

Distribution and field identification of Philippine birds of prey:

1. Philippine Hawk Eagle (*Spizaetus philippensis*) and Changeable Hawk Eagle (*Spizaetus cirrhatus*)

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The two forest dependent, and therefore endangered, hawk eagles of the Philippines were studied in the course of an eco-morphological raptor study carried out mostly in Luzon and Mindanao. The Philippine Hawk Eagle *Spizaetus philippensis* with its two subspecies is endemic to the Philippines, whereas the Changeable Hawk Eagle *Spizaetus cirrhatus* (ssp. *limnaetus*) is widely distributed throughout South-East Asia. Both species were studied in the field, in captivity and in museum collections. The Philippine Hawk Eagle was mainly found in extensive rain forests from sea level up to the mossy forest zone. In contrast, the Changeable Hawk Eagle was observed only very locally and at low elevations. Breeding records of the latter species were obtained, which provide the first breeding evidence in the Philippines. Plumage and silhouettes of both perching and flying birds are described, including the transition from juvenile to adult plumage. The major differences are in the plumage patterns, shape of the head, and form and posture of the wings. Similarities with other raptor species are pointed out in order to avoid misidentifications in the field. The adult Philippine Hawk Eagle can be easily confused with the Barred Honey-buzzard *Pernis celebensis* because of similarities in plumage colour and pattern, and the form of wings and tail. Both hawk eagles have a white juvenile plumage resembling that of the juveniles of five other raptor species (Barred Honey-buzzard, Oriental Honey-buzzard *P. ptilorhyncus*, Rufous-bellied Eagle *Hieraaetus kienerii*, Philippine Serpent Eagle *Spilornis holospilus*, and Philippine Eagle *Pithecophaga jefferyi*) and the adult plumage of the Philippine Eagle.

INTRODUCTION

The two medium-sized hawk eagles of the genus *Spizaetus* are important members of the Philippine raptor community. The Philippine Hawk Eagle *Spizaetus philippensis* is listed in the world list of threatened birds as vulnerable (Collar *et al.* 1994). The Vulnerable category refers to a high risk of extinction in the wild within the medium-term future. *S. philippensis* is endemic to the Philippines and has been recorded on 11 islands, including the main islands Luzon, Mindanao and Palawan as well as the islands of the Visayan region Mindoro, Leyte, Negros and Samar (Dickinson *et al.* 1991), and Bohol (Hornskov 1995, Sargeant 1992). In addition, it has been observed in the past on the small islands of Siquijor, Biliran (Visayan region) and Basilan (Sulu Archipelago). Recent reports, however, exist only for some of these islands: Luzon, Mindoro, Negros, Bohol and Mindanao (e.g. Miranda 1987, Dickinson *et al.* 1991, Brooks *et al.* 1992, 1995, Dutson *et al.* 1992, Danielsen *et al.* 1993, Evans *et al.* 1993a, Hornskov 1995). The lack of recent reports on the smaller islands may indicate that the species has either become very rare or has completely disappeared. On Siquijor it seems likely to be extinct: the last report stems from 1896, documented in Rand and Rabor (1960), and the species has not been observed in the course of recent expeditions (Evans *et al.* 1993b). In some cases the respective islands simply have not been sufficiently explored. Nevertheless, it can be assumed that the Philippine Hawk Eagle still

inhabits some other islands (e.g. Panay) or at least lived there before the onset of intensive destruction of the rainforests (e.g. Cebu).

The polytypic Changeable Hawk-Eagle *Spizaetus cirrhatus* is, in our view, also threatened in the Philippines. The species has a vast breeding range, from India east to South-East Asia, and south to the Sundas. In the Philippines, the subspecies *S. c. limnaetus* has been recorded in the western and southern parts of the country, i.e. Mindoro, Lubang, Busuanga, Culion, Palawan and Mindanao (Dickinson *et al.* 1991, Evans *et al.* 1993a) and in Bohol (Buck *et al.* 1990). Dickinson *et al.* (1991) recommended that Platen's specimen from Mindanao in the collection of the Staatliches Naturhistorisches Museum Braunschweig (Germany) 'should perhaps be re-examined since Mindanao represents an outlier in the distribution pattern.' However, the species was recorded in two sites on Mindanao during this study (see below).

The status of both species in the Philippines during the last few decades is poorly known (McGregor 1909, Delacour and Mayr 1946, Amadon 1953). Dickinson *et al.* (1991) considered both species to be uncommon, with *S. philippensis* being restricted to lowland and mid-mountain forests and *S. cirrhatus* to forested areas. However, the Changeable Hawk Eagle had, until this study, not been recorded as a breeding resident. Low population density, in addition to habitat loss as a consequence of rain forest destruction, may have prevented ornithologists from confirming its breeding.

Another complication could be that the two species are difficult to identify, in contrast to other raptors (e.g. *Haliaeetus*, *Spilornis*, *Butastur*, *Microhierax*). Plumage and shape are similar and the size difference is hardly a useful field character. Nevertheless, this paper sets out to demonstrate that these two raptors can be clearly separated.

MATERIALS AND METHODS

Initially, skins were examined in various museums and morphological measurements and photographs of plumage patterns were taken. Nineteen skins of the Philippine Hawk Eagle were available, which were all measured morphometrically. The Changeable Hawk Eagle is much more common in museums; more than 70 skins were inspected and 36 of them were used for morphometric studies. In addition, five captive Philippine Hawk Eagles and two Changeable Hawk Eagles were repeatedly examined in the Manila Zoological Garden, at the Wildlife Research Center (Manila) and the Breeding Center of the Philippine Eagle Conservation Program Foundation (Toril, Davao). Later, the descriptions were elaborated in the field. Both raptor species were intensively studied in the course of three visits to the Philippines (January to April 1993, November 1993 to February 1994, and March to July 1994). Point counts and observations along line transects were used to estimate abundance (Preleuthner and Gamauf 1998). For the behavioural analyses of the Philippine Hawk Eagle 68 observations were made with a total observation time of 6.8 h. For the Changeable Hawk Eagle 42 observations were made in the field with a total observation time of 3.7 h.

