Conservation Challenge of Dispersive Fauna

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INTRODUCTION

THE six papers in this theme issue of *Pacific Conservation Biology* were presented at a symposium organized by the WildCountry Science Council (see Recher 2003 for an account of WildCountry) at the Adelaide meeting of the Ecological Society of Australia in 2004. The symposium theme of "dispersive fauna" is central to the philosophy and principles of WildCountry. The WildCountry philosophy is based on the argument that the long-term conservation of continental biodiversity is not possible with a system of spatially static conservation reserves by itself. Reserves form the core of WildCountry, but cannot fully sample continental biodiversity, nor allow for the full range of movements characteristic of the biota unless the total area set aside from development far exceeds what society would see as economically or politically acceptable. Because of these limits, a static and spatially limited reserve system cannot meet the challenge of ensuring the evolutionary viability of populations and species. A challenge that becomes increasingly difficult and urgent to resolve in the face of accelerating climate change and the loss and modification of habitat through land clearing, pastoralism, changed fire regimes, and the spread of weeds and feral animals among a myriad of environmental changes driven by human endeavour across the landscape. In my view, probably greater than 50% of the continent is the absolute minimum for a fixed system of reserves to meet the needs of biodiversity conservation, but see Archer (2002) who suggests a minimum of 20% may be required simply to meet the most basic evolutionary criteria.

In the opening paper, Don Driscoll addresses the role of the movement of individuals in evolution and the need to maintain evolutionary processes as a core requirement of biodiversity conservation. Sandy Gilmore, Brendan Mackey and Sandra Berry then review the evidence for large-scale movement, which they call "dispersive", in Australia's vertebrate fauna. Sandra Berry, Brendan Mackey and Tiffany Brown next consider the use of remote sensing to document temporal and spatial changes in landscape productivity for use in describing and understanding the dispersive movements of the fauna. These are followed by three papers describing the movements of individual species; the Australian Bustard *Ardeotis australis*, the Swift Parrot *Lathamus discolor*, and the Southern Bell Frog *Litoria raniformis* are iconic Australian species of conservation concern. Each exhibits a contrasting range of dispersive movements differing in spatial and temporal scales that illustrate the conservation challenge of faunal movements.

The one thing that I find most remarkable about the creation of a conservation reserve system across Australia is the almost total lack of planning that has accompanied its establishment. Yes, there are plans for individual reserves and, yes, there have been some attempts to sample the range of biotic communities, but the system's creation has been largely opportunistic and driven by politics and ideology (see for example, Recher 1997, 1998). To the best of my knowledge, only limited consideration has been given to the needs of the biota for long distance movements and this has been almost entirely in the context of individual species, not the fauna as a whole. Yet, long distance movements are typical of a significant proportion of the Australian fauna (Gilmore *et al.*, this volume) and important in evolution (Driscoll, this volume). While thought has been given to the need for corridors between remnants of native vegetation and reserves (see Saunders and Hobbs 1991; Merriam and Saunders 1993), this has not been a feature of conservation reserve planning until recently.

As illustrated by the studies of Ziembicki and Woinarski (this volume) on the Australian Bustard and by Saunders *et al.* (this volume) on the Swift Parrot, dispersive fauna not only move over long distances, but the frequency and timing of movements can change seasonally and from year to year, as well as differing among individuals within populations. Variability of movements reflects the spatial and temporal variability in primary production on a continent where drought, often prolonged, is a common event. While remote sensing can monitor productivity at a continental scale and assist in conservation management decisions affecting dispersive fauna (Berry *et al.*, this volume), ensuring that the required resources are available on spatial and temporal scales commensurate with the needs of the biota is not possible with a system of static reserves. Not only must organisms be able to move between patches of resources as they become available, but the they must be able to cross the intervening countryside. Moreover, there needs

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to be sufficient area under conservation management to ensure that somewhere within its expanse the required resources can be found. Thus, while WildCountry recognizes the importance of conservation reserves, ensuring "connectivity" across the landscape on a continental scale is central to both its philosophy and principles (see Soulé *et al.* 2004 for details; see Crooks and Sanjayan 2006 for current thought on the role and importance of connectivity in conservation).

The situation is made particularly difficult not only by the different resource requirements of individual species, but the differences between species in the kinds, timing and scale of movements undertaken. Individuals in the population of Southern Bell Frogs studied by Wassens and her colleagues (Wassens *et al.*, this volume) did not move huge distances when compared with a Swift Parrot, but movement between and within habitats according to season and water supply is critical to the population's survival. Movements at the scale of a frog are as challenging to meet within a reserve system as those of a long distance migratory bird or fish.

