

# Has the juvenile plumage of Honey-buzzard evolved to mimic that of Common Buzzard?

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47. Common Buzzard *Buteo buteo*. Günter Bachmeier

**ABSTRACT** Juvenile Honey-buzzards *Pernis apivorus* exhibit a striking resemblance to Common Buzzards *Buteo buteo*, even though the two species are not closely related. Both species, but particularly Honey-buzzards, rather frequently fall prey to Northern Goshawks *Accipiter gentilis* on their Western Palearctic temperate-forest breeding grounds. The author suggests that the juvenile plumage of Honey-buzzard may have evolved to resemble the plumages of the better-defended and more abundant Common Buzzard, in response to this predation pressure. Data in support of this hypothesis are presented and discussed here. These relationships are placed in the context of previously proposed mimicry relationships involving *Pernis* species.

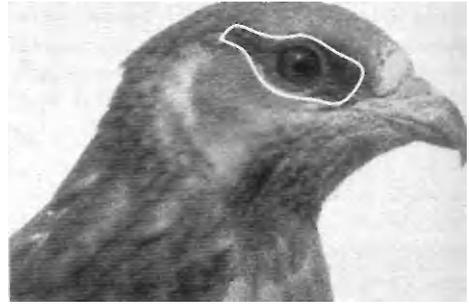
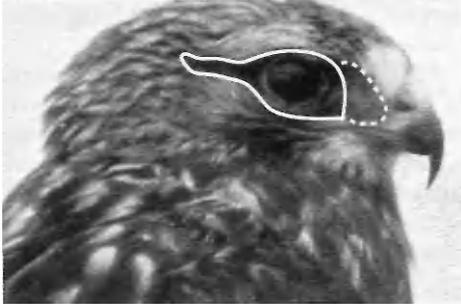
The similarity in appearance of Honey-buzzards *Pernis apivorus*, particularly juveniles, to Common Buzzards *Buteo buteo* has often been described in the literature (more recently by, for example, Cramp & Simmons 1980, Porter *et al.* 1981, Gensbøl & Thiede 1997, Beaman & Madge 1998, Svensson *et al.* 1999 and Ferguson-Lees & Christie 2001). Forsman (1999) even called juvenile Honey-buzzards 'probably the most often misidentified raptors in Europe'. Indeed, juvenile Honey-buzzards show a close, almost uncanny resemblance to Common Buzzards in many ways, in plumage as well as to some extent in structure, across a whole range of plumage morphs (dark to pale) in both species. Human observers can usually distinguish the two species on account of subtle differences in the manner of flight, structure and plumage, as described in the texts cited above. Nonetheless, there exists, in principle, a possibility that this similarity in appearance represents an adaptive evolutionary strategy, a case of 'Batesian mimicry' – the name given to the situation where a harmless or edible prey species evolves to resemble a toxic or otherwise harmful species, so that predators avoid it (Bates 1862). This, for example, is presumed to be the case with the wasp *Vespa*-like patterning shown by many species of insect, such as hoverflies (Syrphidae). One alternative possibility would be a purely coincidental resemblance, perhaps resulting from the genetic relationship (albeit distant) between the two raptor species. Raptors tend in any case to share a rather limited range of typical plumage feature types across the different families. A second explanation could be convergent evolution on account of the different species 'responding' similarly (but independently) to shared environmental pressures. A plausible mechanism for this latter possibility is not obvious, however. The hypothesis presented and discussed here is that this resemblance of juvenile Honey-buzzard to Common Buzzard is a sophisticated example of Batesian mimicry, and that evolution has conferred upon the relatively harmless juvenile Honey-buzzard a degree of protection against predation by Northern Goshawk *Accipiter gentilis*. These two raptors, and Common Buzzard, are sympatric over a large area of Western Palearctic temperate forest (Cramp & Simmons 1980; Hagemeijer & Blair 1997). Such relationships cannot be proven with certainty and must remain by

their nature speculative, but this article examines some arguments for this hypothesis. Ferguson-Lees & Christie (2001) referred to plumage mimicry by various honey-buzzards (and other raptors) in their individual species texts, and both they and their contributor, Dr Carl Edelstam, cited a paper by Edelstam & Ben King as 'in preparation', but unfortunately that has still not been published. These workers suggest that Honey-buzzards mimic a range of different raptor species on their wintering grounds, Common Buzzard not being mentioned as a model species.

