

REMARKS ON THE TYMPANIC CAVITY OF *MALURUS*, *STIPITURUS* AND *AMYTORNIS* (PASSERIFORMES, MALURIDAE)

S. A. PARKER

INTRODUCTION

Mayr & Amadon (1951) and Keast (1961) recognized the subfamily Malurinae for a group of Australasian wren- and warbler-like genera, including *Malurus*, *Stipiturus*, *Todopsis*, *Chenoramphus*, *Glytomyias*, *Dasyornis*, *Amytornis*, *Aphelocephala*, *Sericornis*, *Acanthiza* and *Gerygone*. Harrison & Parker (1965), chiefly on behavioural evidence, restricted the subfamily to include only the first five genera and the Fijian genus *Lamprolia*, and used the term Acanthizinae to cover the remainder. Subsequently, Harrison (1969) redefined the Malurinae *sensu stricto*, including *Amytornis* and excluding *Lamprolia* (which latter may actually be a monarchine flycatcher *vide* Olson 1980). Schodde (1975) raised the Malurinae of Harrison to the rank of family, the Maluridae, a move that emphasizes the uncertainty concerning the group's taxonomic relationships.

A character discovered by Harrison (1969) in the Maluridae, and used by him in his redefinition of the group, is the gap in the interscapular zone of the spinal feather tract. In the present paper, I draw attention to a second unusual feature, the previously unremarked incapsulation of the *cavitas tympanica* (tympanic cavity or middle ear). I first noticed this feature in 1967, while preparing as study skins specimens of the Dusky Grasswren *Amytornis purnelli* and Striated Grasswren *A. striatus*. In 1971 I noted it similarly in the Grey Grasswren *A. barbatus*, in 1973 in the Thick-billed Grasswren *A. textilis*, and in 1976 in the Eyrean Grasswren *A. goyderi*. In 1969 and 1970, while examining collections of mammals during the compilation of a checklist of the mammals of the Northern Territory (Parker 1973), I noticed that certain desert-living forms, *e.g.* *Lagorchestes* and *Bettongia* spp., possessed considerably larger auditory bullae than forms inhabiting moister country. Enquiring of colleagues in mammalogy, I learnt that a correlation between relative size of auditory bullae and aridity of habitat was well known and documented (*e.g.* Webster & Webster 1975, Archer 1981). Below, I present some observations from a preliminary study of this feature in the Maluridae (grasswrens, emu-wrens and fairy-wrens), with reference to its occurrence and interpretation in mammals.

THE AVIAN TYMPANIC CAVITY

In mammals, the tympanic cavity or middle ear is usually more or less entirely enclosed by bone to form the auditory bulla (see for instance Novacek 1977). In birds, however, it is usually merely a shallow concavity in the skull, bounded posteriorly by the *ala tympanica* (tympanic wing), a lateral flaring of the *os exoccipitale*, and ventrally by a much smaller extension of the *os parasphenoidale* also termed the *ala tympanica* (Baumel 1979: 82, 88). In the skull of the Common or American Crow *Corvus brachyrhynchos* (Baumel 1979: 109) and in the skulls of all five Australian species of *Corvus* (including the Little Crow *C. bennetti*, fig. 4b), the exoccipital tympanic wing is not well-developed, providing little more than a posterior wall to a quite open tympanic cavity. In the skulls of other Australian passerines examined by me (including Black-faced Cuckoo-shrike *Coracina novaehollandiae*, Southern Scrub-robin *Drymodes brunneopygia*, Cinnamon Quail-thrush *Cincoloma cinnamomeum* (fig. 3a), Chestnut-crowned Babbler *Pomatostomus ruficeps*, Grey Shrike-thrush *Colluricincla harmonica*, Restless Flycatcher *Myiagra inquieta*, Willie Wagtail *Rhipidura leucophrys*, White-browed Scrubwren *Sericornis frontalis* (fig. 3b), Shy Hylacola *S. cautus* (fig. 3c), White-throated Treecreeper *Cormobates leucophaea*¹ (fig. 4a) and Singing Honeyeater *Lichenostomus virescens*) the tympanic wing is produced forwards to enclose in varying but relatively slight degree the posterior and postero-ventral regions of the tympanic cavity.

