Intermediate stages of age characters create dilemmas in ageing female Ruffs *Philomachus pugnax* in spring

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In many studies, the accurate ageing of waders is of critical importance. In the case of spring female Ruffs, we found that some published ageing criteria were more difficult to use than might be expected. Although some adult and some second year females could be distinguished, many could not be aged because several characters were in an intermediate stage and because there is a lack of knowledge on the rate at which they change during the first 2–3 years of life.

INTRODUCTION

The ability to recognise the age of a wader is of crucial importance in many studies because juveniles, immatures and adults may differ in biometry, migratory strategy, and behaviour. During autumn migration, the difference in plumage between adults and juveniles of most waders is well pronounced (Prater *et al.* 1977, Glutz von Blotzheim *et al.* 1975). However, with the onset of moult into summer plumage, ageing becomes much more difficult.

In spring, Ruffs *Philomachus pugnax* migrate through Europe in large numbers (Glutz von Blotzheim *et al.* 1975). Second-year males do not attain full summer plumage so there is no problem distinguishing them from adults in late spring. However, before mid-April males have not yet completed their moult so ageing can be quite difficult (Joop Jukema, pers. comm.). Females in their first spring most probably can be distinguished from adults by retained juvenile inner median coverts (Kozlova 1962, Prater *et al.* 1977). However, these feathers often are very worn so this feature can be difficult to see, especially in artificial light such as a torch or gas lamp. Also, it is not known how many second year birds moult all of their juvenile inner medians coverts.

Extensive studies on African wintering grounds have shown that, despite considerable variation, leg-colour can be a useful criterion for ageing Ruff (Tree 1971, Pearson 1972, 1981, Schmitt & Whitehouse 1976). The legs of juveniles are greenish, whilst those of adults are usually orange or pink. The final adult colour is reached via a greenish-and-orange-mottled stage (Pearson 1981).

Another criterion for ageing females reported by Chandler (1989) is that the base of the bill is usually orange in adults and uniformly dark in juveniles.

In spring, first year and older Ruffs also differ in the amount of wear on their primaries. First year birds can be expected to have either very worn primaries, or less frequently, a contrast between old inner primaries and fresh (replaced) outer primaries. At the same time of year, adult flight feathers are only slightly worn (Prater *et al.* 1977, Pearson 1981). Moreover, a light ring formed by whitish feathers around bill base is an adult feature (authors' unpublished data).

In this paper we evaluate the usefulness of various features for ageing female Ruffs caught during spring migration and explain some of the dilemmas. We also hope to stimulate discussion of the problems.

METHODS

Fieldwork was carried out on the Volturno plain, Caserta (southern Italy), an area with many artificial ponds of 0.5–5.0 ha. Ruffs were caught at night during 4–8 May 2003 using mist nets in very shallow water with the aid of tape lures. The following features were recorded:

Leg colour, either:
a) orange or pinkish-red (called orange in this paper),
b) greenish (like in juveniles in autumn),
Legs with orange background and small, dark spots were included in category (a), but legs with large spots covering >50% of the leg were included in category (b).

Dark spots on leg:
a) no spots on leg,
b) 1–2 spots,
c) 3–4 spots,
d) >4 spots.
(The left leg was examined; spots on toes were ignored.)

Light ring on the feathers around base of the bill:
a) no ring, all feathers coloured uniformly,
b) complete light ring,
c) incomplete light ring (intermediate between (a) and (b)).

Orange patch on the base of the bill:
a) bill base uniformly dark,
b) clear orange patch on the base of the bill (almost invariably on the lower mandible only (Fig. 1)),
c) small, smudged patch on the lower mandible base (intermediate between (a) and (b)).

Wear on primaries:
A scoring system was used based on the wear categories depicted in Prater *et al.* (1977) and Meissner (2000). A feather with no wear on the tip or edges scores 0 and one with extremely damaged vanes scores 3. Scores 1 and 2 are intermediate. To calculate an index of the amount of wear on the primaries of an individual bird, the wear scores of all ten long primaries are summed. Thus primary wear index ranges from 0 to 30.

Wear on secondaries:
Wear on the ten secondaries was recorded using the same system as for primaries.

Wear on tertials:
The same scoring system was used, but the maximum tertial wear index is 15 because there are only 5 tertials.

Percentage of new summer plumage feathers on back and scapulars:
The percentage of summer plumage feathers (with black centres and bright buff fringes) was recorded in six bands: 0%, present but <20%, 20–40%, 40–60%, 60–80%, >80% but not complete and 100%.

155 female Ruffs were described using this protocol, but in the case of summer plumage feathers on the back, only 100 of them. Due to bad light conditions we did not attempt to score the colour or wear of the inner median coverts.