Honey-buzzards and Common Buzzards are of approximately similar size and shape and share certain plumage features, most notably rather uniform brown upperparts and typically a rather similar pattern of pale and darker areas on the underwing, usually including obvious dark carpal patches. In particular, juvenile Honey-buzzards show a range of features which are different from those of adult Honey-buzzards, but which resemble corresponding features of Common Buzzard. The descriptions in the above-mentioned identification literature, as well as the photographs in Porter *et al.* (1981) and Forsman (1999), yield the following, possibly *Buteo*-mimicking, features of juvenile Honey-buzzard which differ from those of adult birds:

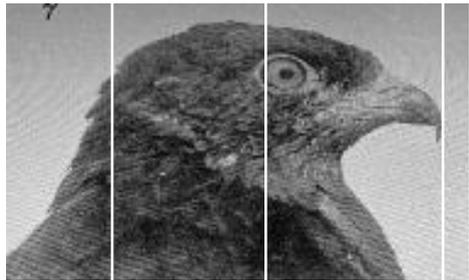
- i underparts often streaked rather than broadly barred (cf. juvenile Common Buzzard);
- ii underwing-tips more extensively dark;
- iii underside of flight-feathers more densely barred (4–5 strong bars instead of 1–3);
- iv this barring petering out in strength across outer primaries resulting in a plainer whitish area between carpal markings and primary tips;
- v generally more uniform and less prominently striped underwing-coverts;
- vi tail-barring less pronounced and more even;
- vii cere yellow instead of grey;
- viii eye dark instead of bright yellow;
- ix slightly shorter inner primaries and tail.

Some of these features are, however, shared by many juvenile raptors, making it difficult to distinguish coincidental from adaptive effects. Nonetheless, the sum of these features (together with the other features that both juvenile and adult Honey-buzzards share with Common Buzzards) results in a striking similarity between these two only distantly related taxa.



48. Rough-legged Buzzard *Buteo lagopus*, showing the 'hooded eye' – a combination of shadow and slightly darker feathering – typical of *Buteo* species to good effect; from Heinroth & Heinroth (1926), plate 153.

49. Juvenile Honey-buzzard *Pernis apivorus*. Compare the shape of the dark feathering around the eye of this typical-morph bird with the *Buteo* in plate 002; the dark eye-mask may mimic the 'shaded eyes' of Common Buzzard *B. buteo* and lend the young Honey-buzzard a more typically raptorial facial appearance. From Heinroth & Heinroth (1926), plate 153.



50. A young Honey-buzzard *Pernis apivorus* recently moulted out of juvenile plumage has largely lost the 'mask' of darker feathering around the eye, and the 'pigeon/cuckoo-like' jizz is developing. Common Buzzard below for comparison; from Heinroth & Heinroth (1926), plate 153.

51. Honey-buzzard *Pernis apivorus* (above) has the eyes set marginally further back in the head than Common Buzzard (below), which has the eye comparatively closer to the bill; from Heinroth & Heinroth (1926), plate 153.



52. A pale juvenile Honey-buzzard *Pernis apivorus* showing a striking 'mask effect'. Does the mask have an additional effect in suggesting that the eye is further forward in the head than it really is? From Heinroth & Heinroth (1926), plate 153.