RESULTS AND DISCUSSION

Distribution

According to our observations, the Philippine Hawk Eagle is distributed from the lowland to the mountain forest but is almost absent from the mossy forest zone. It was more common than expected from reports in the literature. In the central Sierra Madre of Luzon (Quirino and Isabela province) it was observed up to 1,000 m above sea level. In Mindanao, the altitudinal range was between 90 m (PRI, former PICOP, Carmen-Cantilan, both Surigao del Sur prov.) and 1,900 m (NW Mt Apo, South Cotabato prov.). In Luzon, mossy forests grow from about 800-1,000 m upwards. In contrast, at the study sites of Mindanao they are found only above 1,700-1,900 m. The occurrence on Palawan appears doubtful. We re-examined the only museum specimen ascribed to this island and identified it unequivocally as a Changeable Hawk Eagle. Our field observations included a hawk eagle seen at a great distance near El Nido (north Palawan) on a steep forested slope along the coast, but under the difficult conditions it was not possible to positively identify it as a Philippine Hawk Eagle.

The Changeable Hawk Eagle was only locally distributed and was mainly observed at low elevations. In our study it was recorded in 2 out of 19 sites only,

both located in Mindanao. One area was in southern Bukidnon (north-west Mt Kitanglad, Landshot - San Antonio) between the rivers Kalawaig and Loluhan at 600-1,120 m above sea level. The second area is in southern Surigao del Sur on the territory of the PRI, near Bislig, at an elevation of 100-220 m.

We confirmed breeding of the Changeable Hawk Eagle at both localities, the first indication of reproduction in the Philippines. Near Landshot a first year individual was seen hunting over fragmented forest in April 1994. In addition, at least three pairs were regularly observed engaged in territorial displays. At another study site, around the Forest Research Institute Area of the PRI, three more pairs were recorded, each of them with one fledged young (June 1994). All of the juveniles were white, even those from mixed pairs consisting of a white and a dark parent. Another indirect breeding record was provided by a one year old female eagle held in captivity at the Wildlife Research Center in Quezon City, Metro Manila, during our visits in January 1993 and July 1994. Unfortunately, the origin of that bird and of a second adult female could not be clarified. A skin of a juvenile was found in the collection of the National Museum in Manila, but it was not possible to obtain any further information about the origin of this bird and the circumstances of the collection. It is likely that this specimen also originates in the Philippines. At the American Museum of Natural History (New York, USA) we examined two juveniles collected on Palawan. These individuals can be taken as further proof that breeding occurs in the Philippines.

Both species have a strong preference for forest habitats. In general, the Philippine Hawk Eagle was frequently found in large continuous areas of suitable dipterocarp rainforests. It definitely prefers extensive primary or well-structured old secondary forests that had been selectively logged 20-30 years ago. Although both hawk eagles are found in well-wooded habitats, the typical habitat of the Changeable Hawk Eagle differs in some respects from that of the congeneric Philippine Hawk Eagle. The Changeable Hawk Eagle occurs in a mosaic of more or less degraded, fragmented forests, interspersed with clearings, small pastures and crop-fields. Old secondary forests and primary forests were rarely used, the latter only along the periphery. These results are in agreement with observations made on the latter species in the Indian subcontinent (Brown and Amadon 1968) and on Borneo (Thiollay 1983).

Activity

Both species typically perch in an upright position. They may be seen perched right through the day, but mainly in the early morning and in the afternoon. At about 08h00-09h00, making use of warm up-currents of air, they begin to soar. A first peak of flight activity is reached at about 10h00-11h00, with a second lower peak between 13h00 and 14h00. Soaring hawk eagles frequently called (16 % of the observations in *S. cirrhatius* and 18 % in *S. philippensis*), especially in the late morning after foraging.

Perched Philippine Hawk Eagles were typically seen concealed within the canopy of foliated trees along forest edges, or more frequently in the forest interior; very occasionally they sit in exposed situations in semi-open

habitats. Changeable Hawk Eagles perched in the exposed canopy of foliated or dead trees near clearings, along rivers or forest edges. Most observations of both species, however, refer to either soaring or gliding birds.

Description and field identification

Adult, subadult and juvenile plumages of the two species are quite different (Plate 1 and 2). Nevertheless, it is not so easy to distinguish them in every age class (Table 1). Identification difficulties arise from a number of factors, e.g. the varying shape of birds in flight and different flight styles. Calls are also a helpful tool for identification. Characteristic is the short and shrill two-syllable *yiep-yiep* call of the Philippine Hawk Eagle, in contrast to the prolonged, rising shrill scream *yeep-yiep-yip-yip* of the Changeable Hawk Eagle. For the latter species, Brown and Amadon (1969), King *et al.* (1975), MacKinnon (1990) and MacKinnon and Phillipp (1993) described additional calls, e.g. a ringing scream *klee-klee-ek*, a rising *kwip-kwip-kwip-kwee-ah* or a penetrating *klee-leeuw*.

Philippine Hawk Eagle (Plate 1)

Adult (Figure 1)

In the Philippine Hawk Eagle differences exist between populations from the northern and southern regions. Investigations described elsewhere (Preleuthner & Gamauf 1998) prove an abrupt shift in the characters suggesting the existence of two distinct subspecies described as *S. p. philippensis* (Northern Philippine Hawk Eagle) and *S. p. pinskeri* (Southern Philippine Hawk Eagle).

