Natal Downs and Plumage Changes in the Noisy Scrub-bird, *Atrichornis clamosus* (Passeriformes: Atrichornithidae)

G.T. SMITH

CSIRO Division of Wildlife and Rangelands Research,
Locked Bag No. 4, P.O. Midland, Western Australia 6056

ABSTRACT. The newly hatched Noisy Scrub-bird chick has 60 to 81 natal downs distributed in three paired and two single dorsal pterylae. The downs are most numerous and longest on the capital and spinal tracts. The age of the chicks when the contour feather sheaths emerge and burst on the various regions of the body is described. Males and females show no differences in the natal downs or juvenal plumage. The first moult begins when the chick is 41 to 46 days old. The first basic plumage is like the adult female plumage except that the male has a faint grey pectoral band on the upper chest. The second moult takes place during the bird's second summer, through which it attains the second basic (definitive) plumage. The males differ mainly in having a black upper pectoral band. All plumages are described. The distribution of the 840 natal downs in five paired and four single pterylae (both dorsal and ventral) in one specimen of the Superb Lyrebird is described. The differences in the natal downs and subsequent plumages between the scrub-birds and lyrebirds are discussed.

SMITH, G.T., 1978. Natal downs and plumage changes in the Noisy Scrub-bird, *Atrichornis clamosus* (Passeriformes: Atrichornithidae). Records of the Australian Museum 37(3): 157-163.

KEYWORDS: Atrichornithidae, Menuridae, moult, natal downs, plumage changes.

Of the Nosiy Scrub-birds (*Atrichornis clamosus*) collected in the period 1842-1889 (Whittell, 1943; Mees, 1964), only 20 specimens have survived. All were thought to be males until Campbell (1939) described a specimen from the Museum of Victoria that he considered to be a female. This was confirmed when Whittell (1942) published a description of a hitherto overlooked female in the collection of the Academy of Natural Sciences in Philadelphia. The only other published information on Noisy Scrub-bird plumages is a description of a male in first basic plumage (Serventy, 1967) and a brief description of the juvenal plumage (under the heading 'immature') by Smith (1976a). Only brief descriptions of the natal downs are available for the Rufous Scrub-bird (*A. rufescens*) (Jackson, 1921) and Superb Lyrebird (*Menura novaehollandiae*) (Kitson, 1905; Tregallas, 1921; Leach, 1921; Reilly, 1970). Those of the Albert Lyrebird (*M.alberti*) have not been recorded.

The present article describes, for the Noisy Scrub-bird, the distribution and numbers of natal downs per pteryla, the feather development of nestlings, and plumage changes from fledging to maturity. The natal down from one Superb Lyrebird is also described. The aim is to present another body of data that may help to elucidate the relationships of the Menurae.

METHODS

The description of the natal down was based on two wild Noisy Scrub-bird nestlings that died at age one and five days respectively, and one six day old nestling hatched in captivity from an egg collected in the wild. An embryo approximately two to four days from hatching was examined also (the incubation period is 36-38 days; Smith & Robertson, 1976). These data were supplemented by descriptions and photographs of newly hatched chicks in the wild. For each specimen, the number of natal downs in each pteryla was counted and, for the three chicks, the length of five downs on each pteryla measured. All downs were measured in pterylae with five or fewer downs. The number of barbs in a representative sample of downs was counted. Neossoptile terminology is that of Wetherbee (1957).

Descriptions of the feather growth in the nestlings are based on descriptions from 31 individuals in the wild. The number of observations per chick ranged from one to seven, depending on the stage at which the nest was

found. Nests could only be visited once after the nestling was about 16 days old because of the risk that the chick might leave the nest prematurely. The main reason for handling the nestlings was to obtain growth data that could be used to determine age. If the female was near the nest and appeared agitated, only brief notes were made. Because of these limitations, no complete sequence of descriptions was obtained from any one bird. As a result, the descriptions presented here are a composite from all individuals.

Plumage changes after fledging were documented from three females and one male held in captivity. They were acquired as nestlings when 16–19 days old and maintained in a cage, made from a tea chest, until 80–120 days old. Then they were placed in a small aviary (2 × 2 × 3.5 m) and later transferred to a larger one (25 × 8 m).

They were only handled twice in the small aviary and not at all while in the larger aviary. One female bird bred in captivity was examined briefly when four months old and again when 16 months old (Smith *et al.*, 1983). The natal downs from a four-to-six-day-old Superb Lyrebird were also examined.