In the skulls of the Maluridae, however, the relative volume of the tympanic cavity is increased, less by any greater forward production of the tympanic wings than by extension of the cavity backwards, downwards and outwards, manifest as a bulla-like bulging of the posterior, postero-ventral and lateral walls. In the Superb Fairy-wren *Malurus cyaneus* (fig. 1a) the bulla-like effect is slight, increasing through the White-winged Fairy-wren *M. leucopterus* (fig. 1b), Southern Emu-wren *Stipiturus malachurus* (fig. 1c), Striated Grasswren *Amytornis striatus* (fig. 2a) and Grey Grasswren *A. barbatus* (fig. 2b) to an extreme development in the Thick-billed Grasswren *A. textilis* (fig. 2c).

¹ Removed from the genus *Climacteris* by Parker (1982)

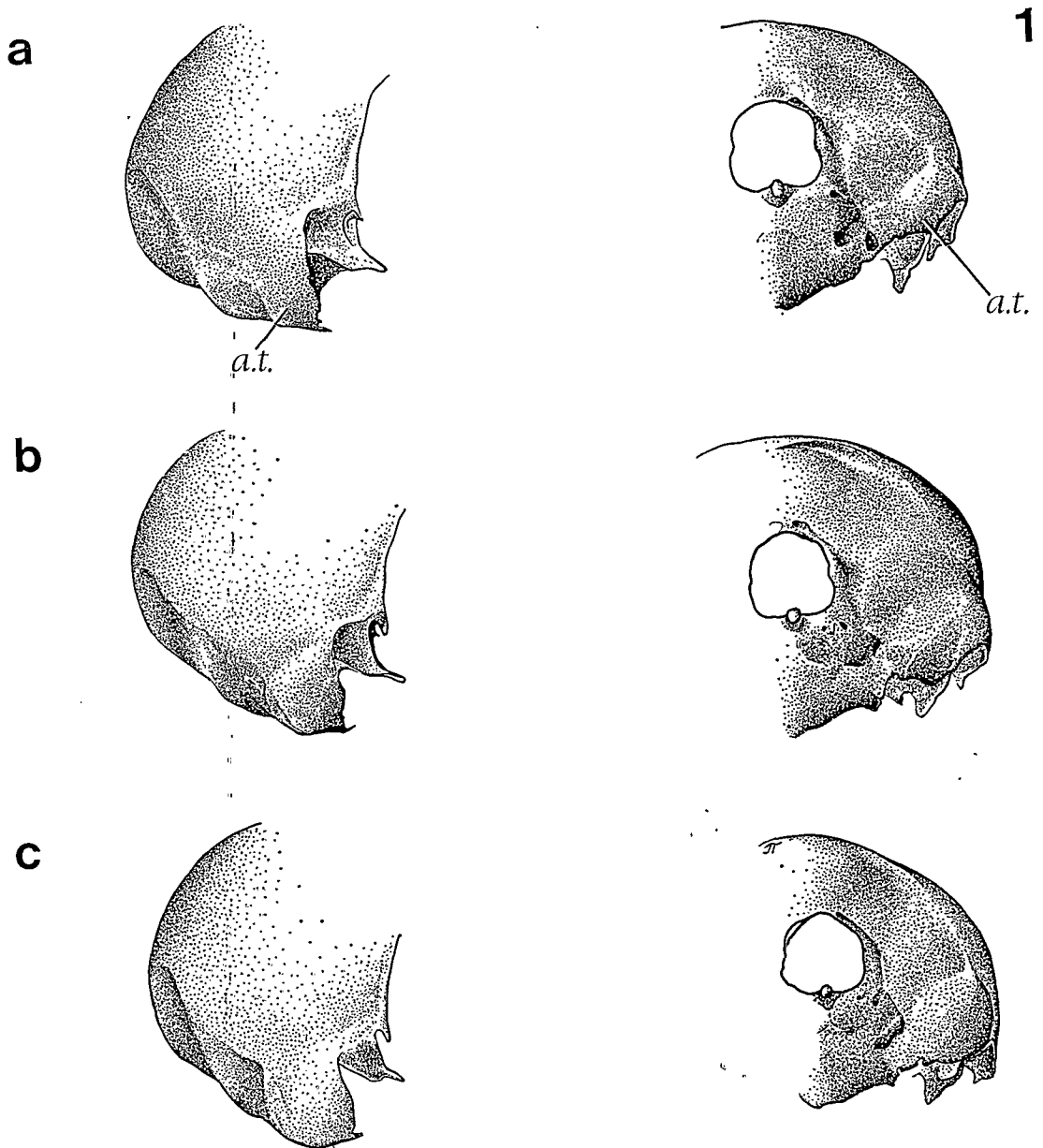
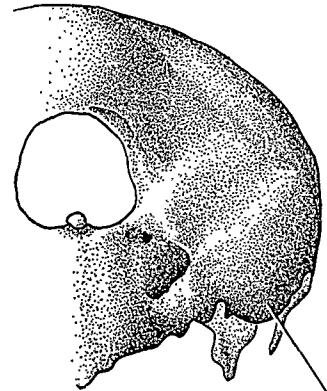
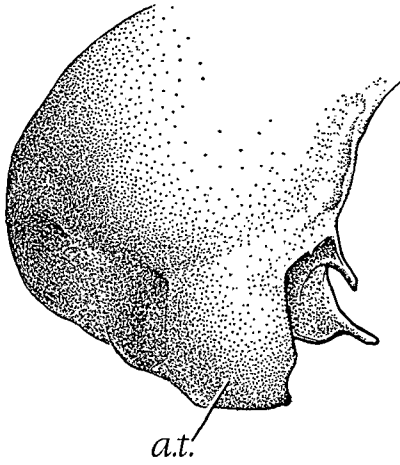


