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Rethinking bird feeding: are we putting extra pressure on some struggling woodland birds?

Bird feeding as a national pastime

Feeding birds is the most common way that people interact with wildlife in Britain. Up to two-thirds of all households spend £250 million on 150,000 tonnes of birdfood annually, mostly seeds (such as sunflower), peanuts and fats in various forms. Estimates suggest there are an average of 100 bird feeders per square kilometre of the country, or one for every nine feeder-using birds, which are primarily Blue Tits *Cyanistes caeruleus* and Great Tits *Parus major* (Davies et al. 2009, BTO 2021). We provide enough food to feed the entire populations of the ten commonest feeder-using species all year round, *three times over*, even if they ate nothing else.

Those birds that are best able to exploit this food bonanza can benefit from increased survival rates and breeding success. Consequently, species such as Blue Tits, Great Tits and even Great Spotted Woodpeckers *Dendrocopos major* have increased their populations, which is in no small part related to the growth of bird feeding over the past 50 years (Woodward et al. 2020). Bird feeding is also beneficial to us humans, by improving our mental wellbeing, lowering stress and giving us a greater feeling of connection with nature. Indeed, bird feeding has become so important as a cultural phenomenon that it has developed into its own field of ornithological science (Toms 2019).

Bird-feeding concerns

Increasingly, however, there are also concerns over the negative impacts of bird feeding operating at such a vast scale (Shutt & Lees 2021). Mike Toms' (2019) superb book describing our relationship with garden birds lists the grim toll of disease epidemics that continue to affect many species, with most of the disease transmission happening around bird feeders. A well-known example is the European Greenfinch *Chloris chloris*, whose abundance rocketed during the 1990s as they exploited garden birdfood, only to dramatically collapse from 2005 as they were infected by the protozoan parasite *Trichomonas gallinae* - which causes the disease trichomonosis - whilst congregating at contaminated feeders.

In addition to the direct effects on birds that use feeders, there is also growing interest in the knock-on effects that bird feeding is likely to have on the wider bird community. It would be surprising if such a colossal input of food resources into the environment did not have impacts that rippled through ecosystems. Indirect impacts of bird feeding may be felt by species that do not generally use feeders themselves, but interact with those that do.

One important indirect effect involves increased competition for species that co-exist in the wider countryside alongside those that benefit from bird feeding. Since the 1960s, the UK abundance of Blue Tits and Great Tits has increased by a respective 24% and 89%, and they reach higher densities in our woodlands than almost anywhere else in Europe (Cramp & Perrins 1993). In Britain, we have created a virtual paradise for these two species, not only providing them with vast amounts of easy food, but also with millions of nest-boxes to help accommodate them. What does this mean for the other species that share their habitat with these subsidised birds?

As woodland generalists, Blue Tits and Great Tits cross habitat boundaries with ease, moving between woodland, villages and suburbs to access garden bird feeders. A recent study (Shutt et al. 2021) found peanuts to be the most common food item in the diet of Scottish Blue Tits, being present in birds up

to 1.4 km from the nearest garden, showing how far this influence extends. It is reasonable to question if boosting the abundance of these generalists by year-round feeding has skewed the wider bird community, especially in the woodlands where many tits return to breed in spring.

Is bird-feeding implicated in some woodland bird declines?

Since the 1970s there have been dramatic declines of some woodland specialists, notably Marsh Tits and Willow Tits whose populations have collapsed by a respective 78% and 92% (Woodward et al. 2020). Research into these declines has not yet found definitive explanations, but much has been learned about their ecology and the problems they face, which have been summarised previously in *British Birds* (e.g. Lewis et al. 2009, Broughton & Hinsley 2015).

From these studies, it is clear that habitat change alone cannot account for the declines of Marsh Tits and Willow Tits. In some areas where woodland seems to have changed very little, or even improved for them, they have still declined or gone extinct. Nationally, Marsh Tits should be benefitting from the increasing maturity of much of Britain's new woodland, although Willow Tits have likely lost out from this. Nevertheless, the expansion of woodland and wetlands over recent decades should have created new habitats for Willow Tits (Broughton et al. 2021). Yet, both species are vanishing even from former strongholds that appear perfectly suitable.

