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Contents

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1. Ageing and subspecific identification of
Crested Serpent Eagle

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Cover photo Glaucous Gull *Larus hyperboreus*.
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Ageing and subspecific identification of Crested Serpent Eagle

ANTERO LINDHOM & ANNIKA FORSTEN

Crested Serpent Eagle *Spilornis cheela* (here also referred to as CSE) is a widespread and relatively common raptor of South and South-East Asia, South China and many Asian islands including Taiwan, Hainan, Borneo, Java, Sumatra and Sri Lanka (Ferguson-Lees *et al* 2001). There is much geographical variation, for example Dickinson & Remsen (2013) list 22 subspecies. Most of the subspecies are island residents, with unclear taxonomical relationships, but five are continental: *cheela* (Nepal, N India), *melanotis* (S India), *burmanicus* (SE Asia), *ricketti* (SC and SE China, N Vietnam) and *malayensis* (Thai-Malay Peninsula). These are also often considered sedentary, but there is some migration along the Thai-Malay Peninsula at least (*e.g.* DeCandido *et al* 2012). Rasmussen & Anderton (2012) mention that the species is a summer visitor in extreme NE Pakistan and Himachal and a winter visitor to the Gangetic plain.

This article discusses ageing of Crested Serpent Eagles and subspecific identification of those continental subspecies which may come in contact with each other and need to be separated in the field. The study is based on photographs, skins (from the collections of NHM, Tring, UK) and field study (in eight countries). There is little published previously about moult and ageing of this species. We did not make a comprehensive evaluation of the subspecies but tried to apply published characters (especially Ali & Ripley 1983, Baker 1928, Ferguson-Lees *et al* 2001) to skins, photos and field observations.

Subspecific identification

The overall trend of geographic variation in

mainland Asia is the clearly smaller size in the south. On the Indian Peninsula the northern birds have a darker head and show more blackish patterning on the underparts than the southern ones. In South-East Asia and China the northern birds are paler and less patterned than the southern ones. This geographical variation on the continent is normally divided into five subspecies (Ferguson-Lees *et al* 2001, Dickinson & Remsen 2013). The plumage differences described here refer to adult birds, but some of them are visible in brown-morph juveniles, although many juveniles show more patterning overall.

The size varies between subspecies but the differences are often not evident in the field. The nominate *cheela* is largest, South Indian *melanotis* is clearly smaller, but clinally (Ferguson-Lees *et al* 2001), *burmanicus* is between those two Indian subspecies in size, *malayensis* is distinctly smaller than *burmanicus* (smaller even than *melanotis*) and *ricketti* is larger than *burmanicus*, but still smaller than the nominate. The wing length of *malayensis* is only about 75% of the nominate, but there is also a sexual difference in size of about 5% in linear measurements. Some of the island forms not covered here are even smaller than *malayensis*. The larger subspecies, especially the nominate, show a somewhat more longish body with a proportionally smaller head compared to the middle-sized and smaller subspecies.

The colour differences of the extremes are quite evident and easy to see. But there is some clinal and individual variation and there are many individuals which are difficult to classify into any of the five subspecies without knowledge of their geographical origin.

The northern nominate (N India and Nepal) is the largest and proportionally has the smallest head.

The brown breast area is thinly barred, and the lower breast to flanks and belly variably and irregularly spotted, the spots being partly pale grey, partly black. The head may be almost black and in general there is little contrast between cheeks and crown, but some have mid-grey cheeks. Birds like this occur in Rajasthan, Uttarakhand, Nepal, (northern) West Bengal and Assam (skins, photos).

Melanotis of South India is normally quite easy to separate from the nominate. The breast has no distinct barring or other patterning. The lower underparts are patterned much as in the nominate. The head is paler than in the nominate, the cap is still darkish, but there is contrast to the greyish cheeks and chin. We could not find the consistent differences in the tail barring described in several sources – starting at least from Baker (1928). Birds like this occur in Karnataka, Goa, Maharashtra, Madhya Pradesh, Chhattisgarh and (southern) West Bengal.

The Indian subspecies come into contact with each other in north-central India. It seems that there is not much migration to the south of the breeding areas. We know of no nominate-like birds from the breeding area of *melanotis*. The separation of these two plumage types is relatively clear cut.

Malayensis of the Thai-Malay Peninsula is relatively distinct. It is the smallest and darkest of the mainland forms. The upper breast is an almost unpatterned brown, and the white spotting and barring on the underparts is large, regular and distinct. The overall impression of the underparts is of clearly-separated differently-patterned areas. The cheeks are often quite greyish. The head looks proportionally large and protruding and the body slim.

