

Devotion to rearing chicks can come at a cost for migratory birds

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Birds that have to work harder during breeding season will feel the effects of their exertions the following year, according to research by Oxford University scientists.

A new study published in the *Journal of Animal Ecology* found that migratory seabirds suffered negative repercussions when they had to spend more time rearing chicks, including decreased breeding success when they returned to the colony the following spring.

The study artificially altered the length of the chick-rearing period for pairs of Manx shearwaters, giving new insights into the consequences for [birds](#) whose reproductive phase doesn't go to plan. All parent pairs involved in the study cared for their foster chicks until they were fully reared - often at their own expense.

Lead author Dr Annette Fayet, of the Oxford Navigation Group in the University of Oxford's Department of Zoology, said: 'The results of this study provide evidence for carry-over effects on the subsequent migratory, wintering and breeding behaviour of birds.'

Carry-over effects are the processes by which events in one breeding season may affect the outcome of the subsequent season. But the exact nature of these effects, as well as whether they affect other events in birds' annual cycles, such as migration and wintering, has been unclear.

Dr Fayet said: 'Birds that had their chick-rearing period extended in our

study delayed the start of their autumn migration and spent less time at the wintering grounds, and while they were there they spent less time resting. When they returned to the colony the following spring, they started breeding later, laid smaller eggs, reared lighter chicks - early, heavy chicks survive better - and overall had a lower breeding success.

'This suggests that the birds were in poorer condition after working harder during the experimental breeding season and shows the negative effects on both non-breeding and breeding behaviour in the year following the experiment.'

Dr Fayet added: 'Conversely, birds that had a shortened breeding season in the experimental year started migration on time, spent more time resting and less time foraging at the wintering grounds, and had a similar breeding season to control birds the following year.'

'Interestingly, this shows that "positive" carry-over effects occur but also that they may be less strong, or are shorter-lived, than "negative" ones.'

The team conducted an experiment involving the Manx shearwater (*Puffinus puffinus*), a migratory bird with an average lifespan of around 30 years. Manx shearwaters nest in burrows on dense colonies along the British coast and embark on a journey of more than 8,000km to the Argentine Sea every autumn.

Each year in spring they produce a single chick, which they generally feed for around 60 days. But the resources allocated by parents to feed their chick can vary: for example, factors such as food shortage, poor weather conditions, inexperience or late breeding - perhaps because of delayed migration or poor body condition - are likely to increase the energy expended during reproduction. This raises the possibility of birds being caught in a 'vicious cycle', where the carry-over effects of a difficult breeding season continue throughout the winter, making it

harder for the birds to fully regain their body condition and thus have an easier [breeding season](#) the following year.

In the study, the researchers swapped chicks between nests on the Manx shearwater colony of Skomer Island, Wales, artificially extending or shortening the chick-rearing period of 42 breeding pairs by around 25%. They then tracked the movement and behaviour of each adult with miniature geolocators, closely monitoring their breeding performance the following year (including laying date, egg mass, chick growth rate and breeding success).

All pairs cared for their foster chick until normal fledging age, which resulted in a delayed start of migration for the pairs which had their chick-rearing period extended.

Dr Fayet said: 'Controlled experiments like this one are rare but necessary to disentangle the complex mechanisms of carry-over effects and cost of reproduction in migratory birds.

'The results of this study are important because they reveal how carry-over effects can develop and affect animals throughout their annual cycle, and not just in terms of their breeding performance. They also help us understand how the decisions birds make regarding their life cycles - such as delaying migration to ensure their chicks are properly reared - are influenced by a complex relationship between individual body condition, external constraints, and current and future reproduction.

'Some 28% of seabird species are globally threatened, and numbers have dropped by 70% over the past 60 years. If all the events in a bird's annual cycle are linked, from breeding to migration and wintering, then any conservation measures to combat a species' decline must address these events together.'

Dr Fayet added: 'However, we still have a lot to understand. For example, our study did not investigate whether carry-over effects affect the two sexes differently: do females, which have to produce the egg, pay a heavier price for being in a poor condition? Additionally, little is known about the duration of carry-over effects, which is likely to affect how long-lived animals optimise their life decisions.'

Manx shearwaters do not recognise their chicks individually, and the [breeding](#) pairs used in this study were able to start migration no later than other naturally late breeders.

More information: 'Carry-Over Effects on the Annual Cycle of a Migratory Seabird: an Experimental Study' *Journal of Animal Ecology*, Wednesday 31 August 2016. [DOI: 10.1111/1365-2656.12580](https://doi.org/10.1111/1365-2656.12580)

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