What could have changed across such a large scale to push Marsh Tits and Willow Tits into their current habitat refuges? Increased competition could be an important factor. As well as being far more numerous, Blue Tits and Great Tits are also socially dominant over Marsh Tits and Willow Tits, so they tend to win any interactions where their niches overlap. That could mean dominating natural food resources and safe foraging areas, or taking over nest cavities and causing breeding failure.

To counter the dominance of Blue Tits and Great Tits, Marsh Tits and Willow Tits both have a survival strategy of establishing a large year-round territory that contains all the resources that a pair needs to support them throughout their life. This means that they naturally occur at much lower densities than Blue Tits or Great Tits, but they underpin this strategy by hoarding natural food within their territories during the autumn and winter, which gives them an advantage during lean times. Non-hoarding Blue Tits and Great Tits have no natural buffer of stored food and are not tied to a fixed territory, and so they rely on what they can find as they forage each day. (Perrins 1979).

Willow Tits have another tactical advantage of being able to excavate their own nest cavities in deadwood. This trait enables them to live and breed in young woodland and scrub ahead of other tits that need pre-existing nest-holes, giving them a unique niche where they should be able to avoid much competition.

These strategies all work when there is a level playing field for the woodland bird community. When all of the tits are exposed to the same natural food availability, then harder winters favour the strategic Marsh Tits and Willow Tits that stay put and hoard food, and milder winters favour the dominant and flexible Blue Tits and Great Tits. But what if bird-feeding removes these natural checks and balances, by providing Blue Tits and Great Tits with a reliable food source so that they never have a lean year, never a truly bad winter?

The competition hypothesis

This is where questions arise as to whether supplementary bird feeding is having an indirect influence on specialists like Marsh Tits and Willow Tits, through increased competition from the generalist tits. This hypothesis is not new but has been explored more deeply in the recent paper by Shutt & Lees (2021). The competition hypothesis, linked to bird feeding, is centred on the increased populations of Blue Tits and Great Tits in the woodlands, and spilling over into more marginal habitats, where they are now common or abundant almost everywhere.

In theory, by releasing Blue Tits and Great Tits from the effects of food scarcity and bad winters via widespread bird-feeding, Marsh Tits and Willow Tits have then lost any advantage they had of staying in their territories and food-hoarding. Instead, the increasing numbers of Blue Tits and Great Tits breeding in the woods dominate their natural food resources. A neat study in Wytham Woods (Farine et al. 2015) showed that Marsh Tits, with their deep knowledge of their territory, are usually the first to discover a new food source, but Blue Tits and Great Tits soon exploit these discoveries and 'parasitize' the Marsh Tits' knowledge.

When the natural food dwindles in the woods, Blue Tits and Great Tits can simply leave to exploit bird feeders over the winter. That leaves Marsh Tits and Willow Tits stranded in their territories with depleted food. Even if there is access to a nearby feeder, Blue Tits and Great Tits still have a dominant advantage. As a basic ecological hypothesis, the competition effect is quite a strong one.

However, demonstrating that competition is happening is notoriously difficult. The interactions are difficult to observe and hard to unravel from local habitat quality, time lags and annual effects. Broad scale analyses have not yet supported the hypothesis of generalist Blue Tits and Great Tits outcompeting Marsh Tits and Willow Tits (Lewis et al 2009, Broughton & Hinsley 2015). That is not completely surprising, as broad analyses tend to smooth out regional effects of stable versus declining populations, or can miss key co-variables. Competition may not even be a main driver of population declines, but it may add additional pressure that makes matters worse.

Is there any evidence at all of competition effects on Marsh Tits and Willow Tits? Detailed population studies do provide some suggestion, including a 20-year study of Marsh Tits in Cambridgeshire that monitored a once thriving population as it collapsed. The main mechanism of this decline appears to be greater juvenile mortality in summer, leading to plummeting recruitment and a downward spiral as territories are left vacant. There is no sign of reduced breeding success or disastrous habitat changes in this population, so could competition be specific enough to eliminate the juveniles in summer?

The answer may lie in the dominance hierarchy among the woodland tits. Juvenile Marsh Tits are near the very bottom of the social pecking order, dominated by adult Marsh Tits and all of the many Blue Tits and Great Tits that forage in the woods after breeding (Perrins 1979). The adult Marsh Tits are more experienced, but increased mortality of the subordinate juveniles suggests that competition for resources has increased, and the young birds can no longer cope. More research is needed on this topic, but only through detailed population studies are these demographic changes becoming apparent.