56 female Ruffs were also caught between 27 April and 16 May 2002 and 2003 in NE Poland near Kolonia Nisko (Reszel region, Olsztyn district). For these birds, only the presence of juvenile inner median coverts and leg colour was noted.

RESULTS

Although female Ruffs were easily separated into two groups on the basis of leg colour, those with orange legs (adult feature) included substantial proportions that had no ring around the base of the bill, an incomplete ring and a complete ring (Table 1). However, among birds with greenish legs there was only one with a complete bill ring. This difference in the proportion of birds of different leg colour and bill ring is significant ($\chi^2 = 17.22$, $p < 0.001$, d.f. = 2).

As with the bill-ring, Ruffs with orange legs included substantial proportions with a clear orange patch on the bill base, a small, smudged bill-patch and a uniformly dark bill. The majority of birds with greenish legs, however, had no orange on the bill (Table 2); again the difference between the proportions of birds with different leg colour and bill-patch is significant ($\chi^2 = 16.58$, $p < 0.001$, d.f. = 2).

Among female Ruffs with orange legs, birds with uniformly dark bills had more dark leg spots than birds with clear orange bill-patches and intermediate birds were in

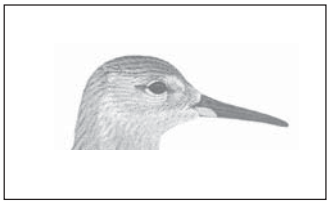

Fig. 1. The head of a typical adult female Ruff showing the position and size of the orange patch at the base of the lower mandible on birds caught in southern Italy in early May.

Table 1. Frequency of female Ruffs according to leg colour and the presence and type of a ring around the base of the bill.

	No ring	Incomplete ring	Complete ring
Orange legs	49	28	32
Greenish legs	35	10	1

Table 2. Frequency of female Ruffs according to leg colour and the presence of an orange patch at the base of the lower mandible.

	Uniformly dark bill	Intermediate bill patch	Clear orange bill patch
Orange legs	40	22	47
Greenish legs	33	6	7

Table 3. Frequency of female Ruffs with orange legs according to the presence of an orange patch at the base of the lower mandible and the number of dark leg spots (the maximum number of spots recorded on any bird was 10).

	Number of spots on leg			
	0	1–2	3–4	>4
Uniformly dark bill	7	12	11	16
Intermediate bill patch	7	10	2	8
Clear orange bill patch	13	13	3	2

Table 4. Frequency of Ruffs with orange and greenish legs having different percentages of newly moulted feathers on the back and scapulars (here, the categories >80% but not complete and 100% are combined).

	Per cent new feathers on the back and scapulars				
	0%	present but <20%	20–40%	40–60%	80–100%
Orange legs	5	15	13	10	20
Greenish legs	8	17	4	4	4

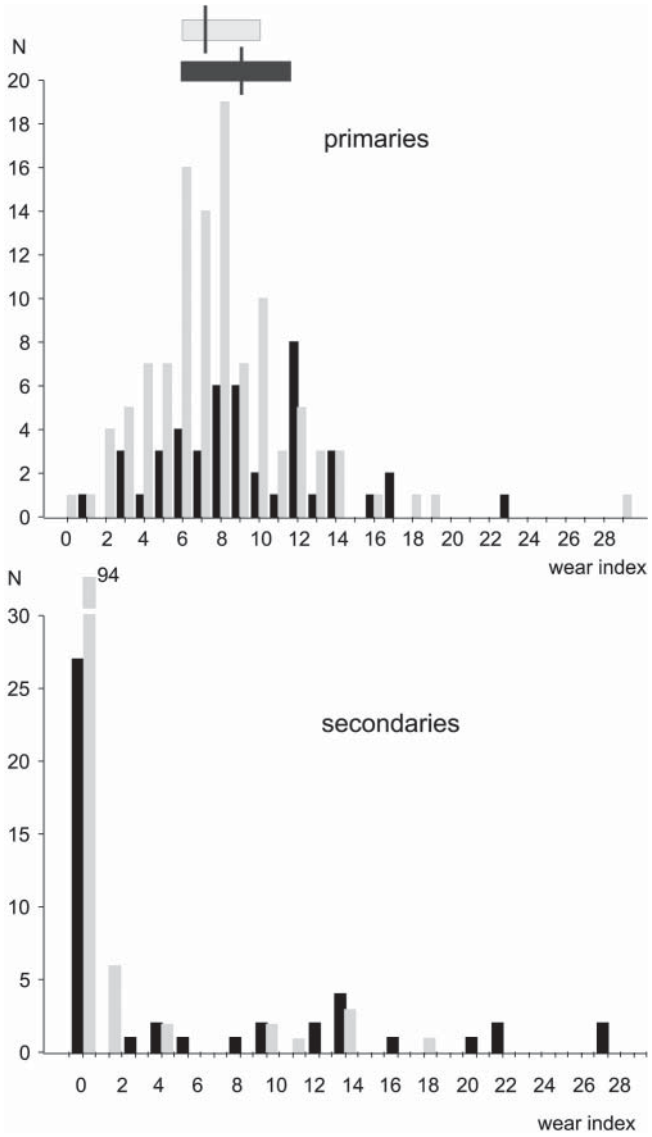

Fig. 2. Frequency distributions of primary and secondary wear indices for orange (grey bars) and greenish (black bars) legged birds. For primary wear indices, the median (vertical line) with interquartile range (rectangle) are given above.

