Fine-tuned travel planning for hazardous journeys

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Fine-tuned travel planning for hazardous journeys

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Few recent research papers radiate the feeling of large-scale geographic and biological coherence and synthesis typical of Moreau's (1972) seminal book on the migration of landbirds between Eurasia and Africa. A study in this direction, however, is that by Rubolini et al. (2002) on barn swallow *Hirundo rustica* fuelling patterns before southward migration published in this issue of the *Journal of Avian Biology*.

Within the context of the Europe-wide 'EURING Swallow Project', Rubolini and co-workers describe the increases in body mass and fat score from late August to early October in barn swallows at 19 roost sites in Spain and Italy. In both first-year and older birds there were consistent differences in body mass and fat score between Spain and Italy, with the birds captured at Spanish roost sites showing smaller maximum fuel stores than the birds in Italy. Consistent with the assumption that barn swallows left the areas of the roost site for southbound long-distance flights across both the Mediterranean Sea and the Sahara, the authors found a positive correlation between the amount of fuel stored at each of the sites and the lengths of the ensuing flight across the two presumed ecological barriers. That the correlation between fuel stores and distance was weaker when calculated for a crossing of the Mediterranean only, was taken as evidence for the fact that after leaving the stopover areas in Spain and Italy, barn swallows do little feeding in North Africa before crossing the Sahara (Fig. 1).

Given that swallows would in principle be able to feed on aerial arthropods while in migratory flight, many of us have assumed that aerial foragers do not face ecological barriers to the same extent as specialised land- and waterbirds. As a consequence, aerial foragers would not need to build up fuel stores to the same extent, something that would come handy given all the ecological costs associated with such stores (Witter and Cuthill 1993). An earlier finding that barn swallows in north-western Europe show rather little fuel storage in late summer (Ormerod 1989) seemed to confirm this preconception. However, it has been found that barn swallows carry substantial fuel stores prior to a Sahara crossing, both in Algeria (Bairlein 1988) and in Italy (Pilastro and Magnani 1997). The new study of Rubolini and co-workers adds importantly to the story not only by confirming that fuelling takes place, but also by showing that the total fuel store deposited at any one site seems to be a function of the width of the barrier ahead.

That the relatively hospitable North African rim can be considered part of an ecological barrier for barn swallows during southward migration, comes as a surprise. Another surprise is that barn swallows at the northernmost sites apparently initiated the big jump from farther away than seemingly necessary. To accomplish this they put on more fuel. This runs contrary to the finding by Pilastro and Spina (1997) in their exciting interspecific comparison of residual fuel stores of birds that have crossed the Sahara in spring. The fuel stores

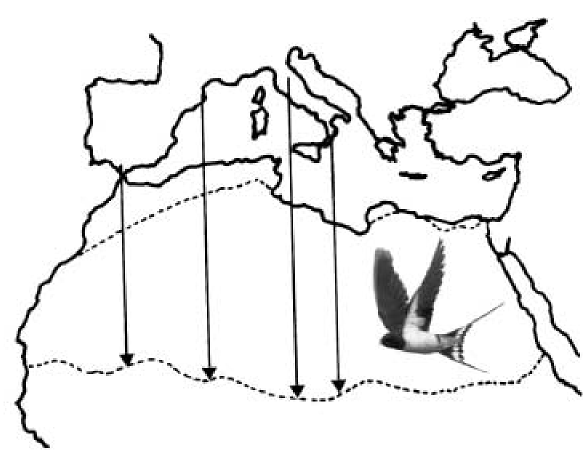

Photo by Ola Bondesson

of birds landing on small Mediterranean islands varied according to from where in Africa the birds had departed. Forest species depart from sites far south of the Sahara and they had very little fuel left when reaching Europe. Some individuals of these species were so lean that they were surely close to making their terminal stop, showing that the penalty for poor travel planning is potentially high. Open-habitat species, however, depart from further north, close to the desert rim, and arrived in Europe far from being exhausted. Thus, between species there was seemingly no compensation for the different distances to be covered. But the barn swallows seem to compensate. Are swallows better travel planners than other songbird species?

That barn swallows all over Spain and Italy start building up body mass and fat stores at the same time also surprised us. Does this mean that they 'just' carry a simple time programme to start preparing for ecological barriers at a fixed date? There is now a wealth of evidence that endogenous time programmes occur widely among songbirds and that such programmes have a genetic basis (Berthold 1996). The conclusion that many details of the migration strategy of barn swallows have a genetic basis may not come as a surprise. Nevertheless, few would have anticipated the additional role played by external cues such as the ambient magnetic field, as recently demonstrated by Fransson et al. (2001) for thrush nightingales *Luscina luscinia*. And think about the range of biological implications carried by such genetic wiring! What kinds of genetic structuring of the population, dispersal, site-faithfulness and the learning of habitat-mosaics and migration routes can we expect on the basis of this premise, not only in swallows but in other bird species as well?

Another way of looking at large-scale patterns of fuelling is the insight it yields about what swallows consider good and poor feeding and refuelling habitats. We may have thought that the northern parts of Morocco, Algeria and Tunisia would be good feeding areas for southward-migrating swallows, but the fuel storage strategies documented by Rubolini et al. suggest otherwise. We may also have thought that there is no need to start fuelling in northern Spain as early as late August to overfly the rest of Spain with a full fuel tank by late September, but natural selection has obviously decided otherwise. This is where resource-oriented ornithologists should get intrigued. Can we explain the swallows' fuelling patterns by the variation in aerial arthropod abundance in time and space? Is there a set date (e.g. in late September) when aerial food resources over large areas show a steep decline? What is the variability between years and do such variations affect how swallows fuel? How would climatic changes affect critical resource abundance? And, coming back to the genetic wiring of the strategies in the predators themselves, is there enough additive genetic variance in the annual programmes of barn swallows to adjust to rapidly changing ecological templates?

Many of the questions emanating from the large-scale barn swallow studies will require similar approaches in the future, either at the resource end of the problem, perhaps involving entomologically inclined friends, or in the comparative sense of verifying the patterns in other aerial feeders. In any case, the study shows the great strength of co-operative, large-scale studies based on networks of dedicated observers. It is striking to see how new and advanced knowledge can spring from a project building on a relatively simple technique (trapping and weighing), but carried out on a large scale in a standardised manner. At an international level this approach was pioneered in the late 1970s and early 1980s by wader enthusiasts (e.g. Dick et al. 1987), and has later paid dividends in studies of passerine migration/fuelling strategies (Bairlein 1991, Lindström et al. 1996, Pilastro and Spina 1997, Schaub and Jenni 2000). If its full potential can be realised, the study on fuelling in barn swallows in Spain and Italy will indeed only be a start!

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