For many bird species there is only a short period in the annual cycle when conditions are suitable for reproduction. As this period varies from year to year, depending on spring conditions, the phenology of birds (i.e. the onset of reproduction) is a phenotypically plastic trait: in warm springs the birds lay at an earlier date than in cold springs. Climate change leads to an advancement of the period of favourable conditions, i.e. the time of maximal prey abundance, and hence birds should also initiate reproduction earlier. However, the temperature dependent mechanisms as used by the prey will differ strongly from that of the birds. Thus, the increase in temperature does not a priori lead to similar shifts in prey and predator phenology.

We show that (1) this is indeed the case in both a resident bird, the great tit (*Parus major*), and a long distant migrant, the pied flycatcher (*Ficedula hypoleuca*), (2) that this leads to mistimed reproduction and (3) that this mistiming has severe consequences for population viability. We furthermore show that (4) micro-evolution of the birds’ temperature dependent mechanism may occur as there is heritable variation in the temperature sensitivity of phenology, and that there is increased selection for more temperature sensitive birds. Finally, (5) we address the pivotal question whether the rate of micro-evolution will match the rate of environmental change.

How can this research be used to inform conservation planning or policy?

Population viability, and thereby biodiversity, will be seriously threatened if the rate of micro-evolution will be insufficient to match the rate of environmental change. Evolutionary ecologists can assess the rate of evolution by detailed studies on a number of model species – i.e. heritability, selection, response to selection. The rate of environmental change however, is determined by socio-economic decisions, as represented by the scenario studies of the Intergovernmental Panel on Climate Change (IPCC). This rate is thus set by political decision-making. Ultimately, our study should contribute to clarifying the consequences for biodiversity loss for each of the IPCC scenarios, enabling policy makers to make an informed trade-off between economic and environmental losses.