

Raptors on Sulawesi (Indonesia): The influence of rain forest destruction and human density on their populations

B.-U. Meyburg & B. van Balen

SUMMARY

Six of the 22 raptor species of Sulawesi, with a land surface of 189 000 km², are endemic. Since many of them inhabit the rain forest and this habitat is rapidly diminishing under the spread of human settlement, it was feared that some of the endemic species might be threatened with extinction.

The authors traversed the island from south to north and over a stretch of 2,500 km concentrated on counting raptors. In all, 254 individuals belonging to at least 15 species were observed, averaging one raptor every 18 km or every 32 minutes. The species seen most frequently were Brahminy Kite *Haliastur indus*, Celebes Serpent Eagle *Spilornis rufipectus*, Barred Honey Buzzard *Pernis celebensis*, Spotted Harrier *Circus assimilis* and Molucca Kestrel *Falco moluccensis*.

The status of individual species is discussed. The northern and southern peninsulas in particular have become heavily populated, so that here the raptor density is noticeably thinner than in the central part of the island, but wherever there is still virgin forest the vulnerable species, e.g. the Sulawesi Hawk Eagle *Spizaetus lanceolatus*, are regularly met with.

Some population changes cannot be attributed to forest clearance or human population increase. Thus the formerly very frequent and adaptable Black Kite *Milvus migrans* is rare to-day as is the Rufous-winged Buzzard *Butastur liventer*.

INTRODUCTION

Sulawesi (formerly Celebes), with a land surface of 189,000 km², is the third largest of the Greater Sunda Islands and, for example, over half the size of Italy. A part of Wallacea, the island is zoogeographically of great interest, particularly on account of its high number of endemic mammal (62%) and bird species (27%). (White & Bruce 1986; Whitten *et al.* 1987). This high degree of endemism is also true for the birds of prey, with no fewer than six of the 21-22 resident species confined to the island.

Since many raptors are inhabitants of the rain-forest — a form of habitat which is rapidly shrinking in Indonesia, as elsewhere — it was feared that several of the endemic species were under threat. Thus Brown (1976) cited both of the island's eagles (*Spizaetus lanceolatus* and *Spilornis*

rufipectus) as possibly endangered, and Meyburg (1986) considered it a matter of urgency that six species should be investigated, since not only the status but also the biology and distribution of this island's raptors are very little known.

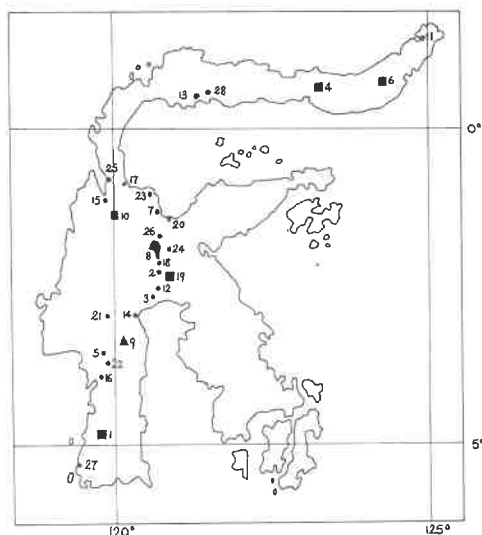
It accordingly seemed worthwhile to seize the opportunity to traverse the island in order to assess as far as possible the frequency and distribution of the raptor fauna, compare this with the data in the literature, and draw conclusions as to the evolution and adaptability of the various species to the increasing human colonization and clearing of the forest. This appeared all the more urgent in view of Indonesia's immense programme of transmigration, whereby since 1905 at least 2.5 million people from the densely populated islands (Java, Madura, Bali and Lombok) have been resettled on those less heavily populated, including Sulawesi.

Our earlier researches into Indonesian raptors on Java (Thiollay & Meyburg 1988; Meyburg *et al.* 1989; van Balen 1991) had already indicated that dense human settlement can lead to a virtually complete disappearance of birds of prey due to destruction of the rain-forest, whilst on the other hand high numbers of raptors can still be found in extensive, undisturbed forested areas, as in a few reserves.