The Philippine Hawk Eagle acquires adult plumage in its fourth year. The adult bird is of slender build, and a typical forest-living hawk eagle with short, rounded wings and a long tail. In perched birds, the wingtips extend less than halfway to the tail tip. Both hawk eagles have pronounced sexual dimorphism. The Philippine Hawk Eagle is smaller (body length: 50-63 cm, weight recorded for two adult females: Samar - 1,168.2 g, Mindanao - 1,281.2 g) than the Changeable Hawk Eagle. The morphological measurements of the female Philippine Hawk Eagle overlap with those of the male Changeable Hawk Eagle.

The Philippine Hawk Eagle is also characterized by a long prominent crest (up to 8 cm), which consists of 4-5 black feathers of unequal length. Depending on the state of excitement, the crest is held in different positions. In profile the steeper forehead of the Philippine Hawk Eagle gives the head a more roundish and delicate appearance compared to the rather flattened 'eagle-head' of the Changeable Hawk Eagle. The colour of the iris is bright yellow, and the cere and bill are dark grey to black.

The upperparts are uniform brownish-olive with a purplish cast when freshly moulted. The head of *S. p. philippensis* is sienna brown on the sides with fine heavy streaks, and the crown has broad blackish-brown streaks. *S. p. pinskeri* has a more whitish ground colour of the head with a paler crown compared to *S. p. philippensis*. The pale crown of *S. p. pinskeri* contrasts with the deep brownish-olive back and is conspicuous in flying birds over a long distance. In both subspecies the throat is white, divided by a black median stripe and bordered by black moustachial stripes. Individuals of *S. p.*

philippensis are ochraceous-tawny to antique brown below with bold black streaks on the breast. Occasionally, fine dark streaks are discernible on the belly. In contrast, as far as can be judged from the sparse museum material, individuals from Mindanao, Samar and Negros have a whitish breast colour with pronounced black streaks. On the lower belly they are narrowly barred white and clove-brown. *S. p. philippensis* has fine clove brown and whitish bars on the long feathered legs and broader bars on the undertail coverts. Specimens of *S. p. pinskeri* are more contrastingly barred blackish and white. The illustrations in Brown and Amadon (1968) and Weick (1980) as well as in del Hoyo *et al.* (1994) all show individuals of *S. p. philippensis*.

The long brownish-olive tail has a broad black subterminal bar followed by a broader unmarked zone and usually four, occasionally five, narrower dark bars basally; however, in the field usually only three or four bars are visible. At first glance there is a strong similarity to the tail feathers of adult honey buzzards *Pernis*, especially when viewed over long distances. Seen from below, the underwing coverts of *S. p. philippensis* are finely barred ochraceous-tawny to clove brown and white; in *S. p. pinskeri* they are brown to blackish and white. The primaries show 8-9 regularly spaced bars; their white bases form a small crescent-shaped panel, which can be seen in flying birds under good light conditions. The secondaries have 7-8 bars on a darker background and thus are not very distinctive. Sexes are almost identical in plumage, but males exhibit a more pronounced contrast with regard to the white panel in the primaries. In females the white panel looks more greyish and washed, in males white.

First year plumage (Figure 2)

Ventrally, first year birds are usually pure white (however, one young bird was observed and photographed which had dark grey flanks like those of a juvenile Rufous-bellied Eagle, Clark and Schmitt 1993). The head and neck are also white, except for the long black crest feathers. If the black crest is not visible, e.g. against a dark background, the nape looks squarish. There is a gradual change in colour from the white head to the broad pale-edged feathers of the greyish back. The uppertail coverts are usually white, but in some birds they are pale greyish-brown. The cere and bill are blackish-grey and, together with the black lores, they form a black mask. The feet are yellow, and like the cere they have the same colour in all age classes.

The median wing coverts and the adjacent lesser coverts have extensive white fringes and form a broad band on the upper side of the wing, which often seems to be broader than in the Changeable Hawk Eagle. The secondaries are dark greyish-brown, and the primaries blackish, heavily barred with 7-9 relatively fine bars. In backlit views in flight, a narrow white sickle-like panel can be seen along the base of the primaries. The feathered legs of *S. p. philippensis* are white, whereas two individuals of *S. p. pinskeri* (from Negros and Mindanao) had fine buffy bars on their tibiotarsi. On the usually greyish-brown tail 5-7 regularly spaced small bars, including the subterminal bar, which is sometimes broader. This tail pattern is not as prominent as in first year Changeable Hawk Eagles.

Table 1. Comparison of the most important identification features of Northern (*S. p. philippensis*) and Southern (*S. p. pinskeri*) Philippine Hawk Eagle and Changeable Hawk Eagle (*Spizaetus cirrhatus limnaetus*)

