Meyburg, B.-U. & R. D. Chancellor eds. 1989
Raptors in the Modern World
WWGBP: Berlin, London & Paris

A Review of the Migration and Wintering of *Aquila pomarina* and *Aquila nipalensis orientalis*

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ABSTRACT

Based on recent studies in the Near East, the migration of *Aquila pomarina* and *Aquila nipalensis orientalis* is analysed.

Both species breed on roughly the same latitudes, but almost completely separated. *A. pomarina* reaches the Near East from the north-west (Eastern Europe) whereas *A. nipalensis* arrives from the north-east (Central West-Asia).

In Africa *A. pomarina* mainly winters south of the Equator (Zambia-South Africa). In the Near East roughly 5 1/2-6 months elapse between autumn and spring peak migrations, which are concentrated with only little - if any - separation between adults and immatures.

A. nipalensis winters over a huge area, from the eastern part of the Sahel zone in the north to South Africa/Namibia in the south. Adult birds dominate north of Kenya/Equator, whereas immatures dominate further south. However, the age classes to a large extent overlap. This pattern is reflected in the migration through the Near East, where immatures initiate the migration in autumn and close it during the spring and vice versa for the adults. For the main bulk of adults, there are roughly only 4 months between autumn and spring peak migrations in the Near East.

Ecological differences (habitat, food choice) are indicated to explain the different migration strategies, but further research is needed.

INTRODUCTION

The migration of *Aquila* eagles wintering in tropical Africa was long a mystery, e.g. Brown (1976) wrote that *A. nipalensis* reaches Africa 'virtually unobserved'. During the last decade observations in the Near East have completely changed this situation, not only for *Aquila* eagles but also for raptor migration in general (Porter & Beaman 1985; Leshem 1985).

On this basis we attempt here to clarify the migration systems of two of the species involved: *A. pomarina* and *A. nipalensis orientalis*. Both are large, heavy birds which succeed in performing a long-distance migration by their ability to soar on thermals and relief-induced currents. This advantage on the other hand implies a dependence on land bridges or narrow sea crossings, so that these two species constitute a good proportion of the soaring raptors passing over the Sinai Peninsula - the only land bridge between Eurasia and Africa.

We focus on the winter distribution of *A. pomarina* and *A. nipalensis* south of the Sahara and compare present knowledge with the dates of the migration in the Near East. Certainly, this is not an easy task. The information on winter distribution is not exhaustive and partly contradictory, mainly due to the problems of identifying *Aquila* eagles. In this context the field-identification of immature/adult *A. nipalensis* on the one hand and of *A. pomarina* on the other is particularly difficult. South of the Sahara the situation is even more complicated as the two migratory species intermingle with the resident *A. rapax*.

We regard *A. nipalensis* (Steppe Eagle) as specifically different from *A. rapax* (Tawny Eagle). Two subspecies of *A. nipalensis* are described, the western *orientalis* and the eastern nipalensis. The vast majority which reach Africa are of the western *orientalis*, whereas *A. nipalensis* mainly winters in India, although reported from Africa a few times. However, we find this consideration beyond the scope of this paper.

MIGRATION IN THE NEAR EAST

The following account is based on studies from a number of localities:
Autumn migration: Belen Pass in Turkey (Sutherland & Brooks 1981), Harissa in Lebanon (Nielsen & Christensen 1970), Kafer Kassam (Dovrat 1980, 1982; Horin & Dovrat 1983) and Eilat in Israel (Shirihai 1982) and Suez in Egypt (Bijlsma 1983).
Spring migration: Eilat (with comments on Sinai and Israel in general) (Christensen *et al.* 1981). (Recent studies in Suez during spring (Wimpfheimer *et al.* 1983; Bruun 1985) are excluded as the results concerning *A. nipalensis* and *A. pomarina* conflict with the general pattern obtained from Eilat and other parts of the Near East. We believe that a significant part of the *Aquila* eagles recorded at Suez early in spring have been wrongly identified).

Autumn migration:

A. pomarina breeds mainly in eastern Europe. Mass migration of *A. pomarina* is well-known from the Bosphorus in Turkey (Porter & Willis 1968), with a maximum of 18,984 recorded in the autumn of 1971, passing between 17 August and 4 October (S. Sogard pers. comm.; Porter & Beaman 1985). From Borcka in north-east Turkey only smaller numbers (736 birds in 1976) are known (Andrews *et al.* 1977; Beauman 1977). Reports of 115 *A. pomarina* from the south-east corner of the Caspian Sea on 11 October 1978 require confirmation (Rands *et al.* 1982). This is the easternmost area of this species' distribution and numbers are bound to be small and insignificant. Besides, the rather late date suggests *A. nipalensis* to be more likely.

Thus the main route south undoubtedly passes west of the Black Sea, and the main bulk of the population arrives in the Near East from the north-west. However, the size of the population in the Caucasus is unknown.