METHODS

In August 1987 the authors traversed the island from south to north in a Toyota Landcruiser. This had recently become possible but was still difficult. Starting from Ujung Pandang, the route passed through Parepare, Makale, Palopo, Wotu, Pindolo, Lake Poso, Poso, Palu, Tomalu, Moutong, Gorontalo and Maelang to Manado (Fig. 1). Along the way, the following reserves and National Parks were also visited: Bantimurung, Perumpenai, Lore Lindu, Dumoga Bone and Gunung Ambang.

Figure 1. Map of Sulawesi with localities visited



- | | | |
|---------------------------------|------------------------------|-------------------------------|
| 1. Bantimurung nature reserve | 10. Lore Lindu national park | 19. Perumpenai nature reserve |
| 2. Batasposo | 11. Manado | 20. Poso |
| 3. Bonebone | 12. Mangkutana | 21. Rantepao |
| 4. Dumoga Bone national park | 13. Moutong | 22. Rappang |
| 5. Enrekang | 14. Palopo | 23. Sausu |
| 6. Gunung Ambang nature reserve | 15. Palu | 24. Taripa |
| 7. Kasiguncu | 16. Parepare | 25. Tentena |
| 8. Lake Poso | 17. Parigi | 27. Ujung Pandang |
| 9. Latimojong Mts | 18. Pendolo | 28. Wonggarasi |

In order to obtain as accurate a view as possible of the distribution and density of the raptors, a very slow speed was maintained, so that — as confirmed by the first author's experience of making roadside counts on extensive trips in many different countries (e.g. Meyburg 1973) — a major part of the visible birds of prey could be recorded. In this way both authors could concentrate entirely on the lookout for raptors, whilst a native driver drove the vehicle. During the whole trip from Ujung Pandang to Manado, covering 2,497 km in 98.5 hours and 17 days of observation, at an average speed of only 25 km per hour, all sightings of raptors were recorded. At suitable vantage points stops were made and also several excursions into the forest were undertaken on foot. The total duration of these stops and excursions on foot amounted to 28 hrs 22 minutes. Whilst the first author concentrated on birds of prey, his co-author also listed other bird species at these vantage points and made tape recordings of their calls (Kukila 1993).

In order to save time, all observations were dictated into a tape recorder, noting the time, mileage, behaviour, biotope, weather conditions etc.

RESULTS

In all, 254 individuals of at least 15 species were observed (Table 1), averaging throughout the trip one raptor every 18 km or every 42.5 minutes. During stops we saw on average one raptor every 20 minutes. Travelling and stops taken together led to an average of one raptor seen every 32 minutes.

Table 1. Raptors counted on Sulawesi (roadside counts and observations from vantage points).

Species	Total number observed (both methods)	Average distance per individual (roadside counts)	Average time per individual (roadside counts)	Average time per individual (vantage points)
<i>Haliastur indus</i>	87	28,7	1h56mn	1h04mn
<i>Spilornis rufipectus</i>	27	92,5	6h34mn	3h12mn
<i>Pernis celebensis</i>	25	99,9	6h34mn	3h50mn
<i>Circus assimilis</i>	20	124,8	8h57mn	4h16mn
<i>Falco moluccensis</i>	19	131,4	7h34mn	6h24mn
<i>Ictinaetus malayensis</i>	17	146,9	12h18mn	4h16mn
<i>Haliaeetus leucogaster</i>	13	192,1	19h41mn	4h48mn
<i>Spizaetus lanceolatus</i>	8	312,1	24h37mn	9h36mn
<i>Pandion haliaetus</i>	7	356,7	32h48mn	9h36mn
<i>Milvus migrans</i>	4	624,3	24h37mn	-
<i>Butastur liventer</i>	4	624,3	32h48mn	38h22mn
<i>Elanus caeruleus</i>	3	832,3	98h25mn	19h11mn
<i>Falco severus</i>	2	1248,5	98h25mn	38h22mn
<i>Accipiter griseiceps</i>	2	1248,5	-	19h11mn
<i>Ichthyophaga humilis</i>	1	2497	-	38h22mn
<i>Accipiter</i> spp.	3	832,3	-	12h47mn
Unidentified	12	208,1	19h41mn	5h29mn

Twelve sightings could not be positively identified. Nor were the following observed with certainty: *Accipiter rhodogaster*, *A. nanus*, *A. trinotatus*, *Falco peregrinus*, *Hieraaetus kienerii*, *Macheiramphus alcinus* and *Aviceda jerdoni*.

