HOT STUFF

Male tit-babblers' warming ways

A bird's arrival in this world can be hazardous, to say the least. Unlike the embryos of mammals, which have the luxury of developing in the warm and stable conditions of their mothers' wombs, avian eggs are exposed to harsh external environments. In addition to the risks posed by desiccation, physical damage and egg predators like snakes and monkeys, avian embryos are exposed to temperature fluctuations dictated by external conditions.

At this embryonic stage of their lives birds lack the ability to regulate their own temperature, yet their survival and development are critically dependent on the thermal conditions they experience. For normal development to occur, eggs need to be maintained within a narrow range of temperatures – neither too hot nor too cold. Fluctuating temperatures are bad news. If an egg cools below the optimal range, embryonic development slows dramatically and may halt altogether if the temperature drops below a threshold referred to as 'physiological zero'. Conversely, if egg temperature increases above the tolerable range, the resultant heat shock may prove fatal.

Notwithstanding a few groups of birds that have evolved remarkable strategies for regulating egg temperature (such as the Australian mound-builders, which make use of the heat generated by rotting vegetation), the most common form of incubation involves direct contact between adults and eggs in order to transfer body heat to the developing embryos. The amount of time an adult can afford to spend off the nest is determined by the rate at which eggs cool when unattended; not surprisingly, birds in cool climates cannot spend as much time off their nests as those in warmer climates.

Biparental care, where both parents are directly involved in caring for eggs and/or young, is much more common in birds than in other egg-laying animals. Typically, the male and female members of a breeding pair perform different roles: females generally carry out incubation duties, while the male is usually involved in providing food to hungry chicks. In some species, however, both males and females incubate eggs and chicks.

One southern African species that exhibits well-developed biparental incubation is the Chestnut-vented Tit-Babbler *Parisoma subcaeruleum*, a charming little passerine that is common in a variety of habitats in the western parts of the subregion. Research conducted in Koeberg Nature Reserve, just north of Cape Town, has revealed that male tit-babblers are remarkably involved fathers when it comes to keeping eggs warm, with incubation duties being shared equally between the sexes. However, it turns out that the actual parental effort of male tit-babblers extends far beyond merely performing 50 per cent of the incubation.

By measuring the temperature of tit-babbler eggs under incubating adults, the researchers discovered a surprising difference between the sexes: the males kept eggs slightly but significantly warmer than the females did. This completely unexpected difference in average incubation temperature was small – less than half a degree Celsius – but very likely sufficient to significantly influence embryonic development rates.

What makes the higher egg temperatures maintained by male tit-babblers even more singular is that males of this species do not possess a brood patch, whereas females do. A brood patch is an area of unfeathered skin on an adult bird's underparts that is richly supplied with blood vessels and acts as a 'thermal window' for efficient heat transfer to eggs or chicks without the impediment of an insulating layer of feathers. By maintaining higher egg temperatures without the aid of a brood patch, male tit-babblers apparently expend substantially more energy generating body heat while incubating than females do. The Chestnut-vented Tit-Babbler is the first bird species in which such a marked disparity between male and female parental effort during incubation has been documented.

ANDREW McKECHNIE □

REFERENCE
Auer, S.K., Bassar, R.D. and Martin, T.E. 2007. 'Biparental incubation in the chestnut-vented tit-babbler *Parisoma subcaeruleum*: mates devote equal time, but males keep eggs warmer.' *Journal of Avian Biology* 38: 278–283.

RYAN EBEDES

The male Chestnut-vented Tit-Babbler incubates eggs at a markedly higher temperature than the female does.