Burmanicus of South-East Asia is paler and quite barred and spotted compared to the nominate. The cheeks are paler and browner. The breast shows some light barring, much less and lighter than in the nominate. It comes in contact with the nominate in NE India, and birds in Assam, at least in the south, are not true nominate, but may be *burmanicus* or intergrades. *Burmanicus* is also paler and larger than *malayensis* with more barring on breast and less distinct spotting on lower underparts. They

come into contact somewhere in the southern parts of South-east Asia, but details are unknown.

Ricketti of N Vietnam and S China is larger and slightly paler than *burmanicus*. The patterning of the underparts is quite similar, but the upper breast may be slightly more barred on average. *Ricketti* and *burmanicus* are quite similar to each other and many individuals are difficult to assign to subspecies.

Sexing

Females are about 5% larger than males in linear measurements (Ferguson-Lees *et al* 2001). Other than that, we could not find anything in the literature about sexual plumage differences. Photos of paired birds show some size difference but very similar plumage.

Moult

According to Baker (1928), the Himalayan birds breed in spring, with the earliest starting in February, while the southern Indian birds may start in December. The eggs of *burmanicus* were taken from February to May. Baker (1935) stated that the species breeds on the plains in February and March but in the hills from March to May. Gokula (2012) reported that the breeding time in Tamil Nadu is from late November to early April, when the young fledge. According to Naoroji (2006), young in northern India often fledge in July. A similar fledging time seems probable for the northernmost and migratory populations more to the east. At least autumn juveniles there seem very fresh. In the Thai-Malay peninsula, nests are occupied from February to May (Wells 1999). It seems that the young fledge during the northern spring or early summer everywhere on the Asian mainland.

There is little information in the literature regarding the moult of the species. Our material for moult consists of 12 skins and 63 photos of varying quality, and may be regarded as rather too small for calculating many standard moult parameters. However, many observations can still be made. Primary and secondary moult contrasts were judged

from photos. It is easy to see whether the adjacent feathers are grown in the same season or not, but it is more difficult to classify the whole wing consistently – for example, whether the innermost and outermost primaries have grown during the same season. Even for feathers moulted in the same season the age difference may be considerable between those grown early and the later ones. It should also be noted that the terminology of feather generations or moult cycles is not very useful in cases like this, because the moult is not complete within any given year, and proceeds in several waves simultaneously. Because of uncertainties in judging the ages of feathers, we are cautious in some of our conclusions. Because of the relatively small material, we have had to combine the different geographical areas, which is not ideal because the combined area stretches from the subtropics with migratory birds into the tropics with resident breeders. However, this situation is helped by the roughly synchronised breeding in the whole area, and by the fact that most migrants are first-year birds and adults tend to be more sedentary (pers. obs. in southern Thailand).

Wells (1999) states that the primary moult proceeds outwards and in waves, with generally no more than two loci. We agree with both statements. Crested Serpent Eagle moults flight feathers mainly during the northern summer. The primary moult timing in our material is presented in Table 1. Birds in active moult in the material are from April to October, except one in November and two in January. Between June and September all post-juvenile birds were in primary moult (but $n=10$ only). One or two primaries may also be growing during the winter months. Wells (1999) found that 80% of his sample between May and August were moulting actively, in contrast to only 8% between September and April. It seems that the species' habits are such that damaged primaries are often seen and some of them are replaced all-year round, but this all-year round moult still does not seem to be very common. Adults seem to start moulting mostly after the young have fledged. They finish moulting before the new breeding season.

The start of the first moult occurs at about the same time as the onset of moult in adults – two 2cy birds

in March had not yet started, neither had one from Selangor, Malaysia on 4 May. So the birds are about one year old when they start their first moult and any birds that have two generations of primaries in winter are at least in their second winter. The first primary moult was still ongoing but presumably finishing in 2cy birds on 31 August (Perak, Malaysia) and 21 October (Peninsular Thailand). After the first moult, the birds have replaced 3-6 inner primaries, and 2-6 secondaries (it varies, but most often both the inner and outer and some central ones) and half to all tail feathers ($n=19$ for primaries, less for other feather tracts).