One aspect which is particularly interesting is the presence of an area of dark feathering through the eye of juvenile Honey-buzzard, which for human observers can even be used as a distinguishing feature from Common Buzzard. However, close inspection of photographs of perched birds of both species (e.g. Heinroth & Heinroth 1926, Bijlsma 1993) reveals that this feature resembles in form the combination of shadow and slightly darker feathering around the eye of Common Buzzard, although somewhat exaggerated in juvenile Honey-buzzard (see plates 002 and 003 in particular). The rather uniformly convex head shape and lack of projecting raptorial brows of Honey-buzzard lead otherwise to a lack of shadow in this area and a rather different, cuckoo-like facial expression, most striking in adult males with their uniform grey head plumage. The dark eye-mark may thus mimic the shaded eyes of Common Buzzard and lend the young Honey-buzzard a more typically raptor-like facial appearance.

The resemblance between the two species extends across a range of plumage morphs of both species. Ferguson-Lees & Christie (2001) described a total of seven plumage morphs of juvenile Honey-buzzard – dark brown, rufous, buff, melanistic, olive-brown, light and whitish, the first four of which they noted as having rather similar counterparts among young *Buteo* species. In addition, the identification literature confirms that the light and whitish phases show

significant resemblance to pale juvenile and adult plumages of nominate Common Buzzard.

#### *Possible reasons for mimicry-based similarity of juvenile Honey-buzzards and Common Buzzards*

If mimicry is indeed occurring, which raptor is imitating which? Mimicry is predicted to be most effective when a scarce species imitates a commoner one (see [www.britannica.com](http://www.britannica.com), entry for 'mimicry'). In the present case, Honey-buzzard is currently much the scarcer of the two species, the estimated European population (excluding Russia and Turkey) being 41,200–48,677 breeding pairs compared with 370,933–472,444 for Common Buzzard (Hagemeyer & Blair 1997). Data from the near-primeval habitats within Białowieża forest, Poland, suggest that Common Buzzard may also have been the more abundant species in prehistoric times, although not by the large margin suggested by the current total European population estimates. Recent breeding population densities for Common Buzzard and Honey-buzzard within these habitats have been recorded at around 0.5 and 0.2–0.3 breeding pairs per km<sup>2</sup> respectively (Tomiałojć & Wesołowski 2005; W. van Manen *in litt.*; L. Tomiałojć *in litt.*). Honey-buzzard is also a comparatively poorly defended species, possessing a relatively weak bill, and claws which are adapted primarily for digging and walking rather than for subduing and killing prey (Glutz von Blotzheim *et al.* 1971); Common Buzzards are stronger and fiercer. This would suggest that the evolutionary pressure for the mimicry is likely to be the avoidance of predation by a third species, Honey-buzzard having evolved such that its juvenile plumage mimics the plumage of the more aggressive Common Buzzard (and not vice versa).

Clues as to the possible identity of this third predator are provided by recent literature from western and central Europe. For example, data from The Netherlands during the period 1990–2004 showed that predation by Northern Goshawks affected up to 30.8% and 33% of Honey-buzzard nests in study areas in the Veluwe and Drenthe respectively, the data being averaged over five-year periods (Bijlsma 2004). These losses involved nestlings, fledglings and/or adults. This phenomenon has been increasing sharply in The Netherlands over the last 30 years, a trend ascribed partly to concur-

rent declines in the hawk's major prey species, such as pigeons (Columbidae) and Rabbits *Oryctolagus cuniculus*. In addition, Bijlsma (2004) described his observation of a nearly fledged, 41-day-old Honey-buzzard nestling being partly eaten by a juvenile female Goshawk, the young Honey-buzzard dying shortly after the hawk had been flushed off. In the German federal state of North Rhine-Westphalia, predation of nestlings by Northern Goshawk was the most frequent single recorded cause of breeding losses over the years 1972–98 in a state-wide monitoring programme for Honey-buzzard (Arbeitsgruppe Greifvögel Nordrhein-Westfalen der NWO 2000). The authors even went on to suggest that recent population increases in Northern Goshawk may be partly implicated in the observed decline in Honey-buzzard productivity over the same period. Their study recorded 346 unsuccessful nesting attempts out of 1,227 monitored, but in only 38 of these was it possible to establish the reason for failure. Undetected predation of adult birds may be the reason behind a proportion of the unattributed nesting failures. The study examined breeding success in terms of numbers of young to fledge, and so predation of fledged young may also have gone unrecorded.