	Philippine Hawk Eagle <i>S. philippensis</i>	Changeable Hawk Eagle <i>S. cirrhatus limnaetus</i>
Adult plumage		3 colour variants (light, intermediate, dark)
Upperparts	uniform brownish-olive	light + intermediate: umber with pale edges, the pale secondary coverts form a narrow band dark: blackish-brown
Underparts	<i>S. p. philippensis:</i> breast ochraceous-tawny with bold black streaks; lower belly uniformly antique brown <i>S. p. pinskeri:</i> breast is white with bold black streaks; lower belly barred clove brown to black and white	light: breast and belly white with bold dark streaks intermediate: grey-brown ground colour with washed markings on the breast (not always visible on the belly) dark: blackish-brown
Tail	brownish with 1 broad black subterminal bar, followed by a broader unmarked zone and usually 4, occasionally 5, narrower dark proximal bars	light + intermediate: umber with 1 dark subterminal bar, followed by 3-4 narrower dark brown bars towards the base dark: dark with grey base and occasional proximal bars
Head	roundish and delicate, long crest <i>S. p. philippensis:</i> sienna brown on the sides with fine distinct streaks, crown with broad blackish-brown streaks <i>S. p. pinskeri:</i> ivory to pale olive grey or dark olive buff with more or less fine black shaft streaks which may be very bold on the crown	flattened 'eagle head' light + intermediate: head and neck pale with numerous fine but distinct streaks, occasionally brownish dark: blackish-brown
Leg feathering	<i>S. p. philippensis:</i> finely barred clove brown and white <i>S. p. pinskeri:</i> heavily banded blackish and white	light: buff with fine white bars intermediate: bars hardly discernible dark: blackish-brown
Underwing	primaries with 8-9 regularly spaced bars white bases to the primaries form a small crescent-shaped panel secondaries with 7-8 bars on dark background <i>S. p. philippensis:</i> underwing coverts ± uniformly ochraceous-tawny, finely barred ochraceous-tawny to clove brown and white mostly at the carpals <i>S. p. pinskeri:</i> underwing coverts barred blackish and white	light + intermediate: the primaries and secondaries with 5-6 broad, contrasting dark regularly spaced bars dark: blackish-brown, the inner half of the primaries and secondaries greyish and barred.
1st year plumage		
Upperparts	broad pale-edged greyish feathers lesser and median wing coverts form a broad white band on the upper side of the wing	light: back umber, pale-edged feathers median wing-coverts form a white band on the upper side of the wing dark: blackish-brown
Underparts	<i>S. p. philippensis:</i> pure white <i>S. p. pinskeri:</i> pure white, occasionally with dark grey flanks	light: pure white or creamy white dark: blackish-brown
Tail	greyish-brown with 6-7 regularly spaced small bars, sometimes a broader subterminal bar	light: umber with 7 broad dark bars, often white spots on the inner web dark: dark with grey base
Head	shape as in adult head and neck white long black crest black mask (from cere to eyes)	light: shape as in adult head and neck white dark: blackish-brown
Leg feathering	<i>S. p. philippensis:</i> white <i>S. p. pinskeri:</i> white, with fine buffy bars	light: white dark: blackish-brown

	Philippine Hawk Eagle <i>S. philippensis</i>	Changeable Hawk Eagle <i>S. cirrhatu limnaetus</i>
Underwing	primaries and secondaries with 7-9 fine distinct bars narrow white sickle-like panel along the base of the primaries	light: broad black tips on the outer primaries distal third to half of the secondaries dark and distinctly barred elliptic patch along the base of the secondaries white bases of the outer and inner primaries form a white crescent-shaped patch with clear barring dark: blackish-brown, the proximal half of the primaries and secondaries greyish
Perching (adults and juveniles)	body length 50-63 cm wingtips extend less than halfway to the tail tip	body length 53-68 cm wingtips extend more than halfway to the tail tip
Flight silhouette (adults and juveniles)	wingspan 105-125 cm, up to twice the body length short and broad wing width of the wing at the indent between the primaries and secondaries is the same as between the secondaries and the wing base, and corresponds with tail length wingtips appear roundish, not very deep fingered when soaring the wings are held slightly dihedrally with the tips of the primary fingers curled up juvenile: like the adult but wings broader	wingspan 125-146 cm, slightly more than twice the body length head and neck obviously protruding broad paddle-shaped wings wings are narrowest at the base wing tips oval rounded and deeply fingered square tail is slightly longer than the width of the wing base when soaring the wings are usually held just below the horizontal, but sometimes level juvenile: like the adult, but wings without extreme trailing-edge
Confusion with similar species	adult: Barred Honey-buzzard juvenile: with white juveniles of Changeable Hawk Eagle, Barred Honey-buzzard, Rufous-bellied Eagle, Philippine Serpent Eagle, Philippine Eagle silhouette: Changeable Hawk Eagle, Barred Honey-buzzard	adult: dark individuals with dark Oriental Honey-buzzard juvenile: white juveniles with white juveniles of Philippine Hawk Eagle, Oriental Honey-buzzard, Barred Honey-buzzard, Rufous-bellied Eagle, Philippine Serpent Eagle, Philippine Eagle dark juveniles with dark juveniles of Oriental Honey-buzzard silhouette: Philippine Hawk Eagle, Oriental Honey-buzzard
Voice	shrill 2-syllable calls	prolonged, rising shrill calls

Second year plumage (Figure 3)

In *S. p. philippensis* the feathers of the crown and the neck are buffy with rufous tips. All of the underparts, including the nearly unmarked underwing coverts are washed buffy. The pale band on the upperwing becomes darker, smaller and also more suffused than in the first year plumage. The tail has the same pattern as in adult birds. One second year individual of *S. p. pinskeri* had a few black streaks on the white breast after the beginning of the moult. Apparently individuals of *S. p. pinskeri* have already developed this trait by the second year.

Third year plumage (Figure 4)

In *S. p. philippensis* the head, including its side becomes darker brown and the crown develops bold blackish streaks. The underparts are more ochraceous-tawny with dark streaks on the breast, and the legs are more conspicuously barred. The underwing coverts are barred too. *S. p. pinskeri* has black streaks on the breast and contrasting black and white barred legs and undertail coverts. The lower belly has some chestnut feathers and shows rather blurred brown and white bars. At this age they lack the characteristic throat pattern with the black mesial stripe and moustachial stripes.