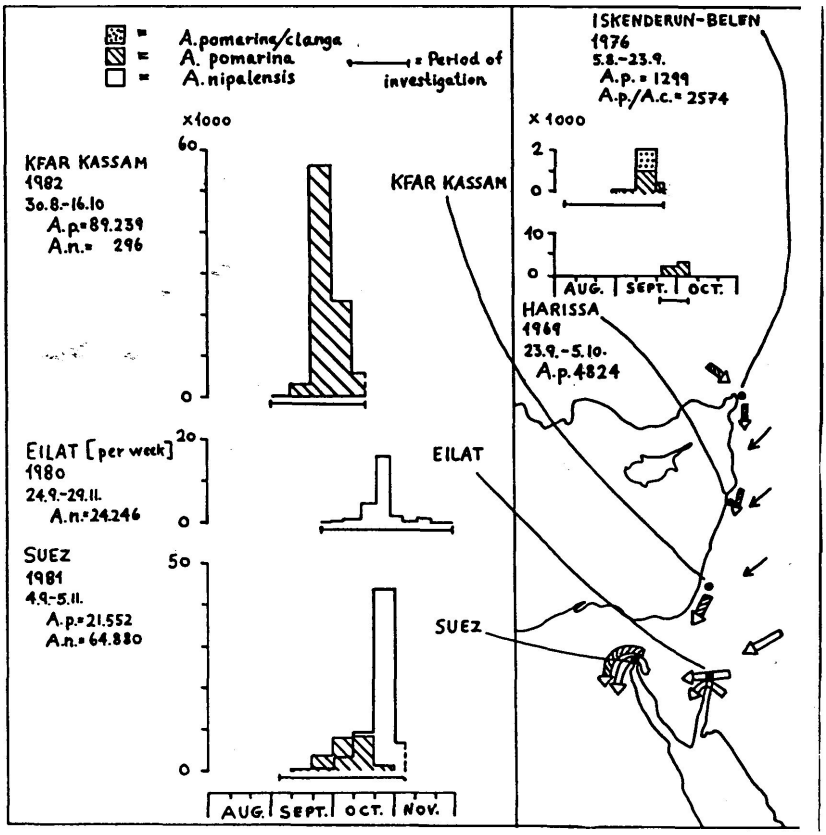
A. nipalensis breeds in central west Asia. Migration is recorded in eastern parts of Turkey with the maximum (some hundreds) recorded at Borcka in north-east Turkey (Beaman 1986). No mass migration is known north or east of the Near East, which is no surprise as there are huge landmasses where the eagles can cross on a broad front.

The autumn migration of *A. pomarina* and *A. nipalensis* through the Near East is summarised in Figure 1. We conclude the following: *A. pomarina* is the earliest migrant of the two, passing through the Near East mainly from mid-September to mid-October, largely late September to early October. A slight difference in peak times is to be expected between the northern Levantine passage and that over Sinai/southern Israel, but there are not enough regular autumn counts from the various sites to form a basis for estimating the exact difference. There is no information on age composition. The whole population likely enters Africa via the Sinai land-bridge (mainly at Suez). There is no certain record from Saudi Arabia (Jennings 1981).

A. nipalensis is the later migrant, passing through the Near East from late September to at least early November and perhaps later. There is a clear pattern in the composition of age classes (Shirihai 1982; Bijlsma 1983). The migration is initiated by juveniles, which dominate in the first ten days of October, to be replaced first by immatures and later by adults. From the last week of October the mass migration is almost exclusively made up of adults.

Large-scale autumn migration is only seen at Eilat and Suez. Thus *A. nipalensis* arrives directly at the Sinai land bridge from an eastern direction. This is supported by the observations from Eilat.

Fig. 1. Summary of autumn migation of *A. pomarina* and *A. nipalensis* through the Near East.



We can conclude, therefore, that the two species are well segregated as regards the timing of their migration; only the numerically less important juveniles of *A. nipalensis* overlap with the main migration of *A. pomarina*. Not until the two species enter the Sinai Peninsula do they actually start to mix geographically and once they have entered Africa at Suez they almost completely 'vanish', i.e. no mass migration is recorded anywhere.

