Divergence of song discrimination and speciation in songbirds

Research environment

The Qvarnström lab at the Department of Ecology and Genetics at Uppsala University studies the ecology and genetics of the speciation process, working primarily on the pied and collared flycatchers. The flycatchers have co-occurred on the island of Öland for around the last 60 years, where they occasionally hybridize, and the population there has been studied continuously for the last 15 years. There are long-term morphological, breeding, and genetic data on thousands of individuals, and an annotated genome of the collared flycatcher. Each spring, a large field team monitors, marks, and measures the breeding population on Öland and performs experiments aimed at understanding the formation and maintenance of the species boundary between the two flycatchers.

Description of the research project

Coexistence between closely related species often depends on differences across species in male sexual signals and female signal preferences. If signals and/or preferences are too similar across species, then females from one of the species might often choose to mate with males from the other. In many cases, such cross-species mating should be costly and, in some cases, it might lead to the breakdown of species boundaries. In birds, the songs produced by males are an important part of female mating choices, but a real challenge is that they are learned early in life by imprinting on the songs produced by surrounding adult males. As a result, males might easily learn to produce songs from the wrong species.

On Öland, where the flycatchers co-occur, nestling flycatchers can discriminate against the songs of the other species from as young as 9 days old, which is likely to prevent them from subsequently learning from the wrong species. Cross-fostering experiments have shown that this discrimination ability is due to genetic differences across species. Two major questions remain, which could form the basis for student research projects:

1) What are the song differences across species that allow nestlings to discriminate?

   To answer this question, the student would compare the responses of nestling flycatchers on Öland to songs that have been manipulated in various ways to make them more or less like the songs of their own species. For example, does adding small parts of songs from their own species make nestlings respond more strongly?

2) Have flycatchers on Öland evolved discrimination against the songs of the other species *in order to* avoid learning their songs?

   To answer this question, the student would travel to one or more field sites throughout Europe, likely in Norway, mainland Sweden, or Finland to test the song discrimination ability of pied flycatcher nestlings that have evolved in the absence of collared flycatchers. If flycatchers on Öland have evolved song discrimination, we expect pied

flycatchers at other locations to show little discrimination against collared flycatcher songs.

Methods

Both research projects would involve performing song playback experiments to 12-day old nestling flycatchers at forest field sites during the month of June 2017. The experiments would be video recorded, allowing computer-based analysis during or after field work. Similar experiments have been performed over the last 4 years, so they are well-established, published methods.

Motivated students are encouraged to contact David Wheatcroft, the post-doctoral researcher leading this project.

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12-day old collared flycatcher nestling emerging from the nestbox.

Adult male pied flycatcher singing.