Changeable Hawk Eagle (Plate 2)

The Changeable Hawk Eagle is larger with a body length of 53-68 cm. It is clearly heavier, at 1,300 to 1,900 g (del Hoyo *et al.* 1994), and more powerfully built than the Philippine Hawk Eagle. Like the latter species it has a long tail, but the wings are slightly longer. In perched birds the wingtips extend more than halfway to the tail tip. This is one of the distinguishing features visible also over long distances.

In adult birds three colour variants were found. Light (50 %) and dark (38 %) colour morphs were the most frequent. In addition to these two common colour phases, a third intermediate variant was observed (12%) which had a suffused grey-brown breast (n=34). We assume that the Changeable Hawk Eagle attains its adult plumage in about four years, the same as the Philippine Hawk Eagle.

Adult

Light colour adult plumage (Figure 5)

Above, the back, upper-wing coverts and secondaries are umber brown with paler edges. The paler fringed secondary coverts form a narrow band. In contrast to the upperparts, the head and neck are pale with

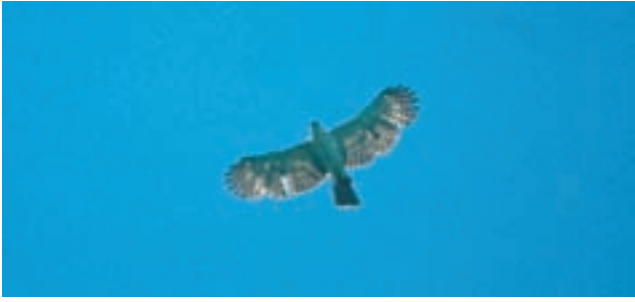


Figure 2: One year old Southern Philippine Hawk Eagle *S. p. pinskeri* at the beginning of its moult. Dalwangan, Mt. Kitanglad, Mindanao, April 1994 (photograph: A. Gamauf and M. Preleuthner)



Figure 4: Third year Southern Philippine Hawk Eagle *S. p. pinskeri*. Breeding Center of the Philippine Eagle Conservation Program Foundation. Toril-Davao, Mindanao (photograph: R. S. Kennedy)



Figure 5: Adult Changeable Hawk Eagle in light colour plumage. Wildlife Research Center, Manila, Luzon, January 1994 (photograph: M. Preleuthner and A. Gamauf)



Figure 3: Second year Northern Philippine Hawk Eagle *S. p. philippensis*. Wildlife Research Center, Manila, Luzon. June 1994 (photograph: A. Gamauf and M. Preleuthner)

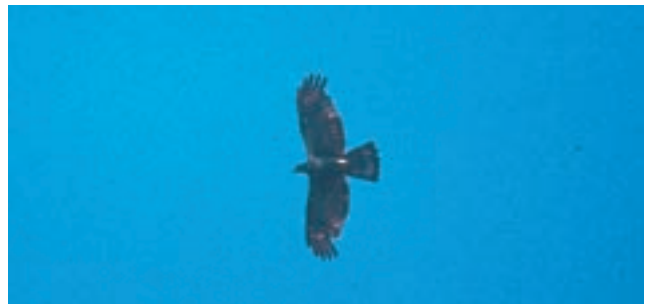


Figure 6: One year old Changeable Hawk Eagle. Landshot - San Antonio, Mt. Kitanglad, Mindanao, April 1994 (photograph: A. Gamauf and M. Preleuthner)



Figure 7: Second year Changeable Hawk Eagle. Wildlife Research Center, Manila, Luzon, June 1994 (photograph: A. Gamauf and M. Preleuthner)