RESULTS

Natal Down

At hatching, the chick is blind, weighs four to five grams and is 40–50 mm in length. A dense line of grey down runs from the crown to the rump, with small thin patches on the shoulders and thighs (Fig. 1). There are eight pterylae distributed as shown in Fig. 2. Both sides of the paired coronal, scapular and femoral tracts are individually numbered 1–2, 4–5 and 7–8 respectively. The number of downs on the two sides are usually not equal as is often the case in passerines (Wetherby, 1957). The natal downs have a short calamus with 7 to 15 barbs and no rachis; each barb has many plumulaceous barbules.

The number and average lengths of the downs in each pteryla are given in Table 1. The occipital (number 3) and spinal (6) pterylae have more and longer down than the other pterylae, although the down in the coronal (superciliary) tract (1,2) is almost as long. The down in the other tracts is shorter and more widely spaced. Observations on wild, newly hatched nestlings indicate that the distribution, number and length of downs found

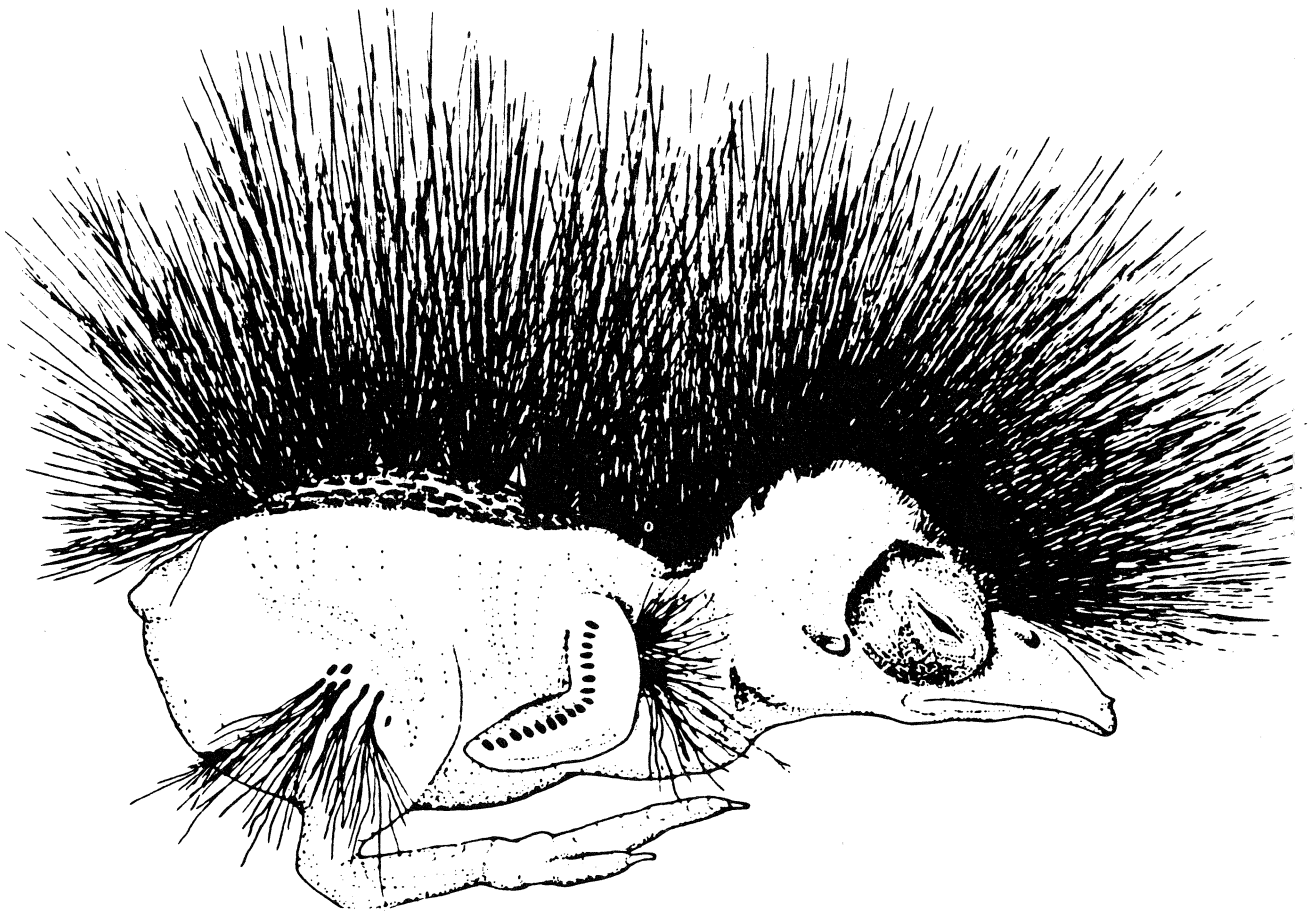

Fig. 1. Noisy Scrub-bird chick, one to two days old.

