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COMMENTARY

Counting the 'lost generation:' improving the accuracy of population assessments in birds

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Assessing the conservation status of the world's animals, including its birds, requires population-trend analysis, which, in turn, requires effective population monitoring (cf. Bildstein *et al*., 2008; Mace *et al*., 2008). One of the darkest secrets of conservation biology remains our all-too-frequent inability to determine accurately the population sizes of the animals we are trying to protect. Although difficulties in population monitoring are particularly acute for secretive, low-density, wide-ranging the animals, the problem remains common and widespread throughout the animal world, including many birds (cf. Ralph & Scott, 1981), even though the latter represent some of the most conspicuous and well-studied of all terrestrial fauna (Gill, 2006).

Long-lived birds, many of which exhibit deferred maturation, can be especially problematic. In such species, populations of subadults, which typically do not breed, can be frustratingly difficult to enumerate, both because of their dispersive nature and their lack of attachment to nest sites. This effectively 'lost generation' of birds, although an essential component of avian demographics – and, therefore a critical element in assessing a species' conservation status – remains one of the toughest nuts to crack in all of conservation ornithology. The problem, which has been known for some time, is inherently biological.

In many species of birds, both subadults and nonbreeding adults, are more vagile, overall, than adult breeders (cf. Newton 2008). In many instances, nonbreeders disperse from population centers, range over wider areas, and, in general, keep a lower profile than do more experienced and mainly competitively-superior adult breeders. The inconspicuous nature of nonbreeders, although selectively advantageous (i.e. keeping a low profile towards competitively superior breeders makes sense), creates a situation that makes them far more difficult to survey and monitor than their breeding counterparts. Although such birds can and have been found and counted in exhaustive – and often exhausting – comprehensive studies in small areas, in most instances these so-called 'floaters' (*sensu* Brown, 1969) which typically serve to buffer inter-annual variations in the sizes of breeding populations, are not surveyed effectively.

Using the biological phenomena of feather molt and communal roosting, the authors attempt to measure the sizes of nonbreeding populations of two species of large eagles – the white-tailed sea eagle *Haliaeetus albicilla* and the eastern imperial eagle *Aquila heliaca* – with DNA fingerprints from recently molted, naturally shed feathers collected at several traditional communal roosts in their study area in north-central Kazakhstan (Katzner *et al*., 2011). In 1 year (2004) feathers collected via this noninvasive, molecular technique identified more than 10 times as many nonbreeders as were identified visually by the researchers, resulting in overall population estimates of the combined nonbreeding and breeding populations that were twice those resulting from traditional visual monitoring and subsequent modeling based on the visual counts.

The results clearly demonstrate the limitations of visually based monitoring schemes in 'capturing' nonbreeding portions of populations for the species involved, and although not surprising demographically, highlight the value of noninvasive DNA finger-printing sampling in assessing overall populations for the two species. Although the general applicability of the of the technique is not described in detail, Katzner *et al*. (2011) demonstrates the usefulness of this noninvasive technique in assessing the overall numbers of birds inhabiting communal roosts, and as such should be of use in the many species of birds that roost communally in traditional roost sites.

One requirement for the successful use of this new technique not addressed in Katzner *et al*. (2011) is an initial appreciation for, and an eventual understanding of, the movement ecology of nonbreeders in the populations in question. Such individuals, unlike breeding adults, are not anchored biologically to active nests, and as such their ecological neighborhoods during the breeding season are likely to be larger and more ephemeral than those of their breeding counterparts. And indeed, their summer ranges may have more in common with those occurring during the nonbreeding season than with those occurring among breeding bird during the breeding season. Although formal studies of the movements of nonbreeders attending communal roosts (and depositing their feathers there) have yet to performed for the species involved, incidental reports of the movement ecology of other species of raptors attending similar communal roosts, suggest that, in some species at least, communal roosts often function more like ‘motels’ than ‘homes,’ and that, whereas, overall numbers of individuals at such roosts may vary little across months or longer periods of time, the identities of the birds involved in individual roosts may vary widely, with individuals birds using a number of different roosts within the same season, while routinely moving among them.

Studies of satellite-tracked turkey vultures, which often roost communally, indicate that individuals do not rest at single communal roosts, but rather alternate among several communal roosts up to 50 km apart (Place *et al*., 2001). The likelihood of increased vagility among nonbreeding versus breeding birds suggests that the former are likely to occupy larger ecological neighborhoods than the latter. With that in mind, conservationists adopting this potentially effective new tool will need to take into account the likelihood of age-dependent variability in movement ecology as they assess population size and density geographically.

Clearly, Katzner *et al*. (2011) provides an insightful and valuable new technique for assessing the regional status of populations of birds in which nonbreeding cohorts roost communally at traditional roost sites. Although this tool requires practitioners to study the movement ecology of the nonbreeding cohort so that the data accrued can be used appropriately – and as such necessitates additional field effort – this is a good thing. Doing so will shed considerable new light on essential life history factors that shape both the successes and failures of this heretofore ‘lost generation’ of birds. Satellite and other advanced forms of large-scale tracking of particularly wide-ranging birds offer a perfect complement for the appropriate use of this new assessment tool. Overall, both avian conservation and avian science will benefit from a new-found appreciation and, eventually, new-found understanding of the movement ecology of this nonbreeding cohort.

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