easier to find than small roosts (a few birds, sometimes only one). However, investigating only the large roosts will bias the results, because large roosts indicate areas of high food abundance, where the diet will usually be less diverse than in areas of lower food abundance. In the latter areas, Montagu’s Harriers normally have a more diverse diet. The small body of literature on the food of wintering Montagu’s Harriers is strongly biased towards large roosts in areas subject to outbreaks of *Schistocerca gregaria* (Cormier & Baillon 1991, Arroyo & King 1995); this bias is often exacerbated by small sample sizes and short sample periods. A second bias in dietary studies relates to the techniques used to study diets: pellet analysis, collection of prey remains, visual observations or

Species	Body weight	Distance	Origin	South	North	Source
Osprey	1486	6393	Sweden	162 (12)	244 (8)	Alerstam <i>et al.</i> 2006
Osprey	1486	5260	Scotland	168 (7)	236 (3)	Dennis 2008
Osprey	1486	4958	USA	241 (52)	-	Martell <i>et al.</i> 2001
European Honey Buzzard	758	6709	Sweden	148 (8)	-	Hake <i>et al.</i> 2003
Egyptian Vulture	2120	4160	France, Bulgaria	194 (3)	-	Meyburg <i>et al.</i> 2004a
Short-toed Eagle	1703	4365	France	234 (1)	-	Meyburg <i>et al.</i> 1996, 1998
Montagu’s Harrier	316	5000	Europe*	153 (16)	-	C. Trierweiler <i>et al.</i> in prep.
Eurasian Marsh Harrier	628	4243	Sweden	127 (23)	161 (13)	Strandberg <i>et al.</i> 2008a
Broad-winged Hawk	455	6998	North America	69 (3)	105 (1)	Haines <i>et al.</i> 2003
Swainson’s Hawk	989	12 728	North America	188 (27)	150 (19)	Fuller <i>et al.</i> 1998
Lesser Spotted Eagle	1370	8725	Central Europe	164 (5)	177 (3)	Meyburg <i>et al.</i> 1995a, 2001, 2004b
Wahlberg’s Eagle	640	3520	Namibia	214 (1)	185 (1)	Meyburg <i>et al.</i> 1995b
Hobby	240	9635	Sweden	151 (4)	-	Strandberg <i>et al.</i> 2008b
Eleonora’s Falcon	390	8600	Italy, Sardinia	134 (1)	293 (1)	Gschweng <i>et al.</i> 2008
Peregrine Falcon	780	3841	Russia, Kola	190 (2)	-	Ganusevich <i>et al.</i> 2004
Peregrine Falcon	780	8436	North America	172 (22)	198 (7)	Fuller <i>et al.</i> 1998

* Consisting of birds breeding in Germany and The Netherlands (12), Poland (2) and Belarus (2).

video recordings at the nest. Each method in itself under- or over-represents certain prey categories (Schipper 1973, Simmons *et al.* 1991, Underhill-Day 1993, Sánchez-Zapata & Calvo 1998, Redpath *et al.* 2001, Koks *et al.* 2007), and so a combination of methods is usually considered to provide the smallest bias. Our Sahelian dietary studies are largely based on pellets.

5 An eye-witness account of Chris Magin may serve to illustrate that Montagu’s Harriers in Africa also capitalise opportunistically on sudden outbursts of food. Returning to Addis Ababa from Lalibella, Ethiopia, in late January/early February 2008, he took the lowland route from Dese, descending into the Afar plains. “As we headed south to Awash NP we passed through Yangudi Rasa NP, which straddles the main road. The grassy plains were extremely well vegetated (i.e. the rains a few months previously must have been extremely good) and the grass was absolutely swarming with a super-abundance of small rodents. Every step you took seemed to cause one to scuttle for safety. I cannot say with certainty what species they were. The skies were alive with raptors, almost entirely harriers. I was so impressed with the numbers that at one point I attempted a rudimentary census, scanning a 90 degree arc very slowly with my 10x50 Zeiss Jenoptem binoculars and counting all harriers seen up to the horizon. I counted 125 in this quarter horizon, so estimated that there were around 500 present within the limits of my visibility. I could see quite far – although it was the middle of the day, this was the cool season, so relatively little heat haze – so probably I could pick out harriers up to 3-4 km away. As there were no locusts or

large grasshoppers present and most of the harriers were quartering low to the ground, I assumed that they were congregating to feed on the ‘exploded’ rodent population. The harriers would have been between the hamlet of Gewane and the junction with the Dese road. I also assume that they would have been within the Yangudi NP limits, if only because the amount of good grazing would have attracted hordes of nomads and their livestock herds if it had been outside the NP boundaries. The harriers I saw must have been Pallid and Montagu’s Harriers, which are common in the area.”

6 The reputation of Richard Meinertzhagen, ornithologist extraordinaire in his time, as being a reliable source of information has crumbled in recent years (review in Garfield 2007). Painstaking research by Alan Knox, Robert Prŷs-Jones, Pamela Rasmussen and Nigel Collar has shown that “much that he left us cannot be taken at face value” (Knox 1993). His note on harriers in Kenya, however, has a ring of credibility, since it was published within months of the actual observation. This is also evident from the remark of Simon Thomsett (in litt.), born and raised in Kenya and intimately familiar with the raptors there: “I believe Meinertzhagen in this case.” Garfield (2007) documents that most of the numerous fabrications occurred long after the event, but concedes that, “All the same, his bird writing, even if sometimes factually wrong, usually tends to be much more dependable and certainly more plausible – therefore less irritating – than his military or political memoirs.”