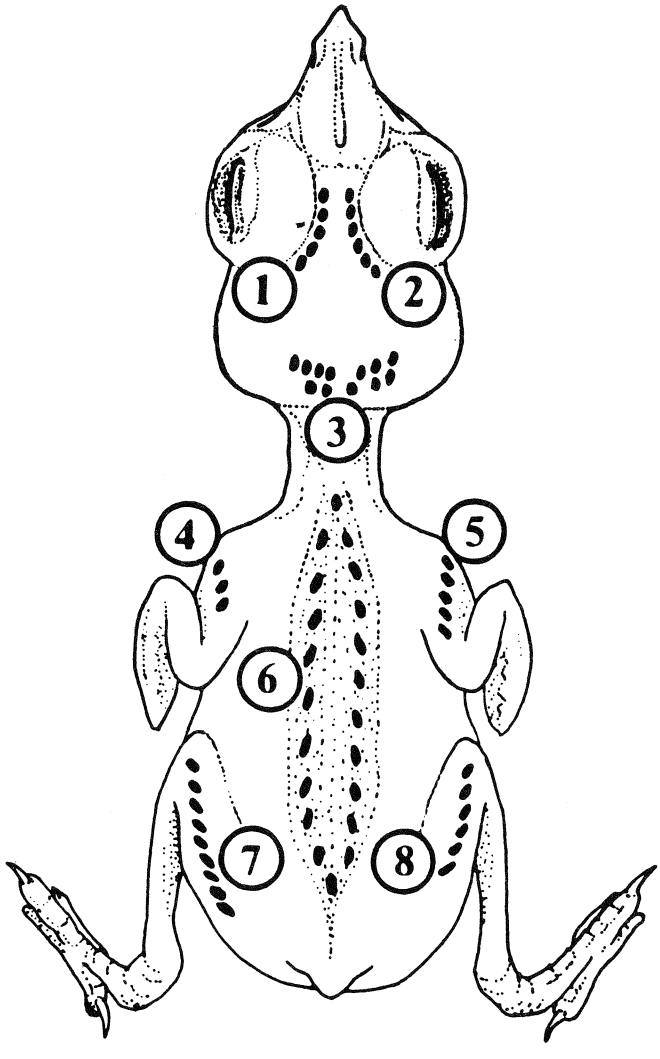

Fig. 2. Distribution of downs in the eight pterylae of the Noisy Scrub-bird chick (drawn from Bird 1).

on the specimens studied was within the range of that of wild, healthy birds. Photographs suggest some variation in the number and length of downs and that Birds 1 and 2 were probably at the lower end of the range, as one might expect from nestlings that died shortly after hatching. Bird 3 appeared to be average, its early death being related to the aviary conditions. The data in Table 1 show that variation in the amount of down may result from differences in the number and length of downs as well as from the number of barbs in each down.

The spinal tract is a distinctive grey weal caused by the prominence of barbed follicles; each down feather in this tract has its calamus surrounded by a sheath of barbs from the first generation of contour feathers.

Development of Juvenal Plumage

Feathers. The ages at which the contour feather sheaths emerge and burst on various regions of the body are shown in Fig. 3. The data are pooled from 31 chicks. Only six of the chicks were subsequently sexed (five females, one male) and an additional four chicks were tentatively sexed as males on their growth characteristics. Examination of the data from these chicks suggests that there is no significant difference between the sexes in the development of plumage.

As is typical of passerines, the first generation of contour feathers is more loosely textured than are the later generations. The first feather sheaths to emerge are those on the spinal tract at the second day after hatching (D2); by D6 the sheaths in all tracts have started to emerge, except those on the chin which do not start until D9. Within each tract there is considerable variation in the age at which individual feather sheaths emerge. Fig. 3 gives the age when the first sheaths emerge in the various pterylae. The difference among individuals in the age at which the sheaths burst is three to eight days.

