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Viewpoint

The Avian Hybrids Project: gathering the scientific literature on avian hybridization

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Hybridization, the interbreeding of different species, plays an important role in several evolutionary processes, such as adaptive trait transfer (Arnold 2006, Arnold *et al.* 2008, Hedrick 2013), adaptive radiations (Seehausen 2004), and the origin of new species (Mavarez & Linares 2008, Abbott *et al.* 2013, Schumer *et al.* 2014). However, hybridization can have detrimental effects for the species involved: one of the species can be driven to extinction (Rhymer & Simberloff 1996) or two species can merge into one leading to a loss in biodiversity (Seehausen 2006, Seehausen *et al.* 2008), so hybridization has also become a relevant topic in conservation (Allendorf *et al.* 2001, Brumfield 2010).

The occurrence of hybridization is mostly rare on an individual basis, but can be common at a species level (Mallet 2005). It was estimated that about 25% of the vascular plants in the UK hybridize (Stace 1975), and many plant taxa are probably of hybrid origin (Rieseberg 1997). In the animal kingdom, hybridization is also a common phenomenon at species level, as shown by the number of hybrids documented in different taxonomic groups, such as mammals (Gray 1972), fish (Hubbs 1955) and reptiles (Jancuchova-Laskova *et al.* 2015).

Birds show relatively high levels of hybridization and several estimates of the incidence of hybridization in this class have been published (Mayr & Short 1970, Meise 1975, Panov 1989, Grant & Grant 1992). The most recent is from Grant and Grant (1992), who estimated that 9.2% of all bird species hybridize with at least one other bird species. Since then the occurrence of avian hybrids has been more thoroughly researched and more cases have been documented (McCarthy 2006). We used the IOC World Bird List (Gil & Donsker 2013) and records retrieved from the Serge Dumont Bird Hybrids Database (Dumont 2014) to update the analysis of Grant and Grant (1992). Hybrids between subspecies were not included and a distinction was made between hybridization in nature and in captivity.

Figure 1 gives an overview of the incidence of hybridization in all bird orders. In total, 1714 out of 10 446 bird species (16.4%) have been documented to have hybridized with at least one other bird species in nature. When hybridization in captivity is included, this figure increases to 2204 species (21.1%). These numbers are most probably underestimates, given our generally poor knowledge of the breeding biology of several bird groups, such as cryptic tropical species, and the difference in detection probability of particular hybrids (Randler 2004). Hybridization occurs in the majority of 39 bird orders, with the exception of nine species-poor orders.

The documentation of numerous avian hybrids (McCarthy 2006) and hybrid zones (Price 2008) has stimulated the curiosity of many ornithologists and has led to an enormous amount of scientific papers. On our website, Avian Hybrids (https://avianhybrids.wordpress.com/), we gather the bulk of scientific literature on avian hybridization, arranged by Order (and on a Family level for the Passeriformes). Currently, all bird order summaries have been entirely written by the first author, but we encourage experts on certain bird groups to critically review these texts and provide revised versions. In addition, we motivate ornithologists to send us non-technical summaries of their latest papers, which will be featured on the *Latest News* section of the website. The goal of this website is to provide a standardized resource on the current state of knowledge on avian hybridization. We believe that this will benefit the scientific community working on birds in general and avian hybridization in particular. Moreover, this website may act as the birthplace of future collaborations.

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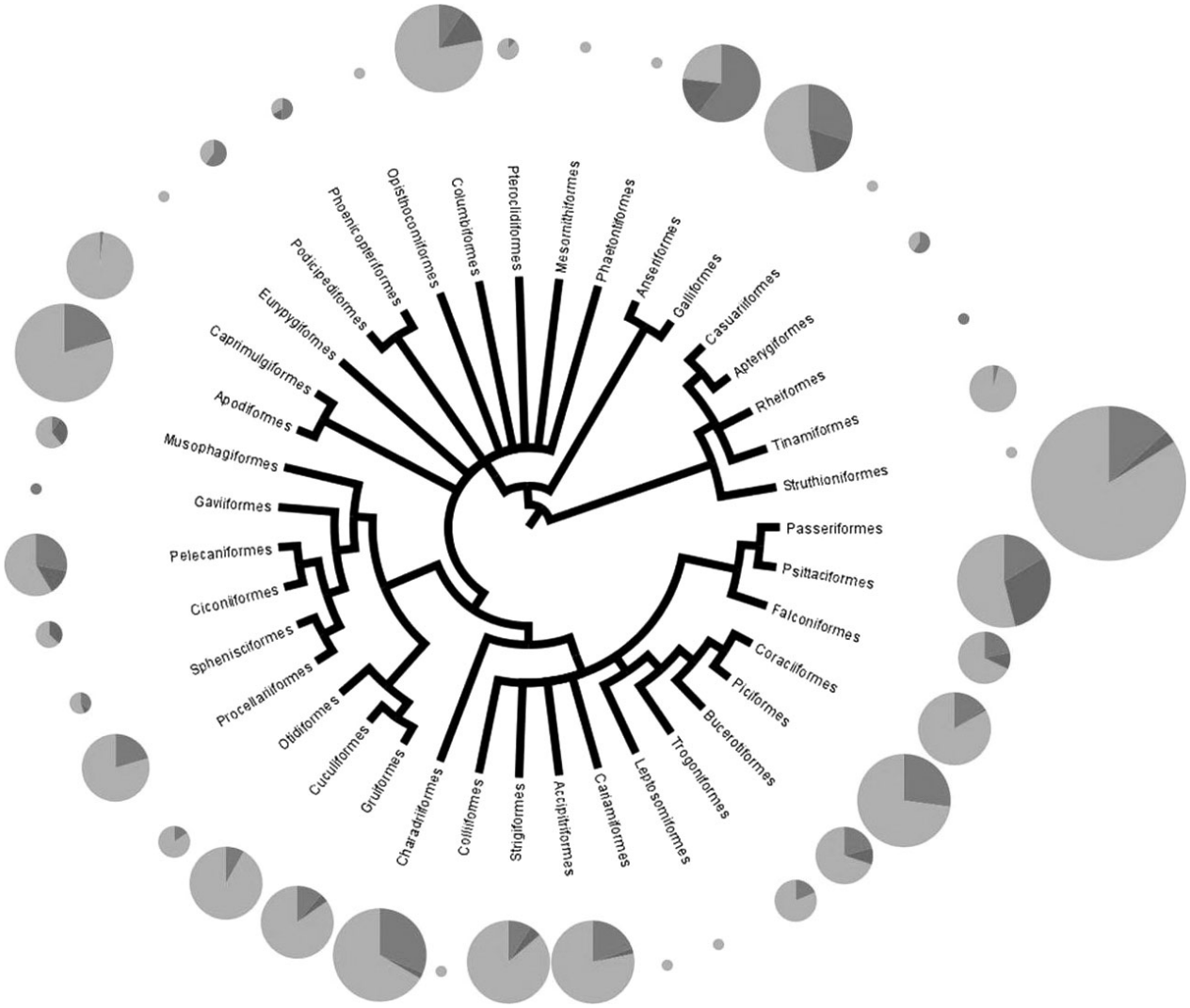

Figure 1. The incidence of hybridization in all 39 bird Orders. The size of the pie charts is proportional to the number of species in the respective Order. Grey scales indicate no hybridization (light), hybridization in nature (intermediate) and hybridization in captivity (dark). Species that hybridized both in nature and in captivity are included only in the former category. The central phylogenetic tree is based on the Tree of Life Project (Maddison & Schulz 2007).

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