Since two of the *Accipiter* species are barely distinguishable and three *Accipiter*s could not be determined, the number of species observed was in reality perhaps higher. All three *Accipiter*s not seen with certainty are particularly difficult to identify by means of roadside counts. This also applied to two other species not observed (Peregrine *Falco peregrinus* and Jerdon's Baza *Aviceda*

jerdoni). The Bat Hawk *Macheiramphus alcinus* was previously recorded only once on Sulawesi (Klapste 1982) and so far there are only four authentic records of the Rufous-bellied Eagle *Hieraetus kienerii* and very few isolated sightings (White & Bruce 1986; Watling 1983).

The human settlement is not evenly distributed but concentrated in the south-west peninsula and the north-eastern tip (Minahassa) of Sulawesi. There was a clear correlation between the density of the human population, which averages between 100 and 300+ inhabitants per km² on the south-west peninsula, and the density of birds of prey. In areas with a high human density (over 50 per km²), roadside counts produced an average of one raptor per 29.5 km and observation from vantage points gave one every 27 minutes. In less inhabited regions one raptor was seen every 15 km and every 20 minutes from vantage points. About 40% of the roadside counts were conducted in densely settled areas but gave only 25% of the total number of birds recorded.

Less significant is the difference in species richness. Taking only the commoner species, the absence of *Pernis* in densely populated areas was particularly striking, whereas *Spizaetus* was still present.

Osprey *Pandion haliaetus*

Prevost (1983) and Poole (1989) reported the breeding of the Australasian subspecies *P. h. cristatus* on Sulawesi, and this we could confirm. All seven birds seen were in the bay of Tomini. One pair (without nest) was seen 6 km south of the village of Kasimbar and a second pair at a nest in a tall dead tree 67 km east of Moutong. The eyrie was only ca. 200 m distant from a Wonggarasi village and was kept under observation for 30 minutes. Both adults spent the whole of this time on the nest, with one of them mainly feeding.

Barred Honey Buzzard *Pernis celebensis*

This was the third most frequently seen species, and in certain places can clearly reach a high density. Thus on 5 August we located at least two territorial pairs and one individual in Central Sulawesi about 50 km south of Lake Poso in an area of 2 km². *Pernis* is especially to be met with in those parts of the island where forest and open grassland alternate. Human changes to the landscape, often to a massive extent, must have benefited this species, which only occurs in another race on the island of Luzon (Philippines). However, excessive deforestation and dense human settlement as in the south-west peninsula and the far north-east, has led to its disappearance from such regions. Of the commoner species, it was the only one we failed to see in places with over 50 humans per km².

Sulawesi Hawk Eagle *Spizaetus lanceolatus*

Brown (1976) and Meyburg (1986) considered it possible that this rain-forest dweller could be threatened by habitat destruction. At least for the present, this is not the case. Although, for lack of time, it was not possible to undertake long excursions on foot, so that observations had preponderantly to be made from the road, which only rarely ran close to the rain-forest, we saw a comparatively large number of these birds, surprisingly as many from the moving car as during stops. These were almost exclusively juveniles, which in part first attracted our attention by their constant begging calls. These young birds were for the most part seen at the forest edge and could only fly short distances; they were clearly still in the early post-fledging stage.

We got the overall impression that in fact each area of forest harboured the bird, so that the population is not to be feared for, so long as sufficient forest remains.

Since the exhaustive discussion of mimicry by Meyer and Wigglesworth (1898), the similarity of plumage between *S. lanceolatus* and *Pernis celebensis* and the difficulty of identifying them in the field has been constantly stressed (Watling 1983). In our opinion this poses no particular problem if one has had experience of other *Pernis* and *Spizaetus* species. *P. celebensis* has the typical *Pernis* mode of flight (very deep wing beats), longer wings and neck, different vocalisation and is quite variable in plumage.