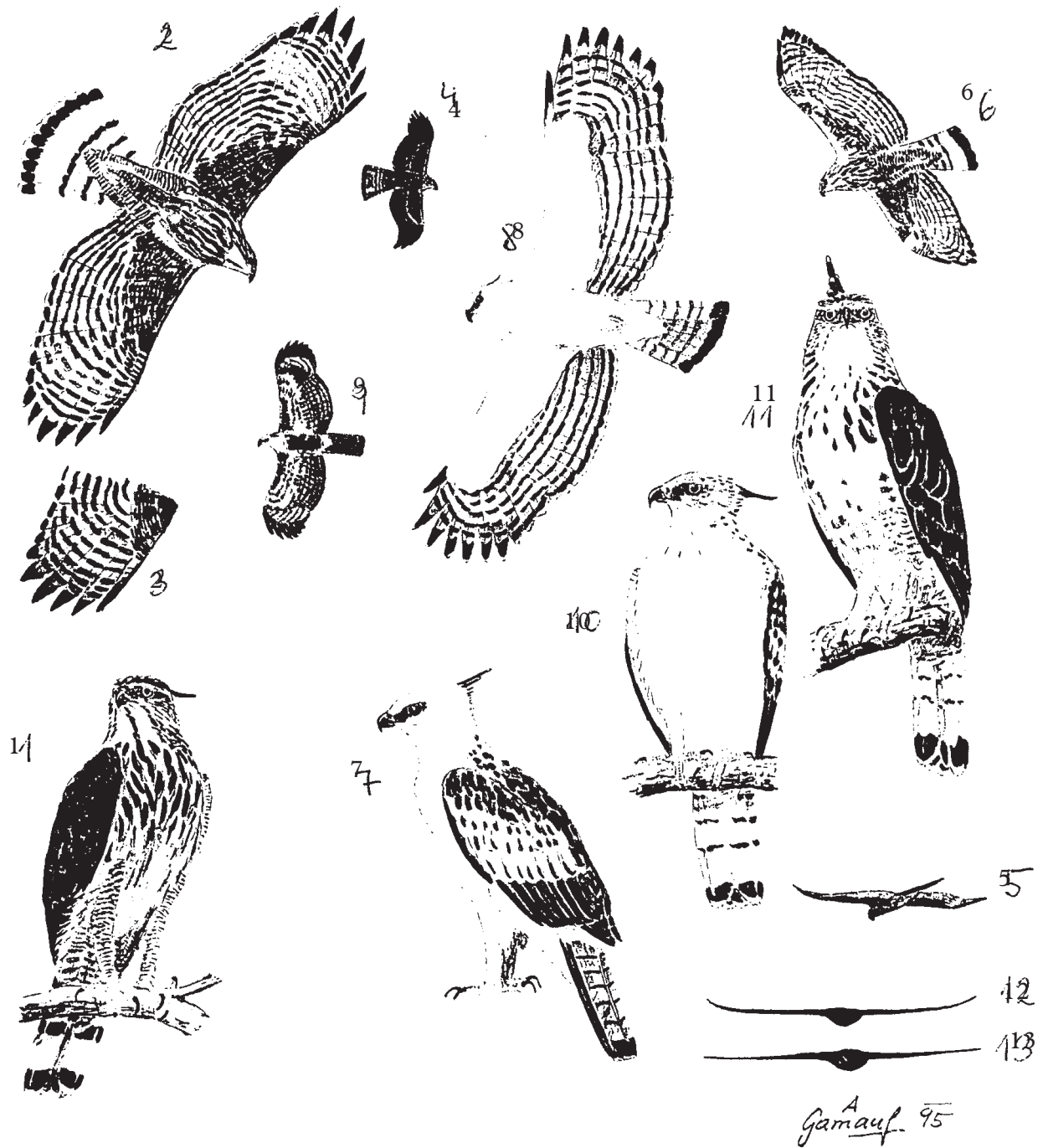


Plate 1: Philippine Hawk Eagle *Spizaetus philippensis*
 Adults from Luzon, *S. p. philippensis*: (1) perched, (2) male from below, (3) female primaries from below, (4) adult from above and (5) from below. Juveniles to subadults: (7) first year individual, perched, (10) second year, perched. Adult from Mindanao, *S. p. pinskeri*: (6) adult from below, (8) first year individual from below, (9) from above; (11) third year individual, perched.
 Flight profiles: (12) typical, (13) occasionally observed soaring profile.

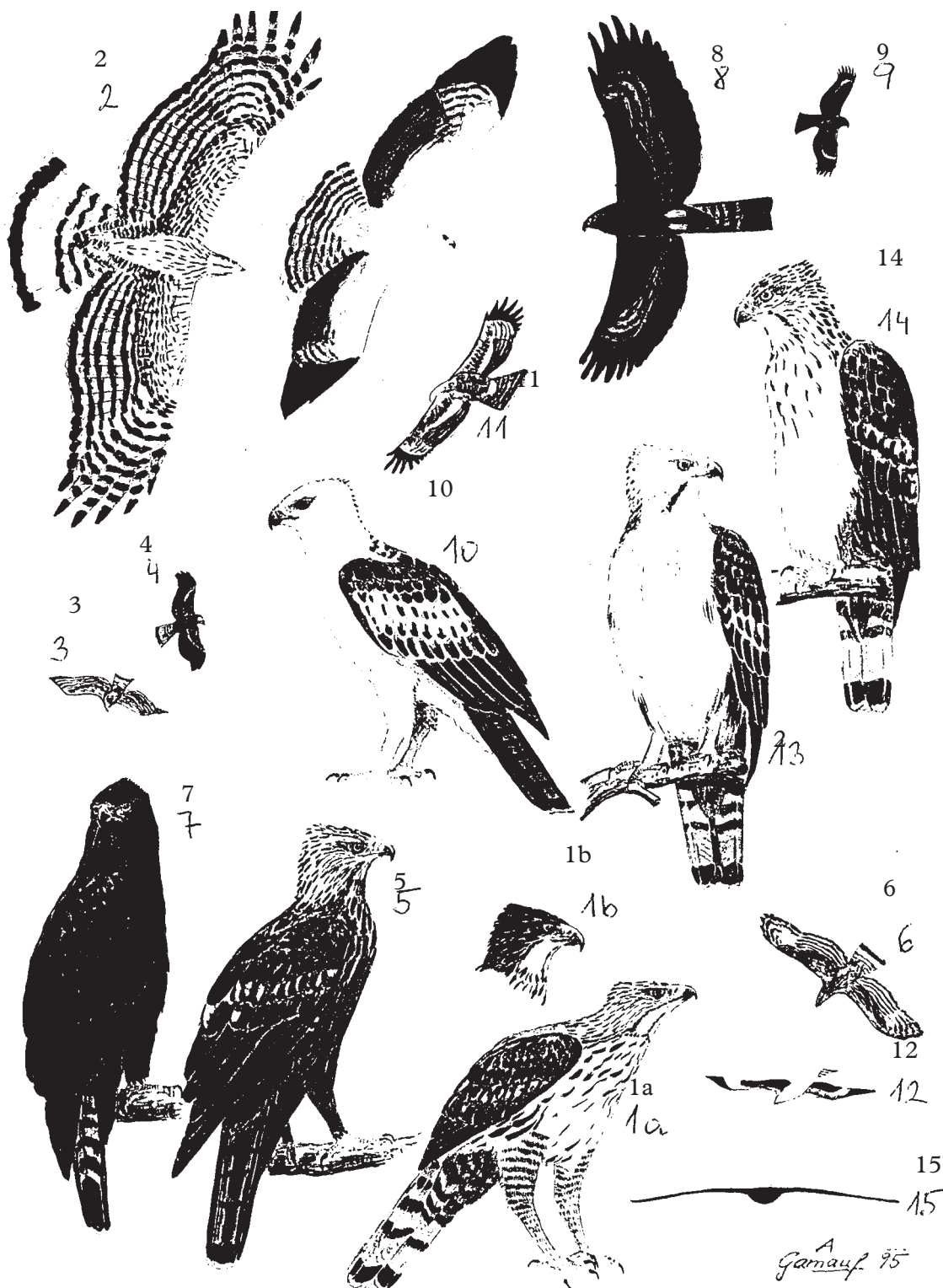


Plate 2: Changeable Hawk Eagle *Spizaetus cirrhatus limnaetus*

Light adult: (1a) pale-headed, (1b) dark-headed, (2-3) from below, (4) from above.