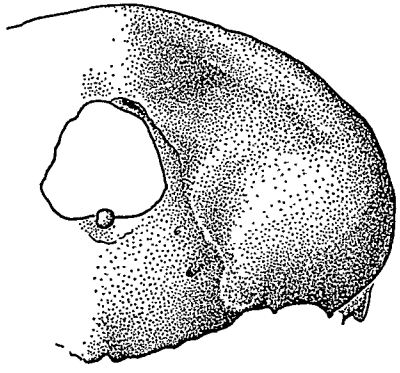
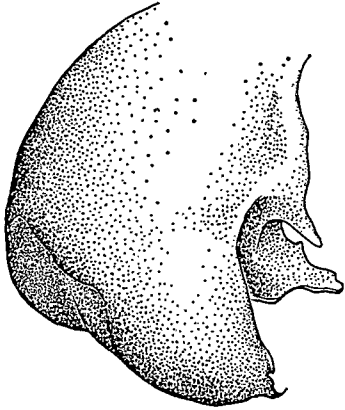
FIGURE 1. Views of skull showing tympanic region (left, lateral, right, ventral, *a.t.* *ala tympanica*). (a) *Malurus cyaneus*, (b) *M. leucopterus*, (c) *Stipiturus malachurus*.

2

a



b



c

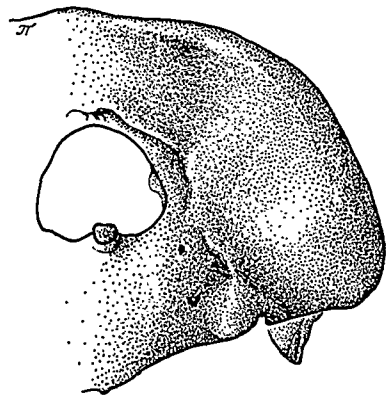
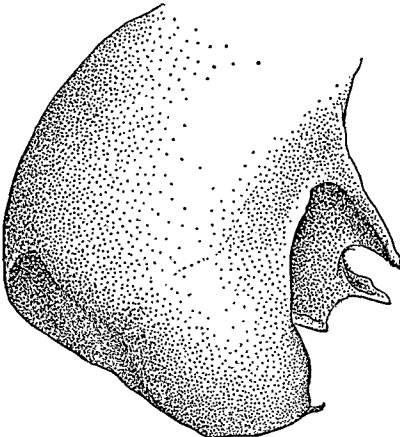