Thus for the autumn migration we have a general knowledge as to the routes followed in the Near East and the timing. However, much fieldwork is still needed to clarify important aspects of it. Below we briefly describe some of the major problems: For *A. nipalensis* we have a distinct pattern of age composition but information for *A. pomarina* on this subject is lacking. The actual sizes of the populations involved are much less known. Apart from the significant route across the Sinai Peninsula, it has recently been shown that large numbers of *Aquila* eagles enter Africa across the Straits of Bab el-Mandeb, at the southern end of the Red Sea. Migration has been recorded in North Yemen (Phillips 1982; OSME expedition autumn 1985, in press) and in Djibouti (Welch & Welch 1986 and *in litt.*). The major proportion of this seems to be made up of *A. nipalensis*; at Djibouti no less than 60,897 were recorded arriving across the Straits in only 17 days (15-22 Oct. and 24 Oct.-1 Nov.) compared with no *A. pomarina* (and only 6 *A. clanga*, 9 *A. rapax* (?) and 16 *A. heliaca*). One of the peculiarities of the migration of *A. nipalensis* at Eilat/Suez is that less than 10% of the number passing are juveniles. This indicates that the main bulk of juveniles may enter Africa over a broader front or by another route. Bab el-Mandeb is one obvious possibility.

The number of *A. pomarina* recorded at Kafer Kassam exceeds that of the whole population as previously assumed. Totals for recent autumns are 1981 (40,932; Dovrat 1982), 1982 (89,239; Horin & Dovrat 1983) and 1983 (142,000; Dovrat 1984). These detailed counts undoubtedly give a good impression of the timing of the migration, but we find it important to critically test the counting method before a general acceptance of these very high figures, e.g. in 1982 simultaneous counts were carried out from 9 posts over a distance of less than 15 km (according to the map in Horin & Dovrat 1983). In our experience this makes it very difficult to avoid a double count (or even higher) of the actual numbers (cf. Porter 1984).

Spring migration:

During spring migration systematic work in the Near East has only been done at Eilat (Christensen *et al.* 1981; Shirihai in press). We conclude that: *A. pomarina* is the later spring migrant of the two, recorded from early March to early May, *with the vast majority from late March to early April* but with significant movements to about the third week of April. This gives a fairly short migration period. The majority pass west of Eilat, indicating that most birds leave Africa via Suez (cf. Ullman 1985). Strong passages have been noted in Lebanon in late March (Cramp & Simmons 1980).

At the Bosphorus, Ritzel (1980) reported the main passages on 2-3 April (respectively 615 and 697 birds out of a total of 1,745 eagles) from daily observations 20 March-4 April. From a survey in Bulgaria the peak day was 3 April (286 eagles out of a total of 330) (Roberts 1979). In central and eastern Europe most birds arrive in early-mid April but in Slovakia in mid-late April. In the Ukraine the first arrival has been noted in late March (Glutz *et al.* 1971). These observations fit very well with the migration through the Near East. Age composition related to the time of migration is unknown for *A. pomarina.*

A. nipalensis is the earliest of the two, migrating from early-mid February to late April/early May. Adult birds open the migration and peak already late Feb./early March, the last true adults being seen in the third week of March. Immatures succeed adults and pass mainly in the 2nd-3rd week of March, to be gradually replaced in turn by juveniles, which dominate from late March onwards. Thus, the migration period is long compared with that of *A. pomarina.*

When looking at the numbers of the different age classes involved, it seems again - as in autumn - that adults far exceed immatures and juveniles in number, at least at Eilat.

At Eilat *A. nipalensis* arrives from a south-westerly direction, which indicates a crossing of the Gulf of Suez. At a level with Eilat the stream changes to a more eastern route, thus heading more directly towards the breeding grounds. Observations from Suez, Sinai and south-western Israel indicate that these areas are to some extent covered by the migration of *A. nipalensis* as well.

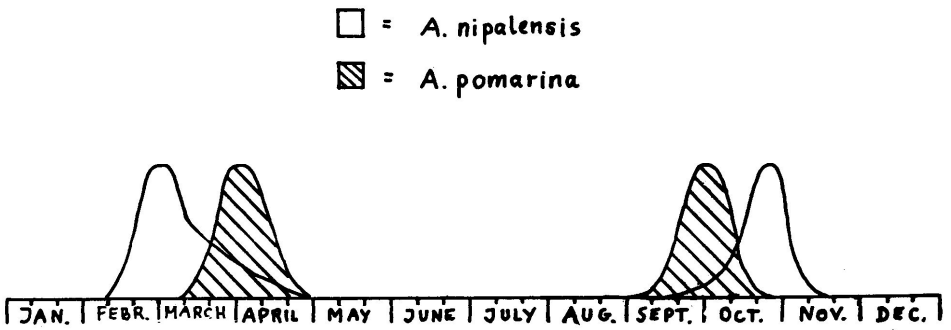
Today *A. nipalensis* breeds only east of 41°E, although perhaps occurring in southern Ukraine (Cramp & Simmons 1980). Information on its arrival at the breeding grounds is scanty and variable. Dementiev & Gladkov (1966) say that it arrives at Volga and west Kazakhstan from the beginning of April, continuing to the second half of that month; Cramp & Simmons (1980) refer to this but add that it has also been recorded in early March in Ukraine and mid-March in Rumania. Glutz *et al.* (1971) refer to a 5-year study at Askania Nova (46°27'N, 33°52'E) where first arrivals were between 3 and 15 March. Schütz (1959) mentions dates from 18 Feb. (obtained) and late Feb. - early March around Kumbaschi (south-west corner of Caspian Sea). (These latter examples could refer to birds which have wintered north of the southern Levant). *A. nipalensis* on migration has been noted north-east of the Caspian Sea (between S. Ural and Umba) on 15-16 March (Glutz *et al.* 1971).