In general, the sheaths burst first on the trunk, while those on the head and appendages break open later. The

	BIRD 1 (5 day old)			BIRD 2 (1 day old)			BIRD 3 (6 day old)			BIRD 4 (32-34-day-old embryo)		
Feather Tract	No. Downs	Mean Down L. (range)	No. Barbs	No. Downs	Mean Down L. (range)	No. Barbs	No. Downs	Mean Down L. (range)	No. Barbs	No. Downs	Down L.	No. Barbs
1	5	16 (15-17)	-	5	16 (12-18)	-	8	16 (15-17)	-	7	18	-
2	6	16 (15-18)	11	6	18 (17-18)	-	8	16 (15-18)	13	8	15	-
3	12	21 (18-22)	15	18	24 (22-28)	10	26	21 (17-22)	15	13	26	-
4	3	11 (9-12)	-	4	13 (12-14)	7	5	10 (9-10)	-	*	*	-
5	5	12 (11-15)	-	2	10	-	7	13 (10-16)	-	4	11	-
6	21	19 (8-20)	12	20	18 (16-19)	10	18	20 (17-25)	10	7	18	-
7	9	10 (8-13)	-	6	15 (12-16)	10	11	12 (11-15)	-	9	13	-
8	6	12 (11-13)	-	6	-	-	8	13 (11-15)	-	9	15	-

* no down; - not counted

Table 1. Number and mean length (mm) of natal downs in the pterylae (see Fig. 1), and the number of barbs in a single natal down from some pterylae of 3 nestling *Atrichornis clamosus*. Only the number of downs and the length of an average down were counted in Bird 4 (a late embryo).