Black-winged Kite *Elanus caeruleus*

Whereas White & Bruce (1987) cite the occurrence of this species at altitudes of 1,100 m, the three specimens we saw were only a little above sea level. We encountered all three on the northern peninsula: one bird on 12 July only a few km from the coast (40–50 m a.s.l.) hovering over a recently clear-felled area ca. 50 km east of Moutong. On the same day a second bird, likewise near the coast, ca. 26 km east of Marisa. The third Black-winged Kite was seen on the following day over an area of alang-alang grass near Kwandang.

Black Kite *Milvus migrans*

Heinrich (in Stresemann 1940) termed this species “the commonest raptor of Celebes”, which Coomans de Ruiter (1947) also still maintained for the south-west coast from Ujung Pandang to Parepare. According to White & Bruce (1986), too, it was “common in towns and harbours and in open country to 1,100 m”. Watling (1983) reported the species as common in the Lore Lindu reserve, but Van den Berg & Bosman (1986) did not see it there.

Since the Black Kite, from our observations, came tenth in degree of frequency, it has clearly suffered a severe decline. Three out of our four sightings were in the environs of Ujung Pandang and Parepare (31 July and 1 August); the fourth was in Dumoga-Bone National Park.

Brahminy Kite *Haliastur indus*

This species was by far the most frequently seen raptor (87 sightings). It has adapted to almost all habitats on Sulawesi but is most often to be seen near water. Not one juvenile was seen, so that at this time of year the young birds have evidently left the island, apart perhaps from a few unidentified raptors seen during the trip and which could have been young Brahminy Kites. This could indicate a very short period during which immatures wear their typical plumage after fledging, all having shed their initial feathers to be replaced by adult plumage in their first year. Other possibilities include the actual absence of immatures, due to a previous poor breeding season in the entire kite population. The long periods of extreme drought during recent years may hit this open area species more than forest dwelling species, such as the Sulawesi Hawk Eagle, of which a considerable number of immatures were seen.

White-bellied Sea Eagle *Haliaeetus leucogaster*

We met with this eagle most often at the northern end of Lake Poso. Here, on 5 August, within three hours, we saw seven White-bellied Sea Eagles, including two immatures which chased each other in play for 15 minutes. Four adults were perched together on a tree at the water's edge. Six others were spotted along the coast of the northern peninsula, five of them on the south side, one on the north, about level with Gorontalo. With the exception of one subadult, all were adult birds. At Molantado, on the northern coast of this peninsula, there was a very bulky but clearly unoccupied nest in a fairly isolated tree, only a few hundred metres from a village, which could only belong to *Haliaeetus leucogaster*. One bird, 8 km east of Palasa, flew in from the sea with a ca. 1 m long seasnake in its talons. Another similarly swooped down to the water some 80 m from the shore but only brushed this with its claws. This hunting attempt was unsuccessful, however.

Lesser Fishing Eagle *Ichthyophaga humilis*

This species is also classified under the name *I. nana*, but Mees (1967) has shown “that this name was antedated by *humilis*”.

Whereas Coomans de Ruiter (1947) described it as not uncommon in the south of the island, White & Bruce (1986) regarded it as infrequent.

We had only one sighting of an adult bird on 5 August 1987, 8 km south of Taripa (ca. 18 km east of Lake Poso). Whilst according to Brown and Amadon (1968) this species is seldom to be seen soaring, we nevertheless first noticed it circling low down but gradually gaining height until

it eventually disappeared in a steady glide to the north-east. Its manner of flight differed in no way from that of other large eagles.

Sulawesi Serpent Eagle *Spilornis rufipectus*

The supposition that this species was threatened (Brown 1976; Meyburg 1986) proved unfounded. Indeed, this raptor ranked second in the number of sightings (27). It showed a considerable ecological adaptability and is to be met with equally in the tropical rain-forest and in rice-fields near villages. It occurs most readily in a not too densely populated landscape, where open water and forest alternate in a mosaic. So long as the forest does not completely disappear, the species can maintain a relatively high population level. Whether a not excessive human settlement can in fact be an advantage for this species will be shown only from further in-depth research into its population dynamics.

Spotted Harrier *Circus assimilis*

From our observations this raptor ranked fourth in frequency, whereas White & Bruce (1987) described it as "seemingly not numerous". We encountered it in both south and north peninsulas and in the central part of the island. This species undoubtedly benefits from the increasing deforestation. We often saw the birds flying quite low over habitations. It showed little shyness when we prepared to photograph it.