Clearly arrival at the breeding grounds of *A. nipalensis* either varies more than for *A. pomarina* or Dementiev & Gladkov are wrong. It can be ascertained from the above-mentioned data that *A. nipalensis* often arrives considerably earlier than *A. pomarina* and there is no reason why the large numbers of adults passing Sinai in late Feb.-early March should take longer to reach the steppes north-east of the Caucasus/Caspian Sea than *A. pomarina* to reach east Europe (since both areas are approximately the same distance from Sinai). Many birds are bound to arrive in March, as is also indicated by Glutz *et al.* 1971 and Schutz 1959.

The poor coverage at other localities than Eilat makes the spring migration in the Near East less well-known, but on the whole this exhibits the same characteristics as the autumn migration. Both species are well separated in the timing and only across the Sinai Peninsula do they mix.

The timing of the spring and autumn migrations through Sinai/Israel is outlined in Figure 2.

Fig. 2. Diagram of the spring and autumn migration of *A. nipalensis* and *A. pomarina* in Israel and Sinai. Note that the diagram does not illustrate numbers of the birds or relative abundance between the two species.



When viewed from the Sinai Peninsula, the overall pattern exhibits several characteristics: *A. pomarina* has a fairly short and intense migration period (approx. 4-5 weeks) in both spring and autumn. It is the first autumn and the last spring migrant to arrive, whilst *A. nipalensis* has a protracted migration period (approx. 7-8 weeks) which is explained by the different timing of the age classes. Juveniles initiate and adults close the autumn migration and vice versa in spring. Overall, *A. nipalensis* migrates later in autumn and earlier in spring than *A. pomarina.*

In an identification context it can be noted that the main overlap in both seasons occurs between *A. pomarina* and juvenile *A. nipalensis.* E.g. the latter species is in a plumage which is easy to identify. However, this can only be used as a very simple check of counting results.

WINTER QUARTERS OF *A. POMARINA*

The African winter quarters of *A. pomarina* are dealt with in a series of works from which two different distribution patterns emerge: (1) rather restricted winter quarters in southern Africa (Glutz *et al.* 1971; Brown & Amadon 1968; Brooke *et al.* 1972; Curry-Lindahl 1981; Brown *et al.* 1982) in contrast to (2) extended winter quarters including areas north of the Equator up to the Sudan savanna (White 1965; Moreau 1972) and even the plains of south-western Chad/northern Cameroon (Cramp & Simmons 1980).

The winter quarters in southern Africa are well documented (see below), whereas a regular winter occurrence further north seems more doubtful. In the following we attempt a re-evaluation of the old and new sources concerning the countries north of 15°S.

Sudan

Cave & McDonald (1955) are the main source and are frequently quoted in later works. Unfortunately, they combine the two Spotted Eagles and say that 'Spotted Eagle *Aquila pomarina* is a rather uncommon winter visitor to northern districts'. Whether they refer to *A. clanga* (Spotted Eagle) or *A. pomarina* (Lesser Spotted Eagle) is unknown and the source is of little value today.

Lynes (1925) does not mention *A. pomarina* from northern/central Dafur and West/Central Kordofan, where he found *A. nipalensis* fairly common (and collected several specimens). From Cental Sudan Hogg *et al.* (1984) record only *A. pomarina* as a passage migrant in March.

Our comments: We have found no evidence of winter occurrence of *A. pomarina* in Sudan.

Eritrea/Ethiopia

Smith & Popov (1953) report thousands of eagles present near Asmara on 9 Nov. 1951 (not 10 Nov. as mentioned in Moreau (1972)). One *A. clanga* was obtained and the majority appeared to be this species. In addition, a specimen of *A. nipalensis orientalis* was obtained (not previously

