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Editorial: Vagrancy, exploratory behavior and colonization by birds: Escape from extinction?

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Editorial on the Research Topic
Vagrancy, Exploratory Behavior And Colonization by Birds: Escape From Extinction?

Vagrant birds, long thought to be mutant or otherwise navigationally incompetent individuals, have now been shown to be the outer fringe of a growing population; vagrancy is the mechanism by which growing populations can colonize newly available habitats (Grinnell, 1922; Baker, 1978; Veit, 2000, 2008; Zawadzki et al., 2019). Since changes habitats are changing at a greater rate and magnitude than ever before (Drinkwater et al., 2003; Poloczanska et al., 2013), there is a premium upon individual birds to explore, so that they can attain habitats that have become newly suitable due to changing climate. Our recent research (Veit, 2000; Zawadzki et al., 2019) clearly identifies a strong link between high rates of population growth and vagrancy, so that the largest numbers of vagrants accompany peak reproduction, as large numbers of young spread out in search of new territories. This is in direct contrast to previous ideas about vagrancy that characterize vagrancy as an act of desperation or navigational error.

Typically, birds disperse during the years prior to breeding, and the majority of long-distance vagrants are juveniles or at least pre-breeders. While species or populations of birds tend to orient in particular directions while dispersing, there are very large variations about the mean direction, resulting in many individual birds orienting in directions from that of the majority of the population. Similarly, probability distributions of distances dispersed by a population of birds are almost always strongly skewed, or "fat-tailed," such that a small proportion of individuals within a population *normally* travel vastly farther than the mean distance. Thus, the suite of movement behaviors typical of birds predispose them toward vagrancy.

The papers with this Research Topic illustrate how vagrancy often results in colonization or recolonization of novel breeding sites. Furthermore, there is increasing

