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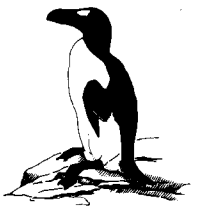

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OVERVIEWS

ON THE IMPORTANCE OF STOPOVER SITES TO MIGRATING BIRDS

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SOMETHING about the migratory time of year commands our attention. People associate the arrival and departure of birds with imminent change, and the phenomenon generally finds us pondering the various mysteries associated with it all. Given the dramatic nature of migration, it is surprising that relatively little research has been directed toward the study of birds during the migratory period. In part this must be a product of the fact that during migration, individual birds spend relatively little time in any one place compared with other seasons, so when thinking about population regulation and adaptation, we tend to assume that those en-route locations are not all that important. At the same time, however, we have little trouble assigning biological importance to the breeding season, even though it occupies less than a quarter of any year in most birds' lives! Long-distance migrants must travel vast distances, often over inhospitable habitats such as oceans, mountains, and deserts. Flights such as these require that migrants carry large stores of fat for fuel and maintain themselves in top physiological condition. Thus, spring and fall migration are probably important periods in terms of potential mortality. Indeed, Sherry and Holmes (1995) have demonstrated both theoretically and empirically that any time of year, including migratory periods, can act to limit populations. The relative importance of each season to demography simply depends on the year and on differences in rates of mortality among seasons during the same year.

Another reason for the relative scarcity of field research during migratory periods must be that many (most?) field biologists are academicians who tend to be tied down with other obligations during the spring and fall. Frank Moore, at the University of Southern Mississippi, is one individual who has managed to break free from the normal constraints, and he and his students and colleagues have begun to inject some newness into field studies of birds by concentrating their efforts during times outside the breeding and winter periods. A growing number of bird studies are conducted during migration, and most hang on the justification that these are brief but critical periods that can affect population trends, and that conservation efforts should therefore address the needs of birds during these periods as well as during the breeding and winter seasons. I find this sort of justification unnecessary and more a carryover from proposals developed for funding agencies that demand such justification than a product of science that demonstrates that migratory periods act to regulate populations. Whether or not population trends hinge on these periods, they are proving to be important periods within which to study birds, as I have argued elsewhere (Hutto 1998). Results from studies during the migratory period, such as the one by Yong, Finch, Moore, and Kelly in this issue of *The Auk*, begin to show us why migratory-season studies are important, both for basic science and for conservation reasons.

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Yong et al. (1998) argue that different social roles and/or physical abilities of the two sexes and various age classes probably arise from different ecological and evolutionary constraints. For example, because most male songbirds spend relatively more time than females in, say, territorial defense, we might expect the development of sexual differences in song and plumage characters related to that fact alone. Indeed, we commonly see differences in coloration and singing activity due to differences in breeding-season behaviors. If we extend this thinking to migration, we also see interesting differences between the sexes in habitat use, foraging behavior, stopover length, fat stores, and other characteristics during spring migration that appear to result from sex-related differences in breeding-season duties as well. If these differences during the spring migration period are related to soon-to-follow differences in breeding behaviors, then such differences should disappear during the fall migration. And indeed, there are fewer sexual differences in behavior during fall migration. Not only that, age-related differences in foraging skills should be most apparent during fall, when numerous inexperienced young birds are making their first trip south. Yong et al. (1998) find evidence for both, which, in and of itself, has interesting conservation implications because the "strategies" employed by different sex (in spring) and age (in fall) groups involve the use of fairly different habitats and geographic locations.

Focussing on Wilson's Warblers (*Wilsonia pusilla*) in New Mexico, Yong et al. (1998) show that the species is about four times more abundant in fall than in spring in their study site, that juvenile birds largely use different habitats than adults in fall, and that males use largely different habitats from females in spring. This illustrates how complicated the process of conservation is going to be—we need information on where and in what habitats each age and sex occurs during each season. Thus, finding the best habitat for Wilson's Warbler will not be as easy as looking for the place where the "species" is most abundant, or where it refuels fastest while en route; the answer is likely to differ between the sexes in spring and among age classes in fall, and the range of needed conditions is going to be much broader than if we ignored such sex and age differences.

Yong et al. (1998) also demonstrate that some habitats (i.e. agriculture fields and edges) are likely to be "sinks" because birds in these habitats tend to be immatures that have low rates of fat deposition and longer periods of stopover. This suggests that immature warblers, which are inexperienced compared with adults, are especially vulnerable to habitat disturbance at stopover sites during fall migration. Insufficient fat stores can lead to energy depletion and/or "exhaustion" that causes mortality during long flights across inhospitable habitats. Indeed, the common observation of grounded birds on ships far at sea may reflect inadequate energy stores prior to a migratory flight. Such occurrences may become more common as we continue to impinge on the habitats where migrants obtain these energy stores. Habitat disturbance and fragmentation on the breeding and wintering grounds appear to have negative effects on a number of migratory passerine species (e.g. Robbins et al. 1989, Askins et al. 1990, Askins 1993, Robinson et al. 1995). The work of Yong et al. shows that migratory passerines (especially immature individuals) may also suffer from disturbance to migration habitats.

For me, a good paper is one that has me staring into space because it has stimulated thought. This paper, and many others based on studies conducted during the migratory period, seem to do that because they open new perspectives. For example, the existence of age differences in fat stores and stopover length in the fall opens a whole new avenue toward studies of the ways in which morphology, dominance, physiological abilities, foraging abilities, or other parameters might act to create such differences. This is what is most refreshing about the paper by Yong et al.—as much as it lends further evidence for the importance of en-route periods in the conservation of migratory birds, it also allows one to see more clearly the prospect of taking a new angle on a variety of long-standing questions in ornithology.

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