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The Bony Casque of the Southern Cassowary *Casuarius casuarius*

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In the adult Southern Cassowary *Casuarius casuarius* the casque, when viewed from its lateral side, is a roughly trapezoidal structure measuring about 17 cm in height, 15 cm in length. It has a maximal width of 7 cm. The outer layer of the casque, usually a light to dark brown colour, resembles hoof material, similar to the 'tortoise shell' as found in the epidermal scales of the marine turtle. When handled, the casque is not as rigid as the keratinous structures of hooves and horns nor like the bony protuberances of antlers and giraffe horns. However, as reported by Crome & Moore (1988), it does 'give', as while it is rigid longitudinally it deforms readily when squeezed laterally. They describe the casque as consisting 'of a keratinous skin over a core of firm, cellular foam-like material that looks like some hi-tech plastic'.

This study, albeit on one skull, augments their findings and adds to the basic knowledge of the structure and ultimately the function of the casque.

A 35-year-old, male Southern Cassowary from the Perth Zoological Gardens was put down on humanitarian grounds, necropsied and its head taken for museum preparation of its skull. The head was macerated in water for several weeks. During this time the 'horny' external sheath of the casque fell away from its internal core. The horny sheath had a hard outer layer covering a softer thicker inner layer. Immediately beneath the sheath was a distinct core of sculpted calcified material. This filled the entire region below the sheath and measured 16 cm in height, 14 cm in length and had a maximal width of 6 cm. The skull was radiographed and photographed (Fig. 1).

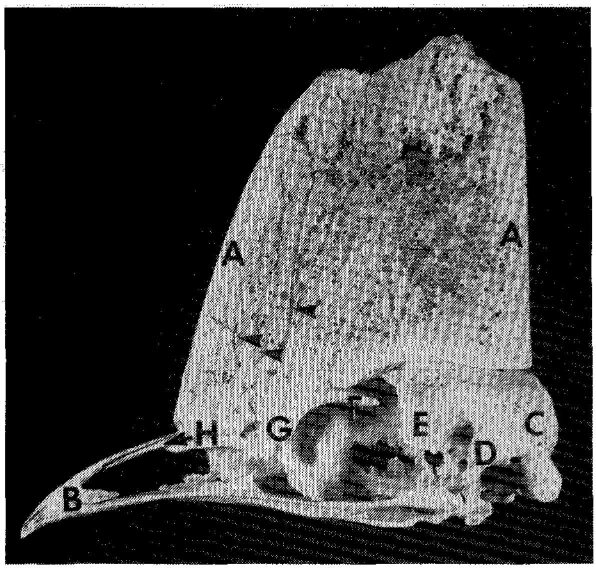

Figure 1 Left lateral photograph of the skull with its dorsal casque. A, calcified core of the casque; B, premaxilla bone; C, occipital bone; D, squamosal bone; E, postorbital process of the frontal bone; F, supraorbital process of the nasal bone; G, lacrimal bone; H arrowed, nasal bone; small arrows, dorsoventrally running vascular grooves. Note the degree of fenestration varies from little at the margins to extensive in the central regions.

The calcified core had an external flattened thick layer (Fig. 1) surrounding an inner dense network of what appeared to be fine trabecular bone. The outer layer of calcification was thick and continuous over the casque's rostral, dorsal, caudal and ventrolateral edges. Over the bulk of its lateral face the outer layer was extensively fenestrated with most fenestrae occurring caudodorsally where little 'bone' was apparent (Fig. 1).

Ventrally, the casque core was fused firmly with the neurocranium (Fig. 1). Caudally, just rostral to the occipital bone, it appeared to fuse with the parietal bones. Over most of its lateral length it was firmly attached to the frontal bone. Towards the orbital region lateral extensions of the casque core extended virtually to the edge of the skull. It encroached upon the nasal bones and possibly the caudal region of the premaxillary bones. In the latter case, it may not have fused with the premaxillaries, it simply may have formed a cover over their origin.

The surface of the outer 'bone' was distinctly carunculated over its cranial and caudal edges and gave the appearance of having much greater support strength in these regions. The entire surface was traversed by dorsoventrally running grooves. These grooves were narrow, up to 1 mm in depth, and were probably the sites where the larger blood vessels and nerves traversed between the keratinous sheath and bony core. Substantial vessels and nerves could then penetrate medially via fenestrae into the substance of the casque.

During maceration large amounts of darkly pigmented sludge came from the deeper regions of the casque. This suggests that there may have been an extensive vascular network and possibly other structures deep within the casque. Unfortunately once maceration was complete, only the fine trabecular network of calcification remained in the deeper regions.

At present, it is tempting to state that the casque core is bone but it could equally well be calcified cartilage. However, a calcified core does support the Southern Cassowary's casque which confirms the earlier reports of a bony casque (Macdonald 1973; Simpson & Day 1984; Beehler *et al.* 1986). A detailed histological examination even via a series of biopsy cores, would clarify the nature of the external sheath and its underlying calcified core. This could, in turn, shed light on the function of this unusual structure.

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Growth and Development of the Yellow-bellied Sunbird *Nectarinia jugularis* in North Queensland

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Some passerines in the tropics grow more slowly than do some in the temperate zone which led to the suggestion (Ricklefs 1968) that slow growth was characteristic of tropical passerines. However, Oniki & Ricklefs (1981) found that the growth rate of some neotropical passerines was not distinguishable from the growth rate of temperate zone passerines and Maher (1986) showed that the growth rate of the Brown-backed Honeyeater *Ramsayornis modestus* in tropical Queensland was also indistinguishable from that of temperate zone passerines. There is, however, a shortage of growth studies of tropical passerines, especially in the Australian tropics.

I present data on growth and development of the Yellow-bellied Sunbird *Nectarinia jugularis* obtained near Townsville, Queensland (19°15′S, 146°48′E) from August to November 1984.

Study area and methods

The study was done in *Eucalyptus-Melaleuca* woodland in the Townsville Town Common Environmental Park. The climate is tropical with contrasting wet and dry seasons with most rain falling from December through March. July, August and September are the driest months. The monthly mean temperature is 19.3°C in July and 27.6°C in January. More detailed climate data are in Maher (1986, 1988). Climate during this study was average.

Nests were usually visited between 0630 and 1000. Individually marked nestlings were weighed on an Ohaus triple beam balance accurate to 0.1 g. The bill was measured from the external nares to the tip and from the corner of the mouth to the tip (gape). The tarsus, manus, seventh primary and one central rectrix were also measured, and development and behaviour were noted. Further details are given in Maher (1986). The weight curves were fitted to the logistic curve (Ricklefs 1967) using a non-linear least squares curve-fitting program.

Adult dimensions were taken, as described above, from ten male and ten female specimens from Queensland in the American Museum of Natural History (AMNH).

Weights of adult sunbirds are from the AMNH, the Australian Museum, the Queensland Museum, and the CSIRO Division of Wildlife & Ecology.

Results

The adult female Yellow-bellied Sunbird is smaller than the male in all measurements except those of the bill (Table 1). The size difference of manus, tarsus, seventh primary, wing chord and rectrix are highly significant