FIGURE 2. (Key as in Figure 1). (a) *Amytornis striatus*, (b) *A. barbatus*, (c) *A. textilis*.

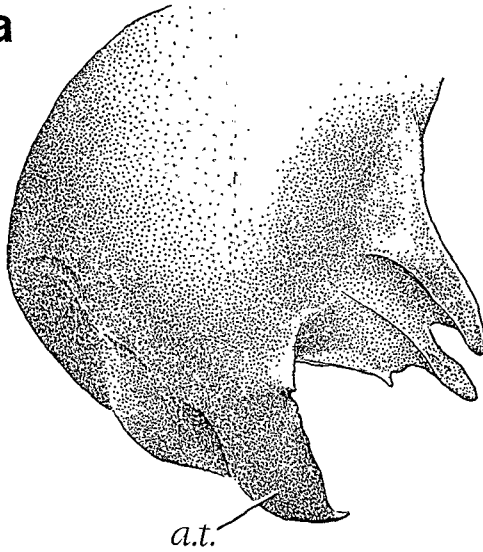
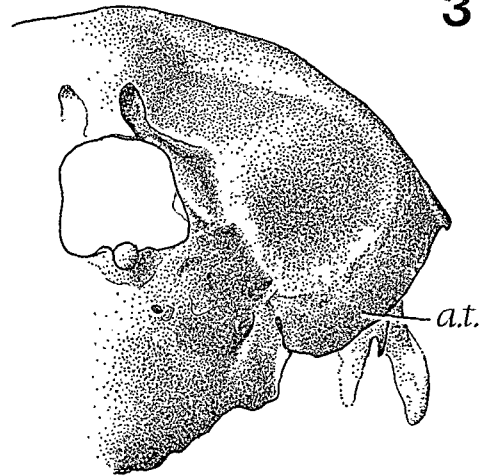
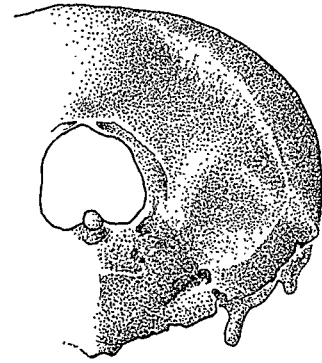
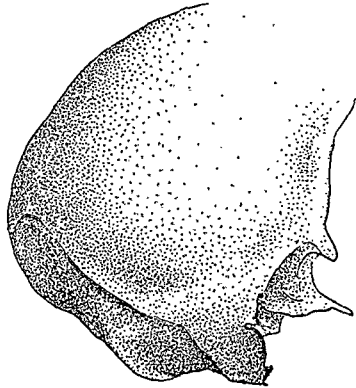
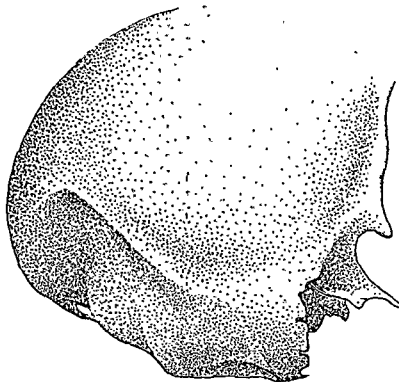
a**3****b****c**

FIGURE 3. (Key as in Figure 1). (a) *Cinclusoma cinnamomeum*, (b) *Sericornis frontalis*, (c) *Sericornis cautus*.