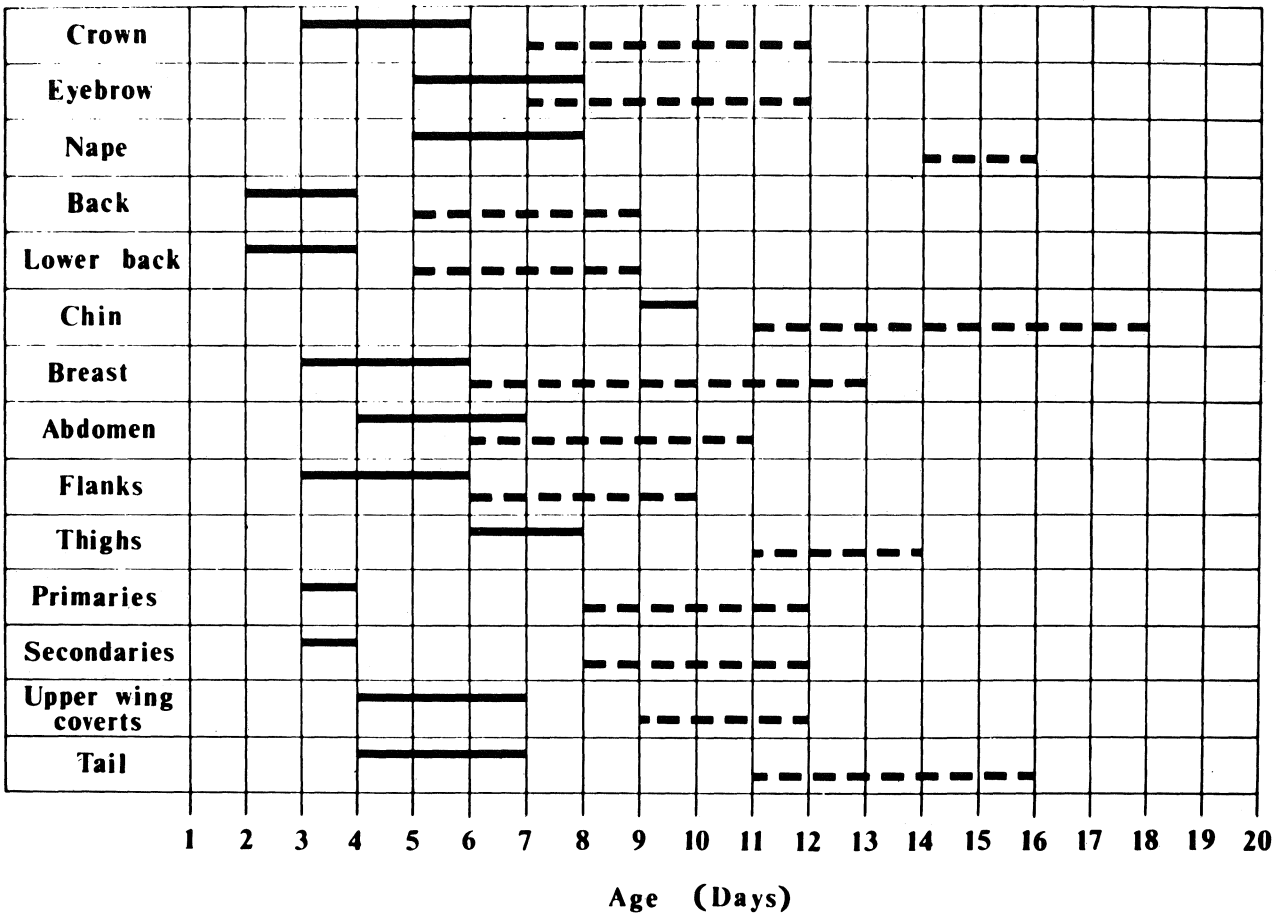

Fig. 3. Range of ages when the feather sheaths first emerge (solid line) and burst (dashed line) on various regions of the Noisy Scrub-bird nestling.

majority of sheaths have started to burst by D18. By the time of fledging (D21-28), the chicks are well feathered, with only a few traces of down and a short tail (25-40mm); at fledging, some feather sheaths still have not burst in the superciliary region, forehead and chin.

Soft parts. The eyes are closed until D3-4 and the eyes of all birds are fully open by D9-12. The eye colour is dark brown, as in the adults.

The colour of the gape at hatching varies from cream (N = 4), pale yellow (N = 6), to yellow (N = 2). By D21 the colour has deepened and ranges from pale yellow (N = 1), yellow (N = 14), to deep yellow (N = 2). Data from nine individuals confirm this progressive deepening of the colour in birds that are hatched with pale gapes. Two birds with yellow gapes at hatching showed no change. At hatching, the mouth is pink and by D4 it has a yellow tinge. At D21 it ranges from pinkish yellow to yellow.

The bill at hatching is pink; by D3 the maxilla has a touch of grey and by D8 it is a dark grey-brown. The mandible may change slowly from pink to cream with a dark proximal end, or it may stay pink until fledging.

The legs are pink at hatching and by D8 have started to go grey; by D21 they are dark grey-brown as in adults. There were no apparent differences in the development or colour of the soft parts between the sexes.

The egg tooth is present until D7 and in all chicks it has been shed between D9 and D14.

Juvenal plumage. There is no apparent difference between the sexes in this plumage. By about D30 the feather sheaths on the superciliary region, forehead and chin have all burst and the bird appears fully feathered except for the short, still-growing tail which is not fully grown until the bird is about 70 days old.

The following description is based on the four captive birds and those found in the wild before fledging: head, nape and mantle cinnamon-brown, darker on the nape and sides of the head; superciliary cream; lower back, upper tail coverts and crissum of dense, grey, loosely textured feathers; throat and breast cinnamon, lighter on throat and grading to grey on the flanks; abdomen grey, tipped with pale cinnamon to give a scalloped effect; thighs chestnut grading to grey; there is a circle of chestnut feathers above the knee.

Primaries and secondaries chestnut on the leading side

of the rachis and grey on the trailing side; tail grey and not completely grown; eye dark brown; gape yellow; maxilla grey-brown; mandible flesh-cream; legs dark grey-brown.

First prebasic moult. Only body feathers are replaced in the first moult. Two females and the male in captivity began the first prebasic moult at 41, 46 and 41 days old, respectively, and finished 49, 55 and 79 days later. The exact time and duration of the moult for the third female was not recorded, but it was similar to that of the other females. Thus the females moulted faster than the male, completing the moult in about 50 days. The more protracted moult of the male, moreover, rarely looked heavy. The sequence of moulting in the various parts of the body was similar to that found in the eruption of the juvenal plumage.

First Basic Plumage

Male. Head, nape and mantle rich brown with darker crossbars, superciliary cream; lower back and upper tail coverts dark grey; chin and throat cream-white grading to grey-buff on the chest, and grey tipped with buff on the flanks; crissum dark grey; faint grey line across upper chest; tail grey with cross bars on the proximal quarter; wing and soft parts as for the juvenal plumage.