A further indication of the status of Honey-buzzard as a prey species may be the head shape, which, as already discussed, lacks the hooded eyes, i.e. pronounced, projecting brows, of typical raptors. The eyes are positioned pigeon-like on a rather convex head surface and thus honey-buzzards must have better all-round vision than most raptors. A photograph of an adult male in Bijlsma (1993) shows that both eyes are visible simultaneously when the head is viewed from above, which is not the case with most other raptors. Extra vigilance must be especially important when digging out wasp nests on the ground, when the birds must be particularly vulnerable to attack (van Nie 2002). A fright-moult (shock-moult) reaction, in which an attacked bird instinctively sheds grasped feathers to allow it to escape, has also been described from adult Honey-buzzards, for example in response to Northern Goshawk attack. Honey-buzzard is so far the only raptor species known to exhibit this particular adaptation to predation pressure (van Nie 2002).

For the mimicry hypothesis to be valid, Common Buzzards must be less at risk of Northern Goshawk attack than are Honey-buz-

zards, owing to their being recognised as a well-defended species and so more likely to injure predators during an attack. Here, the available data are rather unclear. Glutz von Blotzheim *et al.* (1971) referred to numerous incidences of Northern Goshawks killing incubating *adult* raptors, including other Northern Goshawks and 'buzzards', with smaller raptors, such as Eurasian Sparrowhawk *A. nisus*, being even more regularly caught. A German study of Northern Goshawks during 1980–94, in an area of the border between the federal states of North Rhine-Westphalia and Lower Saxony (Krüger & Stefener 1996), recorded 13 instances of Northern Goshawk predation of fledged young and adult Common Buzzards (age not distinguished), compared with only one of Honey-buzzard from an analysis of 5,167 plucked prey remains (these statistics do not include downy nestlings, which are normally taken straight to the nest without being plucked; O. Krüger pers. comm.). However, the ratio of the German breeding populations of the two species is about 20:1 in favour of Common Buzzard (Hagemeijer & Blair 1997), and the study area concerned possesses a relatively low Honey-buzzard population density, at least on the North Rhine-Westphalian side of the state border (Arbeitsgruppe Greifvögel Nordrhein-Westfalen der NWO 2000). Ignoring the small sample size for a moment, we can conclude that even a ratio of 1:13 would represent an over-proportional take of Honey-buzzards. An update of these predation statistics for the period 1981–2002 (7,973 prey items; O. Krüger *in litt.*) yields an almost unchanged ratio of 2:25. In contrast, for a population of Northern Goshawks in the Dutch province of Drenthe, three Honey-buzzards and four Common Buzzards were reported among 3,286 pluckings, which clearly points towards Honey-buzzards being targeted preferentially by Northern Goshawks (Bijlsma 1993). The statistics of the predation frequency will, of course, be influenced in turn by the success of the mimicry adaptation and any protective behavioural strategies!

In support of the proposed difference in vulnerability, newly fledged Common Buzzards left alone by their parents are often highly vocal, whereas Honey-buzzards at this age are usually less so (Arbeitsgruppe Greifvögel Nordrhein-Westfalen der NWO 2000), being in general rather secretive and quiet. Bijlsma (1993)

described how young Honey-buzzards often remain in the vicinity of the nest between fledging and migrating: 'They behave in this phase of the breeding cycle, in contrast to when younger, very quietly. Even the arrival of a food-carrying parent initiates only little begging response. This type of behaviour has clear survival value, as both parents are away from the nest for long periods and the young are hardly capable of defending themselves against predators such as the Northern Goshawk' [my translation]. In contrast to this, Glutz von Blotzheim *et al.* (1971) described a vociferous behaviour of fledged juvenile Honey-buzzards. This seems, however, to refer specifically to birds in flight, perhaps accompanied by the parents (i.e. begging flights; Arbeitsgruppe Greifvögel Nordrhein-Westfalen der NWO 2000). The evidence for the vulnerability difference presented so far may not be conclusive but, taken as a whole, and despite the paucity of data and unavoidable circularity of the argument, it points towards Honey-buzzards being intrinsically rather more at risk of predation by Northern Goshawk than are Common Buzzards.