recorded in Eritrea) and some hundreds appeared also to be present. *A. pomarina* was thought to be present but not obtained (with the comment that "it seems doubtful whether this species can be identified in the field"). This observation apparently forms the basis for the following: Smith (1960) mentions that eagles in thousands pass regularly over the plateau in November but there is no comparable passage in spring. He does not give specific names but makes this statement under the heading of *A. nipalensis orientalis, A. clanga* and *A. pomarina*. Moreau (1972) and Cramp & Simmons (1980) write of large flocks (thousands) of "Spotted Eagles" (*A. clanga/pomarina*) from Eritrea in November. The former refers to Smith & Popov (1953), the latter to Smith (1960) and Urban & Brown (1971). However, the last-named only state that *A. pomarina* probably occurs on passage in south-west and western Ethiopia, not mentioning any certain record. Friedmann (1930) did not collect any *A. pomarina* (or *A. clanga*). Vittery (1983) did not record the species in autumn 1974 but twice during spring 1975 (19 March, 26 April) at the lakes of Addis Ababa.
Our comments: We find it most unlikely that the mass occurrence in Nov. 1951 at Asmara was mainly made up of *A. clanga*. This species largely winters further north and is only a scarce migrant in the Near East. We rather believe the main bulk of these eagles to have been *A. nipalensis* (see below). Nothing in the basic recording at Asmara indicates the presence of *A. pomarina*. With our present knowledge we would expect this species to be further south than Eritrea by early-mid November. Thus *A. pomarina* has apparently not been recorded with certainty in Eritrea/Ethiopia; consequently there is no indication of winter occurrence within the area.

Plains of south-west Chad/Northern Cameroon

The first report is by Viellard (1972), who records small eagles, not *A. wahlbergi*, from Cameroon (Waza) in Dec.-Feb. and mentions observations of mainly immature, more rarely adult, *A. clanga* and at least 2 immature *A. pomarina*. From Chad he mentions a specimen of *A. clanga* (Fort Lamy, 21/1 1971). Thiollay (1975) records 16 *A. pomarina* (2 ad. and 14 imm.) during a survey of two national parks in southern Chad - Zakouma and Manda (c. 9-11°N, c. 18-20°E) - from 9-17 April 1973. He also (1978 and *in litt.*) records *A. pomarina* as almost as common as *A. rapax* in northern Cameroon during a survey in Feb. and Apr. 1973 and unpublished observations in December. (This probably explains the statement already given in Thiollay (1975) that *A. pomarina* is distributed in Eastern Africa and winters in numbers to north-west Cameroon.
Our comments: Wintering *A. pomarina* in the plains of Chad and northern Cameroon was most surprising compared to the general trends in our investigation. Moreover, the reported habitat (e.g. open grassland) apparently does not correspond to the situation found in the main winter quarters in southern Africa (woodland species, see below). At our request Dr. Thiollay kindly supplied us with a photo of one of the eagles from northern Cameroon. This shows without doubt an immature *A. nipalensis*. Thiollay (*in litt.*) will not exclude that *A. pomarina* occurs in the area, but agrees that confusion between this species and immature *A. nipalensis* has occurred. We are not convinced that *A. pomarina* winters in Chad/Cameroon.

Kenya

The status of *A. pomarina* has been obscure. A specimen was collected in Ithanga Hills, north of Nairobi, on 29 Sept. (Lynes 1934; Backhurst *et al.* 1973). The latter source notes that there is no specimen in the National Museum at Nairobi and that the species is hardly known from the area (Kenya-Tanzania). Brown (1970) writes that there are no specimens of *A. pomarina* from Kenya. Bowles (1967) recorded thousands of possible *A. pomarina* eating insects, probably termites, on 11 Nov. 1966 at Sultan Haman (between Nairobi and Mombasa). The record is mentioned in Brown (1970) and (with reservation) in Backhurst *et al.* (1973). Smeenk (1974) does not mention *A. pomarina* from his detailed work in Tsavo in south-east Kenya.

In early Feb. 1971 one of us (SC) photographed a non-juvenile *A. pomarina* near Lake Naivasha. This seems to be the first documented winter record from Kenya. Dowsett (1973), Campbell & Campbell (1975), Pearson & Meadows (1979) and Pearson (1978, 1979, 1980, 1981, 1983a & 1983b) have published several convincing records of *A. pomarina* in Kenya - both from migration and winter time.
Our comments: The specimen collected in late Sept. may explain why Kenya was included in the main winter quarters of the species in some major works (?). With our present knowledge we can say that the specimen was collected very early during *its migration*. There is nothing in the record of Bowles that suggests *A. pomarina* rather than *A. nipalensis*, to which species the reported flock

most likely could belong (see below). Today, Britton (1980) classifies *A. pomarina* as a winter visitor in small numbers in southern Kenya (e.g. south of the Equator), the highest single figures being 16 on 13 Jan. 1979 and about 20 on 14 Jan. 1979 at Elementeita (Pearson 1980).

Uganda

According to Backhurst *et al.* (1973), there are still no records from Uganda. Pearson & Meadows (1979) mention a spring record from south-west Uganda, but without details. Likewise, Van de Weghe (1978) gives second-hand information reporting annual spring occurrence. Britton (1980) classifies the species as regular on spring passage in the western part of the Rift Valley, especially at Rwen Zori National Park in April, while some may overwinter, as evidenced by substantial numbers seen in the northern parts as early as 7-14 Feb. 1976.

