

Preface

Mid to late August in northeastern North America means bird migration has started, and avid birders get up each morning with the hopes of seeing something new. A mixed-species flock led by chickadees of the tit family is always a good place to start. Apart from the chickadees themselves, there are the usual suspects: nuthatches or woodpeckers, perhaps some kinglets. But unexpected gems also pass by as one watches the flock: a couple of black-throated green warblers, a northern parula! or a Blackburnian warbler! Particular images from childhood remain, forever still and crystallized in our minds: we can still see the tree trunk in the hemlock-dominated forest where a white-breasted nuthatch was busily working upside down, making its "ank-ank" call, when then there was a higher pitched "pink-pink" sound from above, and coming around the trunk was a red-breasted nuthatch, looking down inquisitively at the other nuthatch below. Questions remain, too, in the back of our minds, influencing scientific questions two decades later. Was this a random association between species, or did it represent a coherent group? Why were these particular species found together in the flock? What information was shared between those two birds in that split second so many years ago, and more generally, how do such interspecific interactions influence the lives of birds of these species?

We think this is a useful time to collect information about mixed-species animal groups into a book, in part because the extraordinary experience of observing such a group allows us to understand ecological complexity first-hand. As we will argue later in this book, we believe that mixed-species groups can be important to conserve as systems, rather than constructing conservation plans piecewise for the individual participating species. But firstly we concentrate on a simpler story, though one still relevant to conservation: in this age of biodiversity loss, when an urbanizing human population has fewer and fewer experiences with wilderness, mixed-species groups are accessible phenomena for people to appreciate nature. Documentaries have made some examples, such as mixed herds of African ungulates, widely familiar. More importantly, tropical environments are home to mixed-species systems of many taxa, from birds and primates in forests to fishes on coral reefs, and therefore direct experience is within reach of many people. Even in temperate regions, one needs to visit only a local park at the right time of year to see a mixed-species bird flock or explore the shore of a lake to observe a mixed shoal of fish. These experiences can stimulate in any observer, whether student or researcher, many questions about the interconnectedness of species in

a community, and what that means when thinking about the conservation of those communities.

The description of mixed-species groups stretches back centuries, and the literature for certain taxa, such as forest birds, is extensive. Yet, except for a handful of review articles, few publications have sought to compare the adaptive costs and benefits of mixed-species grouping across a broad range of taxa, and even fewer have searched for patterns in the characteristics of such groups in different habitats and taxa. Surely, given the frequent and spectacular nature of these interactions, they are deserving of an introductory description in a book. Undoubtedly, we may not fully capture every aspect of these groups because of the still developing nature of the science and our own limitations. But we hope to establish a foundation of what is known about mixed-species groups, introduce students and future researchers to this topic, and encourage them along new paths of discovery.

The organization of this book should allow readers with different backgrounds and objectives to use it in a variety of ways. In Chapter 1, we describe the scope of the book: defining fluid (not highly persistent) interactions between species of the same trophic level as "mixed-species associations," and then focusing further on "mixed-species groups," which are moving entities, including mostly mutualistic interacting species. The diversity of mixed-species associations is then covered in Chapter 2, with a more fine-grained summary of mixed-species groups in Chapter 3. Readers with a more theoretical interest in evolutionary ecology might want to skip ahead to Chapters 4 and 5, which look in depth at the adaptive costs and benefits of mixed-species grouping, starting with foraging and/or social benefits (Chapter 4), and then moving to antipredatory benefits (Chapter 5).

In the next three chapters, we turn to important concepts in community ecology and conservation that have recently begun to be explored in the mixed-species group context. Chapter 6 investigates communication in groups, as one of the best studied examples of behavior in mixed-species associations. As animals often act as information sources for each other, this subject leads to Chapter 7, in which we examine the roles of species in mixed-species groups, and why some species could be considered keystone species. In turn, such keystone species may be used as targets for the conservation of the whole community, and this subject thus leads to the important topic of the implications of mixed-groups for conservation (Chapter 8).

Finally, in Chapter 9, we collect our thoughts on how the process of writing a book-length treatise on mixed-species grouping has influenced our perception of them. Furthermore, we propose ideas about fruitful directions for future research; we hope that new research may quickly require an expansion of this introductory text.

This book is the collaborative effort of three coauthors. We felt that a collaborative effort was needed to do justice to the wide variety of themes found in the mixed-species grouping literature. We hope that what the book may lack

in unity of style as a result is more than compensated by the unique perspective each of us brought to this research.

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