Female. Similar to male, but without the faint grey line across the upper breast.

Discussion. The main differences between the juvenal and first basic plumages are that (1) the loosely textured feathers on the lower back and around the vent are replaced by normally textured contour feathers, (2) the colour of the head, nape and mantle changes from cinnamon-brown to rich brown with darker crossbars, and (3) the still-growing tail becomes barred basally.

Second prebasic moult. This takes place during the birds' second summer, during the period from late October to March. Like the males' first prebasic moult, it is a slow and gradual process. Scrub-birds at this stage are shy and retiring, but none were seen in heavy moult.

Second Basic (Definitive) Plumage

With the second prebasic moult, both the males and females acquire 'adult' plumage.

Male. As for the first basic plumage, but the chin and throat are white and subtended by a definite black upper pectoral band which widens to the midline to extend slightly upward to the chin and down toward the belly. The crissum is rufous and the rump brown-grey with darker bands.

Female. As for the male but the chin and throat are cream, grading to pale buff on the chest; there is no black pectoral band. The crissum may be grey, tipped with cinnamon or rufous. In one of the captive females the vent became rufous after the third moult. Females in the wild also appear to vary in vent colour after the second moult.

Superb Lyrebird

The distribution of natal down is shown in Fig. 4 and the number of downs in each tract and the range of the length of downs in some of the tracts are listed in Table 2. In lyrebirds, down occurs in more tracts than it does in scrub-birds; it is denser and longer in the capital and spinal tracts than elsewhere, although in tract 12 (ventral cervical) the downs are as dense even if shorter. The downs have 10–15 barbs, each of which bears short barbules. The barbules are shorter and more closely spaced than are those of the Noisy Scrub-bird.

Tract No. (Fig. 4)	No. Downs	Range of Down Length	No. Barbs
1	210	10–30	12
2	51	12–20	11
3	23	10–22	
4	22		
5	47		
6	190	21–31	12
7	25	4–7	
8	51	10–20	
9	47		
10	30		
11	34	12–18	
12	110	9–12	14
13	*		
14	*	2–7	

* not counted (badly damaged from skinning)

Table 2. Number of natal downs and the range in down length (mm) in the pterylae of a four- to six-day-old *Menura novaehollandiae* chick. The number of barbs in a single down from four pterylae is also given.

DISCUSSION

For the closely related Rufous Scrub-bird the only available information on natal downs and subsequent plumage changes are the brief descriptions by Jackson (1921) of a newly hatched chick and of three young birds aged at about three, five and eight weeks. Of the newly hatched nestling Jackson reported: "it had only a little blackish down on the head and down the middle of the back, the other portions being naked and whitish in colour". (The three juveniles in the Museum of Victoria, H.L. White collection, could not be examined.)

This brief description suggests that the length and/or number of the downs on the capital and spinal pterylae are less than those in the Noisy Scrub-bird, and further, that there are no humeral or femoral pterylae. The three-week-old bird, which from its measurements would have fledged recently, is described as being "pale reddish brown all over". This juvenal plumage is, thus, like that found in the Noisy Scrub-bird. Jackson did not give detailed plumage descriptions of the two older male birds but his general comments, noting the absence of a black bar on the chest, suggest that they had been through a first prebasic moult and that their first basic plumage is similar to that of adult females.

The natal down of the newly hatched Superb Lyrebird has been described as short and black and restricted to the head and back, the rest of the body being naked (Kitson, 1905; Reilly, 1970). Leach (1929), however, describes the nestling as being "clad in long, dark grey down" and a week-old chick is covered with thick, grey