According to White & Bruce (1987) there are no breeding data for Sulawesi. We located an occupied nest on 18 August, at the border of the Dumoga-Bone National Park. This was about 12-15 m high in a not very tall tree within a group of only five trees in the middle of cultivation and 80 m away from a road. The nest itself was decidedly small and flimsy, with the brooding female plainly visible. The male, which was perched in a neighbouring tree, twice within 10 minutes brought a dead twig to the nest in its bill.

Sulawesi Goshawk *Accipiter griseiceps*

"The most remarkable feature of the *Accipiter* fauna of Sulawesi is the wealth of species on a relatively small island" (van Merle & Voous 1946). This is in contrast to Borneo, Sumatra and Java. All five *Accipters* observed were during stops at the forest edge or during excursions on foot. Since these took up only a little of our total observation time, it is not surprising that the number of individuals seen was so small. Only *A. griseiceps* could be identified with certainty.

A thorough study needs to be made of this species-rich *Accipiter* fauna.

Rufous-winged Buzzard *Butastur liventer*

Only rarely met with, mostly over ricefields at the forest edge. Coomans de Ruiter (1947) described it as very common, even occurring in towns, so that a severe decline must have recently taken place, for reasons unknown to us.

Black Eagle *Ictinaetus malayensis*

This species is also highly tolerant of the shrinking of the forest. Wherever there are still patches of forest it exploits the surrounding open areas and at any rate is not dependent on large areas of undisturbed rain-forest.

Spotted Kestrel *Falco moluccensis*

Like other Kestrels, this bird profits from the deforestation, so long as this does not exceed a certain limit. It avoids areas of pristine rain-forest. Human colonization of the island has probably helped this falcon's colonization also.

Oriental Hobby *Falco severus*

Two individuals were seen. The first, on 3 August, was perched at the top of a dead tree at the edge of the rain-forest ca. 18 km north of Wutu, 175 m a.s.l. and watched for an hour. It was not at all shy, even when we approached within 30 m of it. Its plumage was in the intermediate stage between young and adult. Breast and belly were in part spotted on a beige background, partly a spotless reddish-brown. Apart from one short flight round, it sat very still the whole time, often briefly closing its eyes. Only once did it call a hurried *gick, gick, gick, gick, gick*.

The second falcon, which was in full adult plumage, was seen on 5 August 22 km south-west of Taripa at 950 m a.s.l. in a lush landscape where open grassland alternated with forest, and also watched for an hour. This bird also spent most of the time perched in a dead tree, making only one brief flight round. Seen from above, in flight it appeared almost black and reminiscent of a swift or swallow, or even a small Peregrine. Its flight was mainly a glide, with barely any wing-beats.

DISCUSSION

Data on the previous and present extent of the rain-forest are relatively scanty. Information on the relative numbers of birds of prey in earlier times is dependent almost solely on the accounts of Heinrich (*in* Stresemann 1940) and Coomans de Ruiter (1947). When these are compared with our own findings, it is clear that two species in particular (*Milvus migrans* and *Butastur liventer*) have severely declined, yet neither is a rain-forest species. We can find no explanation for this plainly drastic decline. On the other hand two species have increased (*Circus assimilis* and *Ictinaetus malayensis*). Both of these must have benefited from the forest clearance. For the true forest-dwellers, especially *Spizaetus lanceolatus*, the situation seems to be the same as in Java. The species subsist in all intact areas of rain-forest, but to-day the minimum area necessary for the survival of a viable population cannot be guaranteed.

It would certainly appear that at present no raptor species on the island is under immediate threat, especially none of the endemics; however, in view of the increase in the human population, the future outlook may well be bleak. Further study of the raptorial fauna of the island is therefore urgently needed and the system of reserves must at all costs be expanded.