Zaire

No records known.

Rwanda

Van de Weghe (1978) reports a relatively constant migration of *A. pomarina* through the eastern parts of Rwanda in Oct.-Nov. (southbound) and late Feb.-early April (northbound), the largest concentration being 110 on 13 March.

Further it is noted as likely that at Equator level it mainly migrates between Lake Victoria in the east and the Rift Valley lakes in the west.

Angola

No records.

Tanzania

Lynes (1934) collected an adult female on 14 March at Iringi District from a flock of migrating eagles and recorded migration on 12, 13 and 14 March. (Were wintering *A. pomarina* in Tanzania based on this specimen taken during its migration ??) Brown & Amadon (1968) map *A. pomarina* as a winter visitor from 5°S and southwards. Backhurst *et al.* (1973) point out that apparently there are more recent records from Tanzania than those of Lynes (1934). A few recent records (2 autumn, 2 winter) from Northern Tanzania (Pearson & Meadows 1979; Britton 1980) imply that *A. pomarina* is a scarce winter visitor in the country.

Malawi

Benson & Benson (1977) report passages of *A. pomarina* between 18 Feb. and 27 March (one specimen 25 Feb.) with a maximum of 30 on 9 March. There are also a few October records.

Zambia

Benson *et al.* (1973) record southbound passages from 8 Oct.-30 Nov. and northbound from 12 Feb.-16 Mar. Three specimens from 17-18 Nov. 1970 were either late migrants or wintering birds (Brooke *et al.* 1972).

Mozambique

Clancey (1971) mentions a few records from southern Mozambique and a Nov.

record near the border with Zimbabwe but states that the species is "certainly more widespread during the northern winter".

To summarise, we have not found any evidence of wintering north of Kenya. If *A. pomarina* does so, we believe it must be in very small numbers only. Furthermore, its scarcity in Kenya and N. Tanzania strongly points towards main winter quarters south of the Equator, leaving the well-documented winter area to be the countries reviewed by Brooke *et al.* (1972): Zimbabwe, Zambia (?), Namibia, South Africa and perhaps southern Mozambique. Steyn (1983) outlines the southern limit of wintering *A. pomarina* across north-east South Africa, in Natal and Transvaal, Swaziland, northern Botswana to north-eastern Namibia, including southern Mozambique and the whole of Zimbabwe.

Long-distance ringing recoveries are few (Ilychev 1982) but they agree with the outlined timing of the migration and extent of the winter quarters. One bird ringed in Estonia was recovered in N. Tanzania, March (2 1/2°S). Another ringed at Kaliningrad was recovered in central Zambia, Feb. (13°S) and one ringed in Latvia was recovered in S. Zimbabwe, Nov. (20 1/2°S). A bird captured in Transvaal was later recovered in Azerbaijan (eastern Caucasus).

Brooke *et al.* (1973) mention that 18 of 21 specimens were non-adult birds and 3 were adults. If this figure is representative for south Central Africa, it could indicate some segregation between the age classes. Yet the rather restricted winter quarters outlined above do not suggest any difference in occurrence between age classes, and there is no indication that adults and immatures are segregated as described for *A. nipalensis*. It will be important to obtain more knowledge on the occurrence of adults/immatures in the main winter quarters of *A. pomarina*.

WINTER QUARTERS OF *A. NIPALENSIS*

Earlier sources generally agree that this species has its main winter quarters north of the Equator in Sudan/Ethiopia/Somaliland, with more or less regular occurrence in northern Zaire and Kenya and accidental records south to Natal (Vaurie 1965; Glutz *et al.* 1971; Moreau 1972). Today occurrence south of the Equator is well documented, especially by Brooke *et al.* (1972). However, information is still incomplete in several countries. Due to confusion with local Tawny Eagles *A. rapax*, many authors are cautious in their statements. A brief summary of the sources checked gives the following:

Sudan

Fairly common non-breeding visitor to the arid regions of the north with records from Darfur, Kordofan, Khartoum, Zeidab and Erkowit (Cave & McDonald 1955). Lynes (1925) collected 5 adult specimens (Dec.-Jan.).

Eritrea/Ethiopia

Palearctic migrant throughout Oct.-April. Perhaps June-July (Urban & Brown 1971). One specimen (juvenile) obtained in Nov. (Smith & Popov 1953) during a mass occurrence of *Aquila* eagles near Asmara in Eritrea. From comparison with the migration schedules in the Near East it appears most likely that the main bulk of these birds were *A. nipalensis*. Friedman (1930) obtained only *A. rapax* and no *A. nipalensis* in the Ethiopian highland in winter, but later Brown (1970) writes that "migrant *A. nipalensis* are very common in the high Ethiopian mountains in winter at 12,000 feet".

Chad

2 recorded in April (Thiollay 1975).