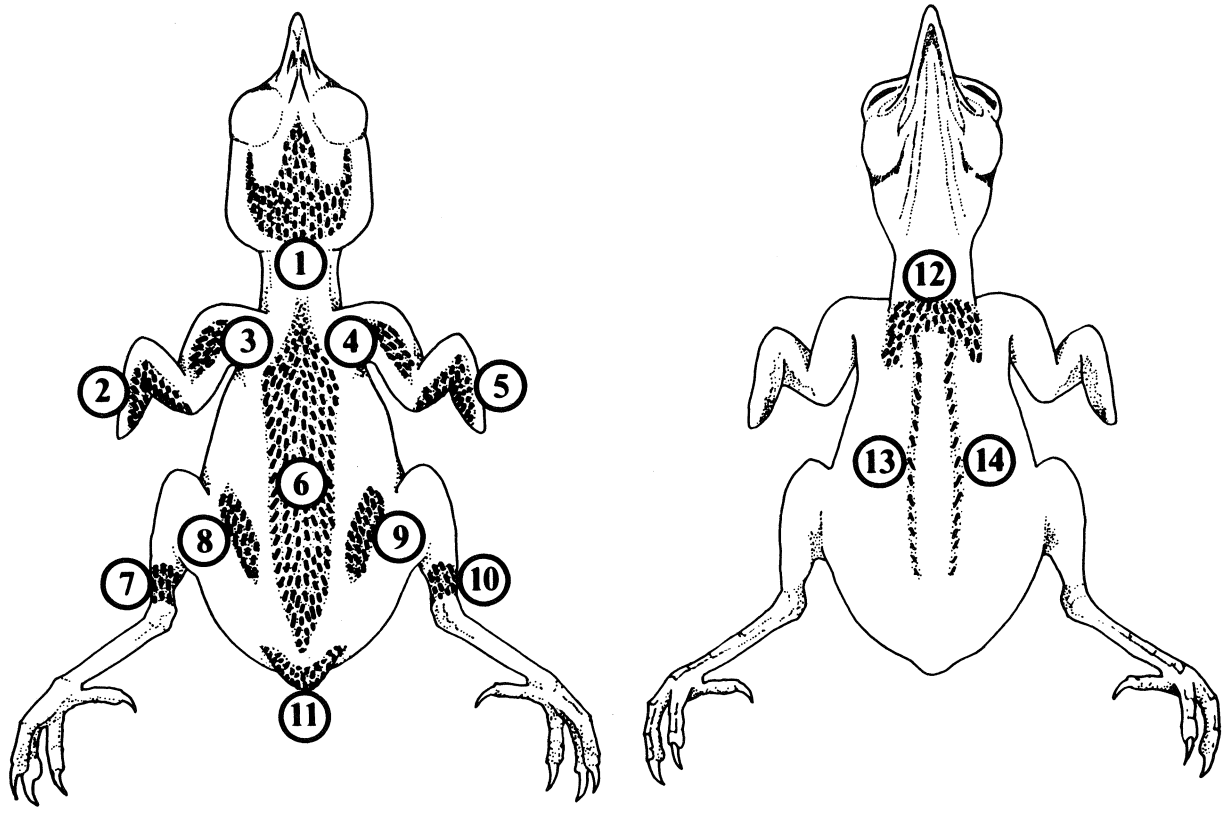

Fig. 4. Distribution of the downs on a four- to six-day-old Superb Lyrebird chick. Left, dorsal view. Right, ventral view.

down according to Tregellas (1921). A photograph of a one-day-old Superb Lyrebird nestling supplied by F.N. Robinson, and another of a very young nestling published by Thomson (1935), show the same distribution I have already described from a four to six-day-old nestling.

At fledging (about six weeks after hatching) the male Superb Lyrebird's plumage is similar to that of the adult female except for rufous tonings to the wings, back and tail coverts, and rufous patches on the forehead, chin and throat (Moroney, 1972). The rufous on the forehead is lost in the autumn moult, of the head and neck during the second year, while the rufous on the chin and neck gradually diminishes at three to four years of age. The tail is moulted in the first spring, and the male's tail gradually develops from the age of two until reaching its full form when the bird is five to eight years old.

Plumage changes in Albert's Lyrebird have not been studied.

There are clear-cut differences between natal down of the Superb Lyrebird and the Noisy Scrub-bird, the latter having fewer pterylae, and fewer and shorter downs in each pteryla. The Rufous Scrub-bird probably has still fewer and shorter downs. In the lyrebirds and the scrub-birds the female takes complete care of the nestling (Smith & Robinson, 1976; Smith, 1976b) and when the female leaves the nest to hunt, the nestling body temperature decreases (Lill, 1979). It may be that the differences in the downs are adaptations to the different temperature regimes during the early nestling periods. They might also reflect different phylogenies.

The juvenal plumage of both the scrub-birds and the lyrebird is brighter in overall tone than that of the adults. All the species are terrestrial, living in dense, dark, wet vegetation where the females care for their offspring for a period after fledging (Smith, 1976b). Experience with the Noisy Scrub-bird has shown that the juveniles are more easily seen than the adults. The brighter juvenal plumage may be an adaptation to help the female maintain short-distance contact with her chick. The brighter plumage may also enable the male to recognize young birds and thus prevent conflict between the male and his offspring.