Intermediate adult: (5) adult perched, (6) from below.

Dark adult: (7) perched, (8) from below, (9) from above.

Juveniles to subadults: (10) light first year individual, (11) from above, (12) from below; (13) light second year; (14) light third year individual.

Flight profile: (15) typical soaring profile.

numerous fine but distinct streaks. The pale colour can be easily seen over long distances. Only some individuals are brownish and do not display this contrast. Unlike some other subspecies, *S. c. limnaetus* lacks a crest but, nevertheless, the nape feathers are more pronounced. The forehead rises slightly and the nape has a square-shaped appearance, which can be seen even at large distances, especially when the bird is excited. This typical head shape is a good identification feature of all age classes. The chin and throat are white, usually with a black median stripe as well as lateral stripes. The strong bill is blackish, the cere greyish, and the eyes are bright yellow.

The long tail is the same colour as the upperparts. There is a wide dark subterminal bar, followed by 3–4 narrower dark brown bars towards the base, a pattern very similar to that in the Philippine Hawk Eagle. The breast and belly are white with bold dark brown streaks. The long and powerful feathered legs, as well as the undertail coverts, are buff with fine white bars. The underwing coverts are densely barred but darker. The primaries and secondaries show 5–6 regularly spaced, broad, contrasting dark bars. The bars on the primaries can often be seen from above.

Intermediate colour adult plumage

Above, individuals of this type are similar to light coloured birds but have a pale or umber brown head and neck. Below, they have a grey-brown ground-colour with similar but more suffused markings on the breast, which are not always visible on the belly. The bars on the legs and under tail-coverts are usually hardly discernible. The underwing markings are nearly the same as in light coloured birds but are not as contrasting. Under good light conditions the bars on the primaries are also visible from above.

Dark colour adult plumage

Melanistic individuals are all blackish-brown. The inner half of the tail is greyish, sometimes with some faint and paler bars on the greyish tail base. Below, the inner third or half of the primaries and secondaries are paler, occasionally with weakly coloured bars. In flight they form a broad grey band, which reaches from the flanks to the outer primaries.

Immature and subadult birds

First year light colour plumage (Figure 6)

In their first year, the underparts and head are pure or creamy white. In profile the young bird has the same square head shape as the adult. Sometimes a slight tuft of black feathers is visible on the nape, but not at a distance. Compared to the overall head shape this trait is not a reliable identification feature. The feathers of the upperparts resemble the adult plumage but the pale edges are broader. There is no clear boundary between the white neck and the umber back. On the wing, two to three rows of the median wing coverts are white and partially dark along the quills, whereas the distal row is somewhat darker. These coverts form a broad 'white' saddle-like band on the upper wings. The secondaries are umber and the primaries are blackish-brown. From below, on the spread wings, the broad black tips on the outer primaries provide a good identification feature at long distances. On the outer third to half of their length

the secondaries have the same colour as the primaries. Since they are rather dark, the bars are visible only under optimal light conditions or with back lighting. Between the black tips and the dark secondaries the white bases of the outer and inner primaries form a white crescent-shaped patch with clear bars. A second whitish, more suffused and elliptical patch is located along the base of the secondaries - another characteristic feature for identification. Seen from above, the upper tail-coverts are white like the belly. The tail is the same colour as the back, with usually 7 clearly visible dark bars. The grey bands between the dark bars are mostly interrupted by conspicuous white spots on the inner webs, but are more extensive at the base of the tail.

Second year light colour plumage (Figure 7)

The face and belly are white with an admixture of some grey, but the flanks, the sides of the head as well as the neck have moulted to a pale umber-grey. The crown is also streaked greyish and a dark malar stripe emerges quite clearly. Although the colour still resembles the juvenile plumage, the tail markings after the first moult are nearly identical with those of an adult.

Third year light colour plumage

The upperparts become darker and the first streaks become visible on breast and belly. The feathered legs and undertail coverts are barred, but do not as contrast as much as in adults.

First year dark colour plumage

It is similar to the adult plumage but has pale zones on the tail and wings without any bars. The ageing of dark older birds in the field is hardly possible.

Flight

Philippine Hawk Eagle

Soaring birds have a silhouette resembling a short and broad-winged eagle with a long square-cut tail. The wingspan is about 105–125 cm in adult birds, up to a maximum of twice the body length. Compared to the Changeable Hawk Eagle the primaries are shorter, making the wingtips appear roundish and the wings proportionally broader. The outer wing is also well-fingered with 8–9 notches, of which only 6 or 7 are usually visible in flight; the remaining notches can be seen upon close inspection; however, these notches are not as deep as in the Changeable Hawk Eagle. The leading-edge is often slightly angled forward. The wings appear broader because of the longer and more bulging secondaries. Along the secondaries the trailing-edge is strongly curved and pinched in at the body. The width of the wing at the indentations between the primaries and secondaries is the same as between the secondaries and the wing base and corresponds with the tail length. The Philippine Hawk Eagle soars holding the wings slightly dihedrally and with the tips of the primary fingers curled up. The strongly splayed wings are pushed well forward, but the carpals are not in line with the bill. In gliding, the carpals are pressed forward and the wings are more angular. The primaries are angled backwards and the tail is folded, giving them a shape like that of a Northern Goshawk *Accipiter gentilis*. Active flight is fast and straight with bursts of flapping between glides.

