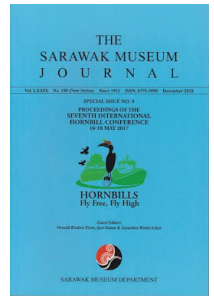




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GREAT HORNBILL CASQUE FUNCTIONS AS A THERMOREGULATORY RADIATOR

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ABSTRACT

Hornbills (*Bucerotidae*) are defined by their casques, structures that are extensions of the beak. The purpose of these structures, which take diverse forms, has been subject to speculation. In this study, it is asserted that a primary function of the casque is thermoregulation, its large vascularised surface area functioning as a structure to facilitate heat exchange. Infrared thermography on a Great Hornbill (*Buceros bicornis*) revealed that the bird's casque exhibited significant percentage of heat loss in relation to the body's resting heat production along a temperature gradient of 19.2 to 34.2°C. The results indicate that the casque is capable of dissipating a disproportionate amount of heat in relation to the rest of its body and even comparable to major thermal windows in other animals.

Keywords: Great Hornbill, casque, hornbill, thermoregulation, physiology, functional morphology

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Hornbills (Bucerotidae) are defined by their casques, structures that are extensions of the beak. The purpose of these structures, which take diverse forms, has been subject to speculation. In this study, it is asserted that a primary function of the casque is thermoregulation, its large vascularised surface area functioning as a structure to facilitate heat exchange. Infrared thermography on a Great Hornbill (*Buceros bicornis*) revealed that the bird's casque exhibited significant percentage of heat loss in relation to the body's resting heat production along a temperature gradient of 19.2 to 34.2°C. The results indicate that the casque is capable of dissipating a disproportionate amount of heat in relation to the rest of its body and even comparable to major thermal windows in other animals.

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INTRODUCTION

The casque is an extension of the beak found in all species of hornbills (Poonswad *et al.* 2013). Despite the casque being a prominent structure that takes many forms and sizes, little is known about its purpose (Kinnaird & O'Brien 2007). While sexual selection and species recognition has likely played a role in the divergence of casque types among hornbill species, there is little sexual dimorphism in terms of difference in proportional shape and size of the casques between males and females.

One concept is that the casque is an organ for amplification of sound frequencies, though dominant frequencies have not been observed to be amplified by the internal structure (Alexander *et al.* 1994). Another possibility is thermoregulation. Large endotherms risk overheating in high-temperature