The Noisy Scrub-bird undergoes a postfledging body moult (first prebasic) to acquire the first basic plumage, and a year later undergoes a second (prebasic) moult to assume adult (definitive) plumage. In the lyrebird, the sequence of moults and the attainment of adult

plumage are different and more complex. There is no postfledging moult. The first moult is in the autumn after fledging, at about six months of age, and only affects the head; the tail moults in the following spring. There are no data on the timing of the body and wing moults. Adult plumage is not acquired by the females until three or four years of age, and by the males not until five to seven years. Such a time span has closer parallels in the Ptilonorhynchidae (bower-birds) and Paradisaeidae (birds-of-paradise) (Sibley, 1974).

The large differences in the number and distribution of the natal downs and the plumage development between the scrub-birds and lyrebirds suggest that the two families are not closely related. Further studies on related families need to be done before the taxonomic significance (if any) of the recorded differences can be established.

ACKNOWLEDGEMENTS. I would like to thank Dr Mary Clench for her encouragement to undertake this study and for her helpful comments on early drafts of the manuscript. Mr Ian Rowley and Dr Richard Schodde also made many valuable comments. L.A. Moore and M.C. Ellis gave valuable assistance in the field and Perry de Rebeira drew the diagarams. Mr A.R. McEvey of the Museum of Victoria supplied the lyrebird skin and Dr A. Lill aged the specimen.

References

Campbell, A.G., 1939. Supposed female and eggs of *Atrichornis clamosus* (Gould). The Emu 38: 355–356.

Jackson, S.W., 1921. Second trip to the MacPherson Range, southeast Queensland. The Emu 20: 195–209.

Kitson, A.E., 1905. Notes on the Victoria Lyrebird (*Menura victoriae*). The Emu 5: 57–67.

Leach, J.A., 1929. The Lyrebird—Australia's wonder bird. The Emu 28: 199–214.

Lill, A., 1979. Nest inattentiveness and its influence on development of the young in the Superb Lyrebird. The Condor 81: 225–231.

Mees, G.F., 1964. Two hitherto unrecorded specimens of the Noisy Scrub-bird, *Atrichornis clamosus* (Gould). Western Australian Naturalist 9: 77–79.

Morony, D., 1972. Plumage changes in the Superb Lyrebird. The Emu 72: 17–21.

Reilly, P.N., 1970. Nesting in the Lyrebird in Sherbrooke Forest, Victoria. The Emu 70: 73–78.

Serventy, D.L., 1967. Mist-netting and ringing the Noisy Scrub-bird. Western Australian Naturalist 10: 151–153.

Sibley, C.G., 1974. The relationships of the lyrebirds. The Emu 74: 65–79.

Smith, G.T., 1976a. Noisy Scrub-bird. **In** 'Reader's Digest Complete book of Australian birds': 335. Reader's Digest Services Pty Ltd, Sydney.

————1976b. Ecological and behavioral comparisons between the Atrichornithidae and Menuridae. Proceedings of the 16th International Ornithological Congress: 125–136. Australian Academy of Sciences, Canberra.

Smith, G.T., C.A. Nicholls, L.A. Moore & H. Davis, 1983. The results of a breeding program for the Noisy Scrub-bird (*Atrichornis clamosus*) in captivity. Western Australian Naturalist 15: 151–157.

Smith, G.T. & F.N. Robinson, 1976. The Noisy Scrub-bird — an interim report. The Emu 76: 37–43.

Thomson, D.F., 1935. Some adaptations for the disposal of faeces, the hygiene of the nest in Australian birds. Proceedings of the Zoological Society of London 1934: 701–707.

Tregellas, T., 1921. Further notes on the Lyrebird (*Menura superba*). The Emu 21: 95–103.

Wetherbee, D.K., 1957. Natal plumages and downy pteryloses of passerine birds of North America. Bulletin of the American Museum of Natural History 113: 339–426.

Whittell, H.M., 1942. A review of the work of John Gilbert in Western Australia. Part II. The Emu 41: 216–242.

————1943. The Noisy Scrub-bird (*Atrichornis clamosus*). The Emu 42: 217–234.

Accepted 3 April 1985