Changeable Hawk Eagle

The silhouette of a soaring bird is distinctive with the head and neck usually obviously protruding (although not visible from all angles) and long broad paddle-shaped wings. The wingspan is relatively short (125–146 cm) in relation to their weight. The widely splayed wings are pushed well forward so that the carpals are often in line with the bill. The wings are narrowest at their base and the broader secondaries are separated from the ample primaries by a less pronounced indent, producing a strongly S-curved trailing edge. The wing tips are more oval compared to those of the Philippine Hawk Eagle and more deeply fingered, usually with 8 notches. These features combine to produce a distinctive shape to the wing, which is a good feature for identification. The square to slightly roundish tail is slightly longer than the width of the wing base and looks more straight-cut in adults than in young birds. The wing in young birds does not have the extreme trailing-edge form of the adults. Even the folded tail appears long, narrow and square at the tip; occasionally it shows a slight notch (not only during moult). In profile, soaring birds hold their wings usually slightly below the horizontal, but sometimes level. During high speed-turns the notched wing tips may be bent slightly upwards. When gliding, the carpals are pressed further forward, roughly in line with the bill. The swept back primaries are closed and appear pointed. The Changeable Hawk Eagle glides on bowed wings when the bars on the primaries can often be seen. Frequently, gliding alternates with 3–4 powerful beats of the fully extended wings.

Confusion with similar looking species

Silhouette

On the formerly well-forested Philippine islands a series of medium to large-sized long-tailed raptors dependent on forests has evolved, with short and rounded wings (Gamauf et al. 1998). Thus, the possibility of incorrect identification is not only restricted to the two hawk eagle species but also to other genera (e.g. *Pernis*).

In flight, the silhouettes of the two honey-buzzard species show several similarities, a major cause of confusion. The larger Oriental Honey-buzzard *Pernis ptilorhynchus philippensis* has the appearance of a typical honey-buzzard. Because of its 'cuckoo-like' long neck and the longer wings it looks more like the Changeable Hawk Eagle. However, the primaries are clearly longer and the long tail tips are rounded. The shorter-winged Barred Honey-buzzard *Pernis celebensis steerei* does not share so many similarities with the characteristic flight silhouettes of the two other honey-buzzard species, *Pernis apivorus* and *Pernis ptilorhynchus*. Nevertheless, it is remarkably similar in appearance to the Philippine Hawk Eagle. In many cases flying Barred Honey-buzzards do not show a long neck compared to the other congeneric species. However, the gently curved trailing-edge of the wing, which is roughly parallel with the leading-edge, and the shorter square-cut tail make a clear differentiation possible. With the perched honey-buzzards there are no real identification problems. They are always more slenderly built and have longer necks and wings, as well as unfeathered legs. In general, the hawk eagles appear heavier and are clearly more stocky

than the honey-buzzards.

Identification problems can also arise with the Rufous-bellied Eagle. This eagle mainly hunts above the forest or in the canopy. Since it spends much time in the air it has the shape of a buzzard *Buteo*, with comparatively long wings and a short tail. Depending on the perspective the tail appears square to round tipped. Details of field identification are given in Clark and Schmitt (1993).

Plumage characteristics

With respect to the colour of the plumage, the greatest similarity is found between the Philippine Hawk Eagle and the Barred Honey-buzzard. This is also true for the transition from juvenile to adult plumage. As a consequence, these species have been misidentified even in some museums.

The large number of 'white' raptors presents a major identification problem. Including the two juvenile hawk eagles, there are seven other white-coloured raptor species, from medium-sized to very large, which can be distinguished safely only with extensive knowledge of morphology and some experience in the field. Among these species, most problems arise with the Rufous-bellied Eagle *Hieraetus kienerii formosus* and the two honey-buzzards. The Rufous-bellied Eagle in its juvenile and even in its blotchy transitional plumage can be easily confused with the Philippine Hawk Eagle. However, there are some distinctive characters which allow the unequivocal identification of the young Rufous-bellied Eagle: it has black marks on the face, upper head, sides of the upper breast, and flanks and, in addition, it has somewhat darker secondaries contrasting with the white underparts and has uniformly dark upperparts.

The distinctive identification features of the two honey-buzzards have already been mentioned above. Both hawk eagles are more likely to be confused with white first year and blotchy sub-adult Barred Honey-buzzard than with rarely seen white, maybe immature, individuals of the Oriental Honey-buzzard.

The two other species are quite easy to identify: the Philippine Serpent Eagle and the Philippine Eagle. Although first year Philippine Serpent Eagles have a suffused whitish colour, their appearance whilst perched, as well as in flight, is distinctively different from that of the hawk eagles. The Philippine Serpent Eagle has a big crestless 'snake eagle' head and a short tail. Soaring birds hold their wings well forward so that the wing-tips extend beyond the bill. In profile the wings are raised strongly dihedrally. It is the most common raptor in more or less forested and disturbed areas, found mainly in forest fragments, clearings and at forest edges. The call is quite different from that of the hawk eagles. No identification problems exist with the largest Philippine raptor, the Philippine Eagle, which has creamy white underparts in all age classes. It has very short round and broad wings, which are held well forward during soaring, and a long slightly rounded tail. Because of its size it is visible at large distances. The structure of the wings allows for unusually slow soaring and gliding. On Luzon and Mindanao it is found only in large primary forests mixed with well-structured secondary forests. It is possible that a few individuals also survive on Samar and Leyte (Kennedy 1985).

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