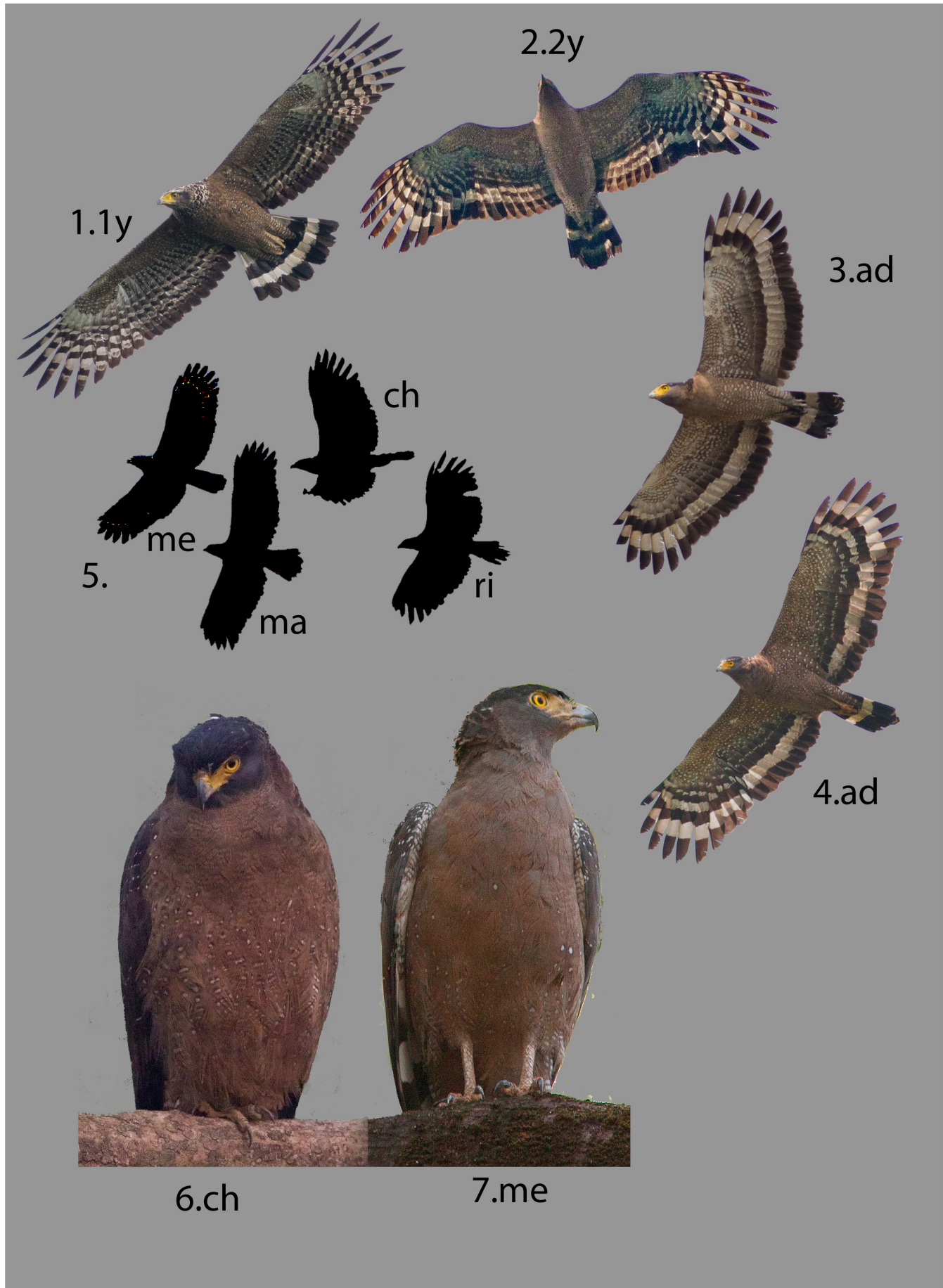
The next moulting season had still not started on 6 March (Annam), 6 April (Arunachal) and possibly 2 June (Guangdong). It was ongoing on 14 May (Madhya), 10 September (Maharashtra) and had ended on 16 November (Perak). The moult wave continues from where it was suspended after the first season, and a new wave starts from the inner primaries. After the second moult, there were still 1-3 juvenile primaries left ($n=5$). If however, there had been a bird of this age class in the material that had dropped all juvenile primaries, we would most probably have missed it, and it even seems probable that this does happen.

