WEAR & REPAIR

Managing the costs of moult

The avian feather is one of the most remarkable structures to have evolved during the long and diverse history of life on earth. Besides providing a highly effective barrier to heat loss, feathers give birds the aerodynamic surfaces required for a mastery of powered flight unparalleled in other flying animals. Feathers also form the basis for spectacular ornaments, like the peacock's tail, and coloration ranging from the startling crypsis of nightjars to the vivid hues of a Crimson-breasted Shrike's underparts.

Feathers are constantly being damaged through physical wear and tear and degraded by keratin-digesting bacteria, and so a bird must shed its feathers periodically and re-grow a fresh set. Recent studies have identified moult as a singularly inefficient process; in some species, the chemical energy contained in the molecules making up new feathers is equivalent to less than five per cent of the total energy spent on the moulting process. This inefficiency reflects the energy-demanding cascade of precisely orchestrated physiological processes involved in rapidly growing a new set of high-quality feathers.

Because of the substantial investment involved, many birds time their moult so that it does not coincide with other energy-demanding periods of their annual cycle. In particular, many species avoid moulting while breeding – growing new feathers while simultaneously trying to meet the appetites of a hungry brood can have serious negative consequences for both adults and chicks. There is evidence from Eurasian species that nestlings provisioned by moulting adults receive less food and experience significantly higher mortality compared to nestlings whose parents avoid overlap of moult and breeding.

Scheduling moult so as to avoid breeding and other energy-intensive activities is relatively straightforward in predictable, seasonal environments where breeding times remain constant from year to year. But things become more complicated in unpredictable desert environments where reproduction is strongly tied to irregular rainfall events. For many arid-zone birds, heavy storms at any time of the year trigger breeding, with reproduction thus coinciding with the flush of food and water that follows good rains. Unexpectedly, many of these species nevertheless show a comparatively predictable annual moult cycle, with feather growth thus sometimes coinciding with breeding activity.

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By taking longer to grow new feathers during moult, arid-zone species like the White-browed Sparrow-Weaver reduce their daily energy and nutrient demands.

Researchers at Deakin University, near Melbourne, recently measured the cost of moult in the White-plumed Honeyeater, a species that is widespread in the arid interior of Australia. The honeyeater has a regular annual moult cycle but an irregular, rainfall-linked breeding pattern. Under these circumstances, the researchers hypothesised, moult should have evolved into a more efficient process so that it is less likely to negatively affect reproductive success. Surprisingly, this was not the case at all: just less than seven per cent of the energy invested in moult by the honeyeaters ended up in new feathers, making it just as inefficient as in typical northern hemisphere species.

One way in which arid-zone birds do, however, appear to ameliorate moult costs is by taking much longer to grow their new feathers. The honeyeaters take approximately 170 days for a complete moult, while in southern Africa, Scaly-feathered Finches take more than 200 days and White-browed Sparrow-Weavers around 180 days. In contrast, moult in similarly sized Eurasian species is typically a much speedier affair: just 62 days in Bluethroats and 70 days in Chaffinches, for instance. Although the total cost of moult is no different between these species, spreading this burden over a longer period means that the extra energy and nutrients required on a daily basis become more manageable.

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REFERENCE

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