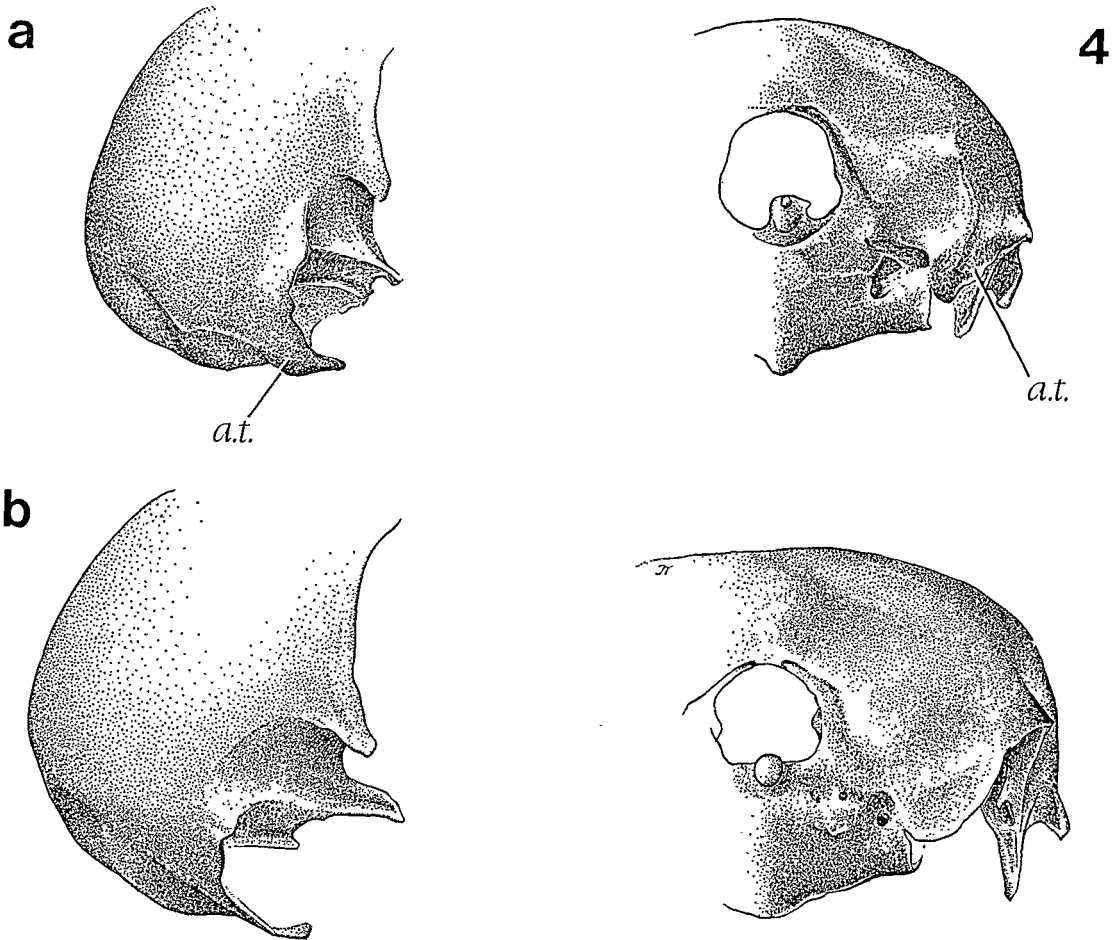


FIGURE 4. (Key as in Figure 1). (a) *Cormobates leucophaea*, (b) *Corvus bennetti*.