Whether or not a visual mimicry will be effective obviously depends on the predator responding to visual signals. Attacking other medium to large raptor species must be a risky action for a Northern Goshawk. For example, a Common Buzzard alerted to the attack could quite feasibly inflict an incapacitating injury on the hawk, resulting in eventual death from starvation. This means that an attacking hawk will have to execute a split-second decision: whether to carry through its attack or whether to pull out, if seen by its prey. This is in marked contrast to its tactics when attacking its more usual prey species, which are only capable of fleeing and not of self-defence. On the other hand, other raptor species must be relatively easy to approach unawares from behind, possessing relatively forward-facing eyes (though less so in Honey-buzzard) and often concentrating on locating their own prey (and especially vulnerable when sitting on the nest). It is likely that a perched Common Buzzard or Honey-buzzard, noticing the approach of the Northern Goshawk at the last moment, will open their wings and, if possible, try to turn their underside and talons toward the attacker. A flying bird is also likely to present talons. The strikingly Common Buzzard-like underwing, undertail and underbody pattern of juvenile

Honey-buzzard may help to encourage the Northern Goshawk to pull out of the attack rather than press through with it, fearing a greater chance of injury than the Honey-buzzard is actually capable of inflicting. Observations of captive young birds confirm that fledged juvenile Honey-buzzards partially spread their wings when threatened (Heinroth & Heinroth 1926). Northern Goshawks often approach their prey from below using the ground as cover (Glutz von Blotzheim *et al.* 1971) and, during such an approach, a signal provided by the underparts patterning of a fleeing bird might prove an effective deterrent. In addition, captive fledged juvenile Honey-buzzards have been described as emitting a 'drawn-out, Common Buzzard-like mew' when agitated (Heinroth & Heinroth 1926), a tentative indication of a possible aural reinforcement of the visual signals upon being attacked.

Bijlsma, quoted in Arbeitsgruppe Greifvögel Nordrhein-Westfalen der NWO (2000), reported cases where adult Honey-buzzards have not been able to repel an attacking Northern Goshawk, even when aware of the attack, confirming that, in the case of Honey-buzzard at least, Northern Goshawks will sometimes take the risk of pressing home an attack on an alerted adult raptor. In many other cases, however, adult Honey-buzzards were seen to be successful in driving off attacking Northern Goshawks from themselves and/or their nestlings.

A persistent vulnerability of fledged Honey-buzzard juveniles to predation by Northern Goshawk, documented by Bijlsma (2004), despite their close resemblance to Common Buzzard, does not invalidate the mimicry hypothesis. Even if Northern Goshawks are not always taken in by the resemblance, the mimicry may lead in some cases to a momentary hesitation in the hawk's attack, allowing the young Honey-buzzard to escape. It is also feasible that a plumage mimicry which evolved in the distant past has persisted, although the Northern Goshawk in the meantime has evolved an ability to distinguish the two species and the subterfuge is currently rarely effective. In contrast with many of the classic cases of Batesian mimicry, the mimicked species does not exhibit an obvious warning (aposematic) coloration, so the effectiveness of the strategy is dependent on the Northern Goshawk carrying out a sophisticated (but fallible) assessment of

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53. Juvenile Honey-buzzard *Pernis apivorus* of the frequent dark/warm brown morph, Finland, September 2001. Note the overall similarity in plumage to that of the Common Buzzard *Buteo buteo* in plate 008, and the aquiline facial expression conferred by the dark mask.

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54. Second calendar-year Common Buzzard *Buteo buteo*, Israel, April 2000.



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55. Juvenile Honey-buzzard *Pernis apivorus* of the frequent dark/warm brown morph, Sweden, September 2004. Note the striking similarity in underwing pattern, particularly the distribution of barring across the flight feathers, to that of the Common Buzzard in plate 00Z.