Northern Cameroon

2 recorded in Feb. or April (Thiollay 1978). Photo of an imm. bird (Thiollay *in litt.*).

Zaire

Chapin (1932) collected 5 specimens (Jan. (2), Feb. (2), March (1)) in the savanna in north-eastern Zaire. Schouteden (1963) mentions a specimen collected in Dec. 1942.

Kenya/Tanzania/Uganda

Brown (1970) says that Tawny Eagles are 2-3 times more common Oct.-April in Kenya than during the rest of the year. It reaches winter quarters near the Equator in Oct. (Reynolds 1974). One photographed in Mar. 1967 is reported as the first from Uganda (Mann 1971).

Britton (1980) describes the species as a common passage migrant and winter visitor to grassland, bushed grassland, wooded grassland and farmland up to 3,000 m, especially near rocky hills, from Oct.-April. The highest numbers reported are up to 500 (mainly immatures) over 1 km^2 on 25 Feb. 1977 in Tsavo (Pearson 1979; B. Boggild Petesen & E. Krabbe *in litt.*) and 350+ on 7 Nov. 1982 near Kisima (Pearson 1983). Bowles (1967) records thousands of *Aquilas* at Sultan Haman

(between Nairobi and Mombasa) on 11 Nov. He suggests *A. pomarina* but we find *A. nipalensis* more likely. Smeenk (1974) concludes, on the basis of his detailed investigations in Tsavo National Park and around Nakuru, that east Africa is one of the main winter areas for immature *A. nipalensis*. He records the species between 11 Oct. and 27 April in Tsavo. Some juveniles or immatures even summer in Kenya (O. Laessøe *in litt.*).

Rwanda

The report of 3 records is interpreted as an irregular or very scarce occurrence in eastern parts of the country in March and Oct. (Van de Weghe 1978).

Malawi

A few observations: Oct., Nov., March (Benson & Benson 1977).

Angola

None recorded.

Mozambique

"Must occasionally occur in southern Mozambique" (Clancey 1971).

Zambia

Passages recorded 24 Oct.-19 Nov. and 10 Feb.-17 March (Benson *et al.* 1973). 800 recorded between 20 Feb. and 17 March 1960 during daily counts 20 miles north of Mpika, Jan.-March 1960 (Tree 1961).

Zimbabwe, Botswana, Namibia and South Africa

A regular visitor arriving late Oct. and leaving late Feb., well-documented by collected specimens (Brooke *et al.* 1972). Steyn (1983) gives the following for southern Africa: Aggregations of over 100 *A. nipalensis* are not uncommon, associated with rain fronts, where the accompanying humidity causes emergence of the main food, termites. Most are seen before mid-Dec. in Zimbabwe, from where they move westwards through Botswana into Namibia to take advantage of the later rains there and in the Kalahari (Jan. and Feb.). Birds on northward migration do not appear to return through Zimbabwe. In South Africa *A. nipalensis* occurs south to the central Cape Provinces but is rare south of the Orange River.

To sum up, we can conclude that the winter quarters of *A. nipalensis* cover a much larger area than those of *A. pomarina*, ranging from arid and mountainous regions in Sudan well north of the Equator, over the savanna in East Africa to flat open country with scattered trees in southern Africa. The latter occurrence, being linked to rain fronts, is of a rather unstable nature.

Brooke *et al.* (1972) show that there is a significant age segregation involved in the winter distribution of *A. nipalensis*. The northern parts are occupied by adults whereas only immatures penetrate south of East Africa. Brooke (1974) further interprets the situation as completely discrete winter areas for adults (E Africa) and immatures (SW Africa) and connects this to their discrete winter ecology (adults being solitary feeders on vertebrates and carrion, immatures gregarious feeders on swarming insects and nestlings of Red-billed Quelea *Quelea quelea*). However, we believe that this segregation should not be viewed too strictly.

At the British Museum, SC has examined a part of the collection of *A. nipalensis*. Of 8 skins of adults, 7 were from Sudan and one from Damaraland in Namibia (this bird labelled immature). In Brooke *et al.* (1972) the last stage (Plate 3) in the photographic series illustrating age development in the species shows a bird in full adult plumage. Four photos examined by SC of January birds in Tanzania showed one juvenile, 2 immatures (3rd/4th calendar year), one adult or nearly so and one adult) (photos by B.-U. Meyburg). Thus there are, even in this scanty material, examples of adult birds reaching the more southern part of the winter range.

In spite of these corrections we agree that the vast majority of adult *A. nipalensis* winter at a considerably more northern latitude than the vast majority of juveniles. Observations by Smeenk (1974) strongly indicate that most adults winter north of Kenya contrary to the conclusion of Brooke *et al.* (1972) and Brooke (1974). The occurrence mainly of immatures in southern Africa is

of a rather unstable nature, thus indicating that this is perhaps not their main winter area.