For Willow Tits, studies show a very clear impact of local competition. The increased numbers of Blue Tits and Great Tits spilling over into marginal habitats, like young woodland, are desperately looking for nest sites in spring. Willow Tits can spend a week excavating a nest cavity, only for dominant Blue Tits or Great Tits to commandeer it. This is one of the main causes of nest loss, accounting for almost one in five Willow Tit nests in northern England and 67% of nests in a Scottish population, which has since gone extinct (see Parry & Broughton 2018). Some Willow Tits have been recorded losing up to

four successive nest excavations to Blue Tits or Great Tits in a single season, and probably failed to breed entirely.

To make matters worse, the other major cause of Willow Tit breeding failure is nest predation by Great Spotted Woodpeckers. This species also benefits from bird feeding and has increased across all woody habitats by 387% overall since the 1960s. Consequently, Willow Tits have by far the highest nest failure rates of all the tits, ranging between 30-67% in northern England. Marsh Tits fare better, having failure rates of around 20% due to nesting in safer cavities in living trees and being better able to fend off Blue Tits.

Invoking the precautionary principle

What is an appropriate response to the negative effects bird feeding when uncertainty remains about its overall impact? The stakes are high, including potential extinction of Britain's endemic subspecies of Willow Tit (*P. m. kleinschmidtii*), but this must be balanced against the immense enjoyment that people get from bird feeding. Not to mention the importance of a multi-million pound industry that has commercial relationships with conservation charities.

Nevertheless, bird feeding in Britain has become a vast experiment with our wildlife, where we input huge food resources without fully understanding of the consequences. Bird feeding has expanded beyond gardens, and there are now permanent year-round feeding stations managed on many nature reserves. Increasingly, ad hoc feeding stations are even appearing in public woodlands, provided by local residents or photographers. With such an intervention also comes responsibility, whether that is to avoid spreading diseases or not contribute to myriad pressures on declining species.

The precautionary principle is a central tenet of nature conservation strategies (IUCN 2005) and warns that delaying action until there is compelling evidence of harm will often mean it becomes too late to avert the threat. We suggest that there is now enough provisional evidence and theoretical basis to consider the precautionary principle with regard to bird feeding where it will largely benefit generalist Blue Tits and Great Tits at the likely expense of specialist Marsh Tits and Willow Tits.

We are not proposing that bird feeding should end, as that would be unrealistic and unnecessary. However, we do suggest that, where possible, regular bird feeding should be cautiously reconsidered, reduced or discouraged around the remaining core habitats of Marsh Tits and Willow Tits, in light of their perilous population declines. The same may apply to providing nest-boxes for Blue Tits and Great Tits in sensitive areas, unless they are for specific studies. With just 8% of our Willow Tits remaining, and only 22% of our Marsh Tits, giving any assistance to their main competitors or predators around the remaining strongholds seems counter-productive to their conservation.

Although many people will be unwilling to reduce bird feeding, others can make informed choices on the necessity and impact around sensitive habitats. If a modest proportion of us stopped or reduced direct feeding, and instead donated the money to conservation organisations for restoring habitats, that could be a positive change. The farmland and carbon used for birdfood production could be spared and more species could benefit from habitat creation, while those of us with access to nature outdoors could continue enjoying wildlife. That would enable those people with limited mobility or greater need to continue to enjoy bird feeding, while reducing the overall impact.

Even switching birdfoods could be beneficial, by avoiding sunflowers, peanuts and fats that are favoured by the common tits, and instead providing millet or grain that are more attractive to declining House Sparrows and Tree Sparrows.

If reduced bird feeding resulted in a moderate fall in the numbers of Blue Tits, Great Tits or, indeed, Great Spotted Woodpeckers, this would not be a conservation disaster. These species would remain very common and merely be falling back to their densities of 50 years ago, which are more typical of elsewhere in their European range. If we can avoid inflating the numbers of competitors and predators, by some of us rethinking our bird feeding habits, that could give British Marsh Tits and Willow Tits a better chance of surviving the biodiversity crisis.

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