The adults also have several moult waves that proceed outwards. Post-juvenile birds always have remiges of different generations ($n=68$) (Wells, 1999, writes that “few” replace the whole wing in one moult, but we are not convinced that this happens at all). There are typically 2-4 adjacent primaries of the same age class, which means that this number of primaries is moulted in one season in one moult wave. Extrapolating from this, it may be possible for a bird to moult all its primaries in two consecutive seasons, but it may also take three years, as in many sub-adult birds. The wing feather moult is very often unsymmetrical.

Ageing

It was not possible to study any known-age individuals, but the pattern is quite consistent.

Adult. A bare yellow area between the bill and eye joins a yellow cere. Warm yellow iris. Puffy crest and blackish crown. Otherwise quite brownish



Photos © Annika Forsten

1. Juvenile. Note the barring of remiges and very fresh plumage. Khao Dinsor, Chumphon, Thailand, 20 October 2012.
2. Second calendar-year. The inner primaries and outer secondaries were moulted and then the moult was suspended. Khao Dinsor, Chumphon, Thailand, 20 October 2012.
3. Adult *malayensis*. All remiges are of adult type, but of varying age. 12 February 2014 Kuala Selangor, Selangor, Malaysia.
4. Adult. Most migrating birds at Khao Dinsor are in their first or second year. There are sedentary birds in the general area, which look quite like *malayensis*. But this individual, which was moving, does not have as large and regular spotting on the belly as typical *malayensis* and seems to have the proportions of a larger bird, so presumably a migrant *burmanicus*. Khao Dinsor, Chumphon, Thailand, 16 October 2012.
5. Comparison of the proportions of adults of different subspecies. *Melanotis* from Goa, India, *malayensis* from Selangor, Malaysia, nominate *cheela* from Bhutan and *ricketti* from Hong Kong. Large *cheela* and *ricketti* show a proportionally smaller and more protruding head and somewhat broader wings.
6. Adult nominate *cheela*. Chitwan NP, Nepal, 23 November 2013.
7. Adult *melanotis*. Compared to the nominate *cheela*, it shows a plainer upper breast without dark barring and a paler head. Goa, India, 22 January 2007.

underparts, with darker lower head and brownish underwing-coverts. A broad, pale grey sub-terminal band traverses the primaries and secondaries. The fingers and trailing edge of the wing are sharply-defined black and contrast to the pale sub-terminal band. On the inner side of the latter there is a narrower dark bar. The upperside of the wing has a similar, but much less contrasting pattern. The pattern of the tail is similar.

There are two morphs of **juvenile** CSE, with intermediates. One has a brown body plumage, superficially similar to adult plumage, and the other is very different, whitish. The brown morph seems to be more common, at least in South-East Asia. In pale individuals the underparts from chin to undertail-coverts are mostly pale buffish and very variably dark-streaked, sometimes almost unstreaked. They have a blackish mask. Pale morph individuals occur at least in the subspecies *cheela*, *melanotis*, *ricketti* (and *batu*, *hoya*). They are common in India, but it is possible that the pale morph does not occur at all in *malayensis* (Wells 1999).

Both morphs have a similar yellowish area

between the bill and eye, and also a prominent crest as in adults, but the eye is duller and more greenish. Brown morph individuals differ from adults by having whitish fringing on crown and neck. Adults have some white feather tips on the neck and upperwing-coverts (which wear off) but they are narrower and adults also show white spots on the lesser and median coverts.

The best ageing character is the barring on the remiges and rectrices. In juveniles, the bars are narrower than in adults and therefore more similar to those in other raptor species (*e.g.* Hawk Eagles and Honey Buzzards), and the terminal band is less well defined.

It is possible to age two age classes of **sub-adults**. The second generation of body plumage always seems to be brown. The brown morph juvenile plumage is quite similar to the adult and sub-adult body plumage (especially when worn) but the pattern of the remiges is very different, it is easiest to age sub-adults by their flight-feathers. The second generation of remiges seem to be inseparable from those of adults. If there are some adult feathers of the same age and the rest are juvenile feathers, then the bird is in its **second**

year. After the first moult, about half of the primaries show an adult type pattern and somewhat less than half of the secondaries show a similar pattern contrasting to the worn juvenile feathers.

Third-year birds show adult remiges of two different ages and some juvenile feathers. Typically, after the second moult, the innermost primaries are fresh, the next ones are slightly worn adult type primaries, the following very fresh adult primaries and the outermost one or two are of juvenile type. There may be no juvenile primaries left, but the age of the bird should still be possible to judge from this moult pattern (fresh-worn-fresh). Most of the secondaries are adult-type in this age, a few are juvenile.

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