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56. Common Buzzard *Buteo buteo*, Greece, March 2005.

potential prey before attacking. The protective effect is obviously not so pronounced that young Honey-buzzards can afford to behave conspicuously!

#### *Mimicry relationships in other Pernis species*

Del Hoyo *et al.* (1994) and, in rather more detail, Ferguson-Lees & Christie (2001) and references cited therein describe various examples of plumage similarities in raptor species not closely related to each other, some thought to be coincidental, others adaptive. Intriguingly, Crested [Oriental] *P. ptilorhyncus* and Barred Honey-buzzards *P. celebensis*, the eastern counterpart species of *P. apivorus*, are thought to show mimicry relationships with hawk-eagles *Spizaetus*. In these cases, the direction of the mimicry is not clear, i.e. whether the hawk-eagle is mimicking the honey-buzzard with the advantage of appearing innocuous to its prey, or whether the honey-buzzard is feigning greater ferocity in order to deter potential predators. Van Balen *et al.* (1999) proposed the following mimic pairs within the Oriental region: 'Malaysian Crested Honey-buzzard' *P. p. torquatus* (adult dark morph) and Blyth's Hawk-Eagle *S. alboniger*; Malaysian Crested Honey-buzzard (adult 'normal' morph) and Wallace's Hawk-Eagle *S. nanus*; Javan Crested Honey-buzzard *P. p. ptilorhyncus* (immature) and Javan Hawk-Eagle *S. bartelsi* (immature); Barred Honey-buzzard *P. c. steerei/winkleri* (adult and immature) and Philippine Hawk-Eagle *S. philippensis*; and Barred Honey-buzzard *P. c. celebensis* (adult and immature) and Sulawesi Hawk-Eagle *S. lanceolatus*. Ferguson-Lees & Christie (2001), in their detailed species texts, additionally refer to the broad and presumed mimicry-related similarity of *P. ptilorhyncus* subspecies to a group of Indo-Malayan *Spizaetus* spp. To this list could tentatively be added 'Siberian Crested Honey-buzzard' *P. p. orientalis* and Mountain Hawk-Eagle *S. nipalensis* of the race *orientalis* (see for example Williams 2000), which are currently sympatric during the breeding season in Japan at least. These eastern *Pernis* taxa differ from *P. apivorus* by their larger size, prominent crest (in many cases), presence of a gular stripe and lack of an obvious carpal patch on the underwing. The similarities within the species pairs are described as extending to flight silhouette, presence or absence of crest, breast and belly coloration and tail pattern.

#### *Mimicry on the wintering grounds*

To what extent the *Buteo*-like plumage characteristics of juvenile Honey-buzzards confer any protection on the African wintering grounds is unclear. Here, the genus *Buteo* is represented above all by wintering eastern Common Buzzards ('Steppe Buzzards') *B. b. vulpinus* (Cramp & Simmons 1980), as well as by wintering Long-legged Buzzards *B. rufinus* and the African species Red-necked Buzzard *B. auguralis* (del Hoyo *et al.* 1994). Many juvenile Honey-buzzards show rather more rich, rufous-brown underbody coloration than western Common Buzzards (Forsman 1999), which might just possibly increase the protective effect in sub-Saharan Africa, the above-mentioned buzzard taxa having more rufous-coloured body plumage than does Common Buzzard. Steppe Buzzard is also, of course, sympatric with Honey-buzzard during the breeding season and this might be of significance in the evolution of this feature. The rufous tail of *vulpinus* (and *rufinus*) is not mimicked, however. An open question would be how much certain plumage features of darker juvenile Honey-buzzards – such as the dark secondaries and resulting contrast between inner and outer parts of the underwing, the often rather uniformly dark and/or rufous underbody and indeed even the dark eye-patch – have been influenced by the abundant presence of well-marked, juvenile Black Kites *Milvus migrans parasitus* on the wintering grounds.