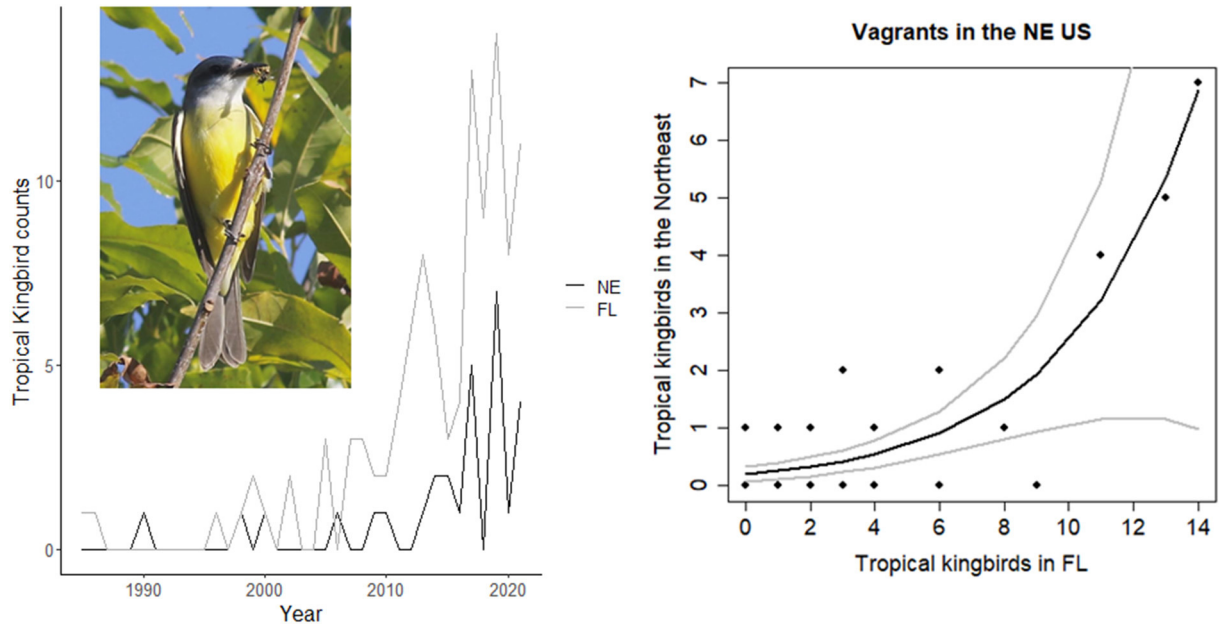

FIGURE 1
(A) (Left) Numbers of vagrant Tropical Kingbirds (*Tyrannus melancholicus*) recorded in Florida (gray line) and the northeastern North America (bold line) 1980-present. **(B) (Right)** Prediction of vagrant Tropical Kingbirds in the northeastern North America on the basis of population growth in Florida. This relationship supports the idea that vagrancy is driven by population growth. Data from Pranty et al. (2016) and eBird (2021); photo by Anthony Ciancimino.

evidence that vagrancy is a positive response to improved conditions rather than a desperate move to escape catastrophe, and is thus carried out by individuals in top physical condition. This perspective on vagrancy contrasts with the traditional view of being a consequence of incompetent navigation. Combining these ideas, we suggest that, in order to colonize newly available habitats, new habitats that support elevated reproduction in response to abundant resources must exist to generate vagrants. To experience whether previously unoccupied areas are suitable for breeding, birds must first travel to these places, and this initial movement of discovery constitutes vagrancy by definition.

Growing populations produce more young birds, which consequently disperse in a variety of directions and distances. Thus, growing populations should produce vagrants, as predicted by Grinnell in 1922 to be "*the regular thing, to be expected*." This concept has profound consequences for adjustment of species ranges as the world's climate changes. For example, using as an example the recent range expansion of Tropical Kingbirds into North America and associated spread of vagrants north to Canada (Figure 1), demonstrates how range expansion is often accompanied by multiple instances of long-distance vagrancy.

Our Research Topic illustrates these concepts using examples of marine birds. Henry et al. show how exploratory behavior by albatrosses from growing populations in the central Pacific Ocean has preceded range expansion to distant islands in the highly productive California Current. This expansion led to higher population growth rates in the new colonies. They further caution about the use of habitat modeling that does not consider conditions found in both the "destination" and well as the "original" range. In this sense, vagrancy can lead to novel distributions and changes in what Hutchinson (1957) termed, the "realized" portion of the "fundamental" niche. Zawadzki et al. demonstrate how population growth within the core portions of the range of Lesser Black-backed Gulls led to colonization of Iceland and Greenland, and substantial expansion of wintering range into North America. Acosta Alamo et al. take advantage of voluminous data on occurrence of vagrant North American Gulls in Europe and vagrant European Gulls in North America. This contrast allowed the authors to ask whether vagrancy was driven primarily by population growth of the species concerned rather than passive dispersal by prevailing winds. The results, though mixed, in general support the link between population growth within the core range and expansion to new environments. Veit et al. analyzed the spectacular population increase by Elegant Terns within their very limited range in the eastern Pacific and its association with increasing eastward vagrancy, culminating with successful colonization of western Europe. These papers taken together point to the biological importance of vagrancy and how it will likely be of increasing importance to species survival during intense climate change (Davis and Watson, 2018; Gill et al., 2019). Given the importance of range expansions or shifts accompanying climate change, future research should focus on examination of routes

followed by individuals, especially if those individual routes can be linked to local environmental conditions. We further need to ask whether physiological condition measures can be linked to distances traveled to address whether long distance dispersal is more likely driven by poor or good environmental conditions. Finally, our analyses to date suggest that growing bird populations are more likely to generate vagrants. If found to be generally true, this idea has important implications for the ability of species to find newly suitable habitat—or disperse through increasingly-fragmented habitat—as the climate, and perhaps other environmental characteristics, change.

Author contributions

RV conceived the idea and wrote the draft editorial. LM and RV constructed the graphic in Figure 1. LM, LZ, MA, and RH made modifications to the final version. RV, LM, LZ, MA, and RH shared in the writing and analyses. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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