REFERENCES

- AMADON, D. 1974. Taxonomic notes on the Serpent-eagles of the genus *Spilornis*. *Bull. Brit. Orn. Cl.* 94: 159-163
- BALEN, S. van 1991. The Java Hawk Eagle *Spizaetus bartelsi*: WWGBP Project Report No. 1, March 1990. *Birds of Prey Bull.* 4: 33-40.
- BALEN, S. van 1994. The status and conservation of birds of prey in the Sondaic and Wallacean Region of Indonesia. This volume.
- BERG, A.B. van den & C.A.W. BOSMAN 1986. Supplementary notes on some birds of Lore Lindu Reserve, Central Sulawesi. *Forktail* 1: 7-13
- BROWN, L. 1976. *Eagles of the World*. Newton Abbot: David & Charles.
- BROWN & AMADON 1968. *Eagles, Hawks and Falcons of the World*. 2 Vols. Feltham: Hamlyn
- COOMANS DE RUITER, L. 1947. Roofvogelwaarnemingen in Zuid-Celebes. *Limosa* 20: 213-229
- KLAPSTE, J. 1982. Bat Hawk on Celebes in December 1981. *Dutch Birding* 4: 29-30
- KUKILA. 1993. Sulawesi Bird Report. *Kukila* 5: 4-26
- MARLE J. G. van & K.H. VOOUS 1946. The endemic Sparrow Hawks of Celebes. *Limosa* 19: 15-23
- MACKINNON, J. 1979. A glimmer of hope for Sulawesi. *Oryx* 15: 55-59
- MACKINNON, J. & M. B. ARTHA 1982. A National Conservation Plan for Indonesia. Vol. VI: Sulawesi. Bogor: FAO & PPA (Field Report 35)
- MEES, G. F. 1967. Zur Nomenklatur einiger Raubvögel und Eulen. *Zool. Meded.* 42: 143-146
- MEYBURG, B.-U. 1973. Observations sur l'abondance relative des rapaces (*Falconiformes*) dans le nord et l'ouest de l'Espagne. *Ardeola* 19: 129-150
- MEYBURG, B.-U. 1986. Threatened and near-threatened Diurnal Birds of Prey of the World. *Birds of Prey*

- MEYBURG, B.-U., S. van BALEN, J.-M. THIOLLAY & R. D. CHANCELLOR 1989.** Observations on the endangered Java Hawk Eagle *Spizaetus bartelsi*. Pp. 279-299 in Meyburg, B.-U. & R. D. Chancellor (eds.): *Raptors in the modern world*. Berlin, London & Paris: World Working Group on Birds of Prey.
- MEYER, A.B. & L.W. WIGGLESWORTH 1898.** *The birds of Celebes and neighbouring islands*. 2 Vols. Berlin: Friedländer.
- POOL, A. F. 1989.** *Ospreys. A natural and unnatural history*. Cambridge: Cambridge University Press
- STRESEMANN, E. 1940.** Die Vögel von Celebes. III. *J. Orn.* 88: 389-487
- STRESEMANN, E. 1940.** Zur Kenntnis der Wespenbussarde (*Pernis*). *Arch. f. Naturgesch.* (n.F.) 9: 137-193
- STRESEMANN, E. 1959.** Die Gliederung der Schlangenadler-Gattung *Spilornis*. *Vierteljahrschr. Naturforsch. Ges. Zürich* 104: 208-213
- PREVOST, Y.A. 1983.** Osprey distribution and subspecies taxonomy. Pp. 157-174 in: Bird, D.M. (ed.): *Biology and management of Bald Eagles and Ospreys*. Ste. Anne de Bellevue: Harpell Press
- THIOLLAY, J.-M. & B.-U. MEYBURG 1988.** Forest fragmentation and the conservation of raptors: A survey on the island of Java. *Biol. Conserv.* 44: 229-250
- WATLING, D. 1983.** Ornithological notes from Sulawesi. *Emu* 83: 247-261
- WHITE, C.M.N. & M. D. BRUCE. 1986.** *The Birds of Wallacea*. An annotated check-list. London: British Orn. Union.
- WHITTEN, A. J. 1987.** Indonesia's Transmigration Program and its role in the loss of Tropical Rain Forests. *Conservation Biol.* 1: 239-246
- WHITTEN, A. J., M. MUSTAFA & G. S. HENDERSON. 1987.** *The Ecology of Sulawesi*. Yogyakarta: Gadjah Mada Univ. Press

Dr. Bernd-U. Meyburg
Wangenheimstr. 32
D-14193 Berlin
Germany

S. van Balen
P.O.Box 310
Bogor 16003
Indonesia