The rather less *Buteo*-like appearance of adult Honey-buzzard could be consistent with the reduced vulnerability of adults and their need to advertise territories and find mates, thus favouring more unambiguous species recognition. Indeed, particularly for adult males of many species, conspicuousness often evolves as an advertisement of fitness, despite an obvious negative survival value. In comparison, in the eastern *Pernis* species it is often the adult plumages which are thought to exhibit mimicry. In only one of the above-mentioned *Pernis/Spizaetus* mimicry pairs proposed by van Balen *et al.* does the effect extend only to the 'immature' plumages (of both species in this case).

Edelstam & King (in Ferguson-Lees & Christie 2001) proposed a different hypothesis, namely that the enormous variability of (mainly adult) plumages of Honey-buzzard mimics a range of different raptor species on

the wintering grounds. According to Edelstam & King, the various plumage morphs mimic specific plumages of more powerful raptors, thus allowing Honey-buzzard to achieve protection from its enemies, the relative scarcity of each of the raptor models involved having caused the mimic to split into a number of morphs. Ferguson-Lees & Christie (2001) wrote of Honey-buzzard: 'Each morph of this relatively weak insectivorous kite corresponds to an age class or a colour morph of one or more mainly Afrotropical raptors, including six hawk-eagles, seven snake-eagles and two large Accipiters'. They mention in this regard Booted Eagle *Aquila pennata*, Short-toed Eagle *Circaetus gallicus*, Wahlberg's *Hieraaetus wahlbergi* and Long-crested Eagles *Lophaetus occipitalis*, Ayres's *H. ayresii* and Cassin's Hawk-Eagles *Spizaetus africanus*, together with the African breeding Snake-Eagles *Circaetus* spp., African Goshawk *Accipiter tachiro* and Great Sparrowhawk *A. melanoleucus*. Quite possibly, different evolutionary strategies are followed with respect to the highly variable adult and the rather more stereotyped juvenile plumages of Honey-buzzard.

The identity of potential predators in Africa south of the Sahara which might discriminate between *Buteo* and *Pernis* is unknown. However, the proposed mimicry of mainly Afrotropical small eagles described above suggests that predation pressure is significant and that survival benefits can be gained by mimicry on the wintering grounds. The fact that the insectivorous *Pernis* species spend much more time in their wintering than in their breeding ranges will, as pointed out by Edelstam & King, favour the development of mimicry of models present in winter. Nonetheless, this must be set against the intrinsically greater vulnerability of newly fledged birds on the breeding grounds. In contrast to the situation for European Honey-buzzard, there is relatively little overlap with the ranges of *Buteo* species on the wintering grounds of Crested [Oriental] Honey-buzzard, since *B. b. japonicus* winters only in the north of this area (Ferguson-Lees & Christie 2001). The fact that young European Honey-buzzards are accompanied in winter by *Buteo* models may have allowed the *Buteo* mimicry to develop in *Pernis apivorus* and not in *P. ptilorhynchus*. This, combined with the absence of *Spizaetus* eagles in the breeding areas of European Honey-buzzard, and the comparative lack of those

eagles in the wintering grounds, may well have led to the divergent appearance of European Honey-buzzard compared with its eastern relatives.

### Conclusion

The hypothesis that juvenile Honey-buzzards have evolved to mimic Common Buzzards is distinctly plausible on several counts. Given the present state of knowledge, all that can be attempted here is a plausibility analysis. The available field data are not extensive, while experimental evidence, comparing survival rates of two populations of Honey-buzzards, one *not* exhibiting mimicry of a better-armed species, is not available. Clearly, more data on Northern Goshawk predation rates of Honey-buzzard and Common Buzzard, differentiating if possible between adult, fledged young and nestling, and whether taken on or away from the nest, would contribute to the debate, as would further field observations and experiments with mounts (cf. Krüger 2002). Nonetheless, the hypothesis that mimicry has played a key role in the evolution of the juvenile Honey-buzzard's appearance stands up to the evidence currently available.

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