Providing the habitats needed by frogs on the necessary spatial and temporal scales may be possible within a single reserve, but the water needed to do this is likely to be sourced from areas long distances from either the population or the reserve. Providing water than becomes as much a conservation challenge as ensuring that somewhere within southeastern Australia there will be the nectar resources needed by Swift Parrots. The decline of honeyeaters (Meliphagidae) along the east coast of New South Wales where many species wintered in abundance is not because there are no longer winter nectar resources, but is the consequence of land clearing and habitat change in agricultural areas remote from where the birds winter (Recher 1999). Populations will never exceed the number which can be sustained by the least abundant resource. Thus, there is now a situation of coastal parks in New South Wales, some of which at least were justified on the grounds that they held large, wintering honeyeater populations, where there is an abundance of nectar and few birds to use it.

According to Gilmore *et al.* (this volume), 342 species of land and freshwater birds, or just over half of continental Australia's avifauna undertake long distance movements. The numbers are less for mammals (27 species, 8%), reptiles (5, <1%), frogs (2, 1%) and freshwater fish (36, 16%), but they are significant components of the fauna nonetheless. The movements of birds are probably the best known, but many Australians, including many conservation managers, do not fully appreciate the scale of avian movements within the continent or the numbers of birds involved. This is due to the fact that Australia does not have the spectacular mass seasonal migrations of birds (and mammals and fish) characteristic of the Northern Hemisphere.

Palaearctic waders aside, avian migration in Australia is what I call "diffuse". Birds migrate between breeding and wintering grounds, but unlike other continents where migratory birds accumulate large stores of fat and then undertake mass long distance movements to next fattening grounds and form massive flocks which are impossible to ignore, the more equitable environment of Australia allows birds to move more leisurely between locations, feeding as they go. This may also mean that the routes taken vary somewhat between years and that the distance traveled may also vary according the resources encountered en route. It is a pattern of movement that most Australians never notice. However, migration is only one of the types of dispersive movements characteristic of Australian birds and other fauna. Where Ted Davis and I work in the semi-arid eucalypt woodlands of Western Australia east of the wheatbelt between Norseman and Southern Cross (e.g., Recher and Davis 2002) (the Great Western Woodlands), we have recorded 80 of a possible 150 bird species on our plots. We consider 102 of the 150 (68%) and 49 of the 80 (61%) to be dispersive. This includes all the birds of prey, cuckoos, trillers, chats and pardalotes, and most of the honeyeaters, woodswallows, parrots and whistlers plus others. These are the most abundant groups of birds on our plots. However, only a small proportion of the birds on our study areas migrate in the strict meaning of the term.

The literature on the movements of animals is littered with a complex and fairly confusing terminology and it is not my intention to unravel it here. Gilmore *et al.* (this volume) provide a reasoned account of terminology, addressing such nuances as the differences between migration and nomadism, irruptions and dispersal. Whatever the movements of a particular species are called, it is likely that during its lifetime an individual will move in many different directions and for many different reasons, including dispersing from its natal area to wandering long distances in search of food. Among invertebrates, much movement is "passive" and directed by weather patterns something not considered in this series of papers.

All the dispersive birds in the Great Western Woodlands move long distances seasonally and from year to year taking advantage of superabundant food resources in the form of other birds and vertebrates (birds of prey), nectar and other energy-rich carbohydrates (honeyeaters, pardalotes, lorikeets and others), seed, fruit and young leaves (parrots, emu, honeyeaters, woodswallows, trillers and others), and insects (trillers,

chats, whistlers, woodswallows and others). Some of these movements could be termed migratory (e.g., Western Warbler *Gerygone fusca*; Grey Fantail *Rhipidura fuliginosa*), but most involve tracking resources which vary spatially and temporally in abundance. Such movements can be considered "nomadic", but are not random searches, no more than human nomads move randomly in search of pasture or food. Most likely, dispersive birds have a good knowledge of the regions they frequent, as do human nomads, and, despite distances and the temporal and spatial variability of production, "know" where food is most likely to found at any particular time. These are long-lived birds (>10 years) and accumulated individual and flock knowledge extending back over decades cannot be discounted, just as they form part of human hunter-gather knowledge.

Regardless of how we describe the long-distance movements of birds and other fauna in Australia, it is clear that long-distance movements are central to their survival and that dispersive fauna are core components of the biota across most, if not all, of the continent. Accommodating their movements is therefore a key requirement for biodiversity conservation and requires careful management of the resources they require on spatial and temporal scales not provided by a scattered and static system of reserves. Something more is needed and it is this need that generated the symposium in Adelaide and is the theme of the papers in this volume.

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