Waterbird Movement Across the Great Dividing Range and Implications for Arbovirus Irruption into Southern Victoria

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Waterbird movement across the Great Dividing Range and implications for arbovirus irruption into southern Victoria.

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ABSTRACT

Waterbirds are the major hosts of various arboviruses. Murray Valley Encephalitis Virus (MVEV) is an arbovirus native to northern Australia, whose major hosts are ciconiiform (herons and cormorants) and other water birds. MVEV is transmitted to humans by mosquitoes and can cause acute encephalomyelitis. In Victoria, MVEV is restricted to the north side of the Great Dividing Range (GDR) suggesting that waterbirds cannot cross the high country. We tested this hypothesis by analysing data on waterbird banding and recovery and discovered that 12 species can cross the GDR. This suggests that waterbirds could potentially carry arboviruses including MVEV to southern Victoria.

Waterbirds are the major vertebrate hosts of various arboviruses in Australia.[1] Waterbirds in general, but especially ciconiiformes, are the main host of Murray Valley Encephalitis virus (MVEV), a member of the flaviviridae family that can cause acute encephalomyelitis in humans.[1,2] Positive serology for MVEV antibodies have been detected in 5 waterbird families.[3] MVEV is transmitted to humans by various mosquitoes including *Culex annulirostris*, *Culex australicus*, and *Culex quinquefasciatus*.[1] The virus is endemic to far Northern Australia,[4] but epidemics have occurred in Victoria in 1917-1918, 1951 and 1974 and MVEV antibodies were detected in sentinel chickens in northern Victoria in 2008[5] and again in March 2011 (unpublished) suggesting that the virus was circulating. Incursions of MVEV outside its endemic range are thought to be caused by movement of viraemic waterbirds rather than movement by mosquito vectors.[6] Victorian incursions are thus thought to be linked with the movement of infected waterbirds to southern breeding grounds concurrent with extensive rainfall and flooding in eastern Australia.[7] Detection of MVEV antibodies in sentinel chickens in 2008, in the absence of any significant flooding, imply a change in MVEV mode of transmission.[5] All clinical cases of MVEV in Victoria thus far have occurred north of the Great Dividing Range (GDR) suggesting that the mountain range acts as a barrier to waterbird dispersal[8]. We tested this assumption by investigating banding recovery data for waterbirds across the GDR in Victoria.

We investigated southern movement across the GDR in 5 avian families known to be hosts of MVEV. We queried the Australian Bird and Bat Banding Scheme (ABBBS) database[9] for records of birds banded north of the GDR and recovered in southern Victoria. For each species, we recorded the number of bird banded north of the GDR

(Lat < 37˚30'S) and the number of individuals recovered in southern Victoria (Lat > 37˚30'S). To avoid inclusion of east-west movement of South Australian birds, only birds banded in or north of the Coorong (Lat. < 36˚10'S) were included in the analysis.

We discovered that 12 waterbirds commonly occurring in Victoria can cross the GDR, 7 of which are known MVEV hosts (Table 1). Our results indicate that the GDR does not impede movement of waterbirds. This suggests that MVEV and other waterbird borne arboviruses like Sindbis, Alfuy and Kunjin viruses could be carried to southern Victoria by waterbirds.[1] Mosquito species responsible for transmitting MVEV to humans are known to occur in southern Victoria and in the Melbourne metropolitan region.[10] Consequently, there is a real risk of MVEV infection occurring south of the GDR. Metropolitan Melbourne may be especially at risk because man-made wetlands are highly appreciated by the public and are now a common feature of new residential estates. These may prove a strong attractant to waterbirds, and breeding sites for mosquito vectors. The attraction of urban wetlands to waterbirds may be enhanced under climate change due of reduced precipitation and water availability in south eastern Australia.[11] The prevalence of wetlands in residential developments could also present a risk for other avian-vectored diseases like Japanese Encephalitis and Avian influenza. Overall, our results suggest that waterbirds can cross the GDR and could potentially carry arboviruses, and other viruses, from northern Australia to southern Victoria.

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Table 1. Waterbird species recovery data. Presented are the number of individual banded north of the Great Dividing Range (Banded) and the number of individuals recovered in southern Victoria (Recovered). Species in bold are known hosts of MVEV.[3]

	Banded	Recovered
Order: Anseriformes		
Family: *Anatidae*		
Black Swan, *Cygnus atratus*	6,703	11
Blue-billed Duck, *Oxyura australis*	39	
Musk Duck, *Biziura lobata*	23	
Australian Shelduck, *Tadorna tadornoides*	2,870	65
Australian Wood Duck, *Chenonetta jubata*	8,391	4
Grey Teal, *Anas gracilis*	22,002	45
Chestnut Teal, *Anas castanea*	293	
Pacific Black Duck, *Anas superciliosa*	24,373	85
Australian Shoveler, *Anas rhynchotis*	14	
Pink-eared Duck, *Malacorhynchus membranaceus*	346	
Hardhead, *Aythya australis*	467	
Order: Gruiformes		
Family: *Rallidae*		
Buff-banded Rail, *Gallirallus philippensis*	434	
Lewin's Rail, *Lewinia pectoralis*	10	
Baillon's Crake, *Porzana pusilla*	79	
Australian Spotted Crake, *Porzana fluminea*	7	
Spotless Crake, *Porzana tabuensis*	85	
Purple Swamphen, *Porphyrio porphyrio*	222	
Dusky Moorhen, *Gallinula tenebrosa*	413	
Black-tailed Native-hen, *Gallinula ventralis*	343	
Eurasian Coot, *Fulica atra*	4,566	6
Order: Ciconiiformes		
Family: *Anhingidae*		
Darter, *Anhinga novaehollandiae*	425	

Family: *Phalacrocoracidae*		
Little Pied Cormorant, *Phalacrocorax melanoleucos*	6,117	7
Pied Cormorant, *Phalacrocorax varius*	68,993	1
Little Black Cormorant, *Phalacrocorax sulcirostris*	5,760	10
Great Cormorant, *Phalacrocorax carbo*	6,180	35
Family: *Ardeidae*		
White-faced Heron, *Egretta novaehollandiae*	346	
Little Egret, *Egretta garzetta*	454	
Great Egret, *Casmerodius albus*	1,025	
Intermediate Egret, *Mesophoyx intermedia*	1,775	
Cattle Egret, *Bubulcus ibis*	20,794	53
Nankeen Night Heron, *Nycticorax caledonicus*	624	1
Little Bittern, *Ixobrychus minutus*	56	
Australian Bittern, *Botaurus poiciloptilus*	20	