DISCUSSION

From the literature (e.g. Webster & Webster 1975, Archer 1981) it seems that in terrestrial mammals there is, with some exceptions, a correlation between increasing relative size of auditory bullae and increasing aridity of habitat. In the evidence presented here from *Amytornis*, *Stipiturus*, *Malurus*, *Cinclosoma* and other Australian songbirds there is likewise conformity and exception to this trend. *Amytornis*, the species of which are largely terrestrial, is one of the most aridicolous of the Australian passerine genera (Keast 1958, 1961, Parker *et al.* 1978). Similarly, *Malurus leucopterus* is also largely a species of the arid zone, whereas *M. cyaneus* inhabits dense thickets in moister areas. Yet *Cinclosoma cinnamomeum*, a terrestrial bird of sparsely vegetated stony plains and sandhill desert, shows a relatively slight development of the tympanic wings, whereas *Stipiturus mala-*

churus, of dense, usually wet, herbage and thickets, shows a degree of development in this feature greater than that in *Malurus leucopterus*.

As to why many desert animals show relatively enlarged auditory bullae, there is evidence from mammals that larger bullae enhance sensitivity to low-frequency sounds such as those produced by the attack-flight of owls and the strike of snakes; the selection pressure for such sensitivity to evolve would be particularly great for animals living in areas with very little cover, where sparse vegetation would both increase the need to forage and decrease the protection (Webster & Webster 1975, Archer 1981 and references therein). Predators exerting such influences on the diurnal grasswrens might well include falcons, hawks, owls hunting at twilight, and large snakes (of which last I have, while searching for nests of the Eyrean Grasswren in Sandhill

Canegrass *Zygochloa paradoxa*, encountered several examples concealed well up within the tall dense tussocks).

ACKNOWLEDGEMENTS

For help in the preparation of this article I am indebted to the following: my colleague Jenni Thurmer, who drew the figures of skulls, Dr Patricia Vickers Rich of Monash University, who assisted me with the nomenclature of the avian skull, and Dr Michael Archer of the University of New South Wales and my colleague Mr Peter Aitken, who introduced me to the literature on mammalian auditory bullae.

REFERENCES

- Archer, M. 1981. Results of the Archbold Expeditions, 104. Systematic revision of the marsupial dasyurid genus *Sminthopsis* Thomas. *Bull. Amer. Mus. nat. Hist.* 168 (2): 63-223.
- Baumel, J. J. (ed.) 1979. *Nomina Anatomica Avium*. Academic Press: London, New York.
- Harrison, C. J. O. 1969. The affinities of the blue wren genus *Malurus* and related genera: with special reference to the grass-wren genus *Amytornis*. *Emu* 69: 1-8.
- Harrison, C. J. O. and S. A. Parker. 1965. The behavioural affinities of the blue wrens of the genus *Malurus*. *Emu* 65: 103-113.
- Keast, J. A. 1958. Speciation in the genus *Amytornis* Stejneger (Passeres: Muscicapidae, Malurinae) in Australia. *Aust. J. Zool.* 6: 33-52.
- 1961. Bird speciation on the Australian continent. *Bull. Mus. comp. Zool.* 123: 305-495.
- Mayr, E. and D. Amadon. 1951. A classification of recent birds. *Amer. Mus. Novit.* 1496: 1-42.
- Novacek, M. J. 1977. Aspects of the problem of variation, origin and evolution of the eutherian auditory bulla. *Mammal Rev.* 7 (3-4): 131-149.
- Olson, S. L. 1980. Lamprolia as part of a South Pacific radiation of monarchine flycatchers. *Notornis* 27: 7-10.
- Parker, S. A. 1973. An annotated checklist of the native land mammals of the Northern Territory. *Rec. S. Aust. Mus.* 16 (11): 1-57.
- 1982. The relationships of the Australo-Papuan treecreepers and sittellas. *S. Aust. Orn.* 23: 197-200.
- , I. A. May and W. Head. 1978. Some observations on the Eyrean Grasswren *Amytornis goyderi* (Gould, 1875). *Rec. S. Aust. Mus.* 17 (24): 361-371.
- Schodde, R. 1975. Interim List of Australian Songbirds. Passerines. Melbourne: RAOU.
- Webster, D. B. and M. Webster. 1975. Auditory systems of Heteromyidae: functional morphology and evolution of the inner ear. *J. Morphol.* 146: 343-376.

S. A. Parker, South Australian Museum, Adelaide, South Australia, 5000.

Accepted 6 August, 1982.