between (Table 3). This is a significant relationship (χ^2 = 16.80, $p < 0.02$, d.f. = 6).

Both the median primary and secondary wear indices were significantly higher (i.e. the feathers were more worn) in birds with greenish legs than in birds with orange legs (Fig. 2; Mann-Whitney U test: primary wear index, Z = 2.36, $p < 0.02$; secondary wear index, Z = 4.13, $p < 0.001$). However 78% of Ruffs examined had a zero secondary wear index. The tertial wear index was similar in both groups (Z = 0.18, $p > 0.05$). There was a fairly weak, but significant correlation between the primary and secondary wear indices ($r_s = 0.49$, $p < 0.05$).

Birds with greenish legs had a significantly lower percentage of newly moulted feathers on the back and scapulars than birds with orange legs (Table 4, χ^2 =12.93, $p < 0.02$, d.f. = 4).

Among the 56 female Ruffs examined in NE Poland, juvenile inner median coverts were noted more frequently in birds with greenish legs than in birds with orange legs (Fisher exact test, $p < 0.001$). Juvenile coverts were noted in 11 out of 16 birds with greenish legs and in one out of 40 birds with orange legs.

DISCUSSION

Among the 155 female Ruffs examined in Italy, only 35% could be aged with a high degree of certainty.

Of 109 females with orange legs, only 9 showed all of the other features suggesting they were adults. These had no leg spots, a well-defined bill ring and a clear orange patch at the base of the lower mandible. Eight of them had no secondary wear and their primary wear indices were <10. Forty-six females had greenish legs suggesting they were immature (Hayman *et al.* 1986, Chandler 1989).

From the first winter onwards the legs of Ruffs become more orange (Prater *et al.* 1977, Hayman *et al.* 1986, Chandler 1989). The typical bright orange leg colour of adults is attained after about two years, but the rate of colour change appears to be variable (Prater *et al.* 1977, Hayman *et al.* 1986). Studies in South Africa, however, have shown that at least some adult Ruffs change to a greenish leg colour in winter and a few juveniles have pink legs, typical of adults (Schmitt & Whitehouse 1976). Moreover, about 50% of adults examined there had dark spots on orange or pink legs. According to Pearson (1981) the orange leg colour is usually assumed between September and May of the second year, and rarely as early as the first spring or summer or as late as the beginning of the third year. Kozlova (1962) and Glutz von Blotzheim *et al.* (1975) also report that in winter the legs of at least some adults become less bright, fading even until they are greenish.

Taken together, our observations and those reported in the literature indicate that the majority, but probably not all Ruffs with orange legs caught in spring, are adults and those with greenish legs are juveniles.

We found a clear tendency for birds with greenish legs to have no bill ring, no orange patch on the lower mandible and fewer summer plumage feathers on the back and scapulars. This provides confirmation that these features are all characteristic of second year birds. However, it is equally clear that although these may be age-specific features, their occurrence is not consistent within a migratory season. Possibly this is an effect of differences in hormone levels between individual birds.

As there is so little difference in primary and secondary wear between orange and greenish legged birds (Fig. 2), it would seem that this is not a useful ageing criterion for Ruffs.

In conclusion it appears that ageing female Ruffs in spring is more difficult than might be expected from the literature. Although some birds can be distinguished as definite adult and definite second year, many other are impossible to age with confidence, especially those with intermediate characters. The main problems are the variability of these characters and lack of knowledge on the rate and time that they change over the first 2–3 years of the birds' lives. The only means by which these issues can be resolved is to examine a sufficient sample of known-age retraps (i.e. birds originally ringed as chicks or young juveniles) caught in their second and third calendar years.

Ringing recoveries show that birds trapped in Kenya and in South Africa belong to a quite different breeding popula-

tion to the birds stopping over in south and central Europe. Ruffs caught in Europe appear to derive exclusively from the mid and western Palearctic, whereas those from eastern and southern Africa breed further east (Glutz von Blotzheim *et al*. 1975, Pearson 1981, Underhill *et al*. 1999). It is not known whether these populations differ in the rate of change of leg colour or in the proportion of second-year birds with retained juvenile inner median coverts.

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