We have little recent information on the age composition in the northern parts of the African winter quarters. One could mention that many immature as well as adult *A. nipalensis* can winter on the Arabian Peninsula (Jennings 1981; Stagg 1985 and *in litt.*; many photos by F. Walker examined by SC).

The statement by Brown *et al.* (1982) that most *A. nipalensis* do not pass the Equator seems dubious. The gregarious nature of the occurrence in southern Africa makes it easier to record large concentrations *in situ*, but this need not reflect the actual proportion of the population involved.

We do not know of any long-distance recoveries of ringed *A. nipalensis* (cf. Ilychev 1982). The statement on the discrete feeding ecology between adults and immatures also seems to need modification. Smeenk (1974) mentions that the numerous immatures in Kenya feed on anything from carrion and vertebrates to insects; termites are not the principal food source of *A. nipalensis* in Kenya.

DISCUSION

There are approximately 5 1/2-6 months between the autumn and spring peak migrations of *A. pomarina* in the Near East. For adult *A. nipalensis* there are approximately a little more than 4 months between autumn (last week of Oct.) and spring peaks (around 1st March). We believe that this reflects latitudinal differences in their winter quarters in Africa. *A. pomarina* largely winters south of the Equator, the main range at latitudes level with Zimbabwe, with a thinner distribution north and south. The main winter range of *A. nipalensis* covers a much larger area; adult birds predominate north of the Equator, immatures and juveniles are common in East Africa (Kenya) but are otherwise found at the same latitudes as *A. pomarina.*

In the southern Levant the main migration period of *A. pomarina* is about one month each season (mid Sept.-mid Oct. and late March-late April). That of *A. nipalensis* extends over 1 1/2-2 months each season (early Oct.-mid Nov. and late Feb.-late April). Thus besides migrating earlier in autumn and later in spring *A. pomarina* has a more concentrated migration in both seasons.

For *A. nipalensis* the picture is more complex. The immatures - especially juveniles - initiate the migration in autumn and close it in spring. Where the timing is concerned, they (particularly the juveniles) approach *A. pomarina* but, as regards the duration of the migration, this is protracted rather than concentrated within each season. Inevitably, their earlier start in autumn gives a better opportunity to reach southern latitudes in Africa - as shown by the winter distribution - and consequently explains their later arrival in spring. The migration of adult *A. nipalensis* in both seasons is very intense and equal to *A. pomarina* as regards the duration of their passage in the Middle East.

The inactive method of migration implies that the eagle itself cannot do much to increase its speed. Each day it has to wait for the thermals to start and to break off late in the afternoon when they cease. In the Near East this pattern, to the ground observer, is reflected in morning and late afternoon peaks as the strong mid-day thermals often carry the soaring raptors to altitudes beyond eyesight. When thermals are the main force in the migration, hardly more than 7-8 hours can be used per day. The implications seem apparent for a long-distance migrant. The speed will be the same no matter whether the bird is heading for a distant or nearby goal. The crucial point of success in reaching a distant goal will therefore be the regulation of when the migration is started.

The migration of *A. pomarina* and *A. nipalensis* demonstrates how their strategy is adapted to these problems. The more distant the winter quarters, the earlier the autumn migration has to be initiated. This is shown both by *A.pomarina* vs *A. nipalensis* and comparison of the different age classes of *A. nipalensis.*

The differences in winter quarters again set different standards for the spring migration, which in the Near East appears as a reverse picture of the autumn, e.g. early in autumn is late in spring and vice versa.

These migration strategies result in very different situations for the two species in the breeding season:

A. pomarina arrives late in spring. This leaves only a short period of approx. 150 days (5 months) to produce the new generation. The period between egg-laying and independence of the young

lasts 120-130 days (Cramp & Simmons 1980). Consequently the time for a successful breeding is very short.

In contrast, adult *A. nipalensis* arrive earlier at their breeding areas (perhaps with some variation from west to east), where they will spend up to 7 months (c. 215 days). Whilst information on the breeding cycle is incomplete (Cramp & Simmons 1980), it is obvious that the conditions of its breeding strategy are different from those of *A. pomarina*.

We may conclude with the following overall picture:

A. pomarina and *A. nipalensis* both breed on roughly the same latitudes in Eurasia (between 40-60°N) but with hardly any geographical overlap. *A. pomarina* belongs to the extensive woodland of Eastern Europe and A nipalensis to the steppe regions of the Asian interior. Both are passive migrants and during their migration share one entrance to Africa - the Sinai land bridge. The timing of the migration shows specific characteristics both between the two species and, with *A. nipalensis*, for different age classes. Within their winter quarters the two species again display specific characteristics in respect of distribution, habitat and food, although here some overlap occurs.

ACKNOWLEDGEMENT

Lene Smith is thanked for correcting the English in the manuscript.

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