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Wetland conservation in the Murray–Darling Basin – is it going down the drain?

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Over the last 100 years, *Emu – Austral Ornithology* has aimed to highlight conservation issues of particular concern for the avifauna of the southern hemisphere and to use objective scientific findings to influence conservation policy and decision making, both at a national and international level. Indeed, one of the earliest publications in the journal was the Minutes of the State Government Representatives on Bird Protection (Anonymous 1908), which formed the first list of Australian birds requiring protection. Since that time the journal has continued to highlight important avian conservation issues. Unfortunately, although this admirable goal has been pursued, it is noteworthy that a search of the extensive *Emu* electronic archive for the word 'conservation' gives approximately as many hits as the word 'decline'. This Editorial aims to highlight one of the most serious threats to Australian avifauna in recent times.

The Murray–Darling Basin represents one of the most important areas in Australia for avian biodiversity. The area comprises the largest river system in the country, flowing through four States, from south-western Queensland through New South Wales, Victoria and South Australia. Consequently, this river system encompasses a range of habitat types, many of which are endangered and declining within Australia (Australian Natural Resources Atlas, see www.anra.gov.au; accessed 29 May 2009). *Emu* published one of the first papers to document the impact of human activities on the avifauna of the Murray River (Boehm 1952). Erhard Boehm described many potential impacts including forest clearance, fencing and introduced plants. However, one notable effect he did not mention was any impact of active water regulation in the Murray–Darling river system on the habitats downstream and the resulting declines in bird numbers. This is now a highly topical issue. A combination of water regulation (including the continued filling of massive agricultural dams upstream, the total storage capacity of which amounts to 1.4 times the mean annual flow) and the associated increase in evaporative loss from the river system, along with drought conditions has resulted in a catastrophic decline in water flow through the lower Murray (Goss 2003). This in turn has resulted in habitat modification along 97% of the length of the river system (Goss 2003). As well as reduced water flow, the effects of these regulation measures on the river system include increases in time between floodplain inundations, reduced flood volumes and increased salinity (CSIRO 2008). Models suggest that the end-system flow has been reduced by an estimated 61% in the last 100 years by water regulation developments upstream, leading to a situation now in which water ceases to flow at the mouth of the River Murray 40% of the time, owing to water removal (CSIRO 2008). It is also estimated that during this period, for all the major wetlands and floodplains along the River Murray, the time between significant water inundations has doubled and flood volumes have decreased to approximately one quarter of their original flow, specifically as a result of active regulation and removal of water upstream (CSIRO 2008). Models of the long-term projected effects of the reduced rainfall (–8%) and run-off (–21%) seen in the Murray–Darling Basin in the last 10 years resulting from climate change, suggest that the next 25 years will see a further decrease in flow at the barrages of 50%, if these conditions were to continue (CSIRO 2008). The resulting lack of water flow would have 'very serious consequences' for the health of the ecosystems along the lower Murray (CSIRO 2008).

These serious consequences can already be seen in the decline of waterbird populations associated with the Murray–Darling Basin (Nebel *et al*. 2008; Paton *et al*. 2008). Within the Murray–Darling system, the Lower Lakes, the Coorong, and the Murray mouth used to represent some of the finest jewels in Australia's ornithological crown (see e.g. White 1913; Hanks 1929) and they remain vitally important to Australia's shorebird and waterbird populations today. The Coorong and the Lower Lakes, together with the Macquarie Marshes in New South Wales, were Ramsar listed in 1985–86, in recognition of their international importance for birds. The Coorong and Lower Lakes were designated because they provide habitat for 30% of the waders that spend the summer in Australia (www.ramsar.org; accessed 29 May 2009). This area continues to support a minimum of 111 000 individuals of waterbird species and for nine of those species the area supports more than 1% of the estimated global population, a criterion for continued listing as a Ramsar site (Paton *et al*. 2008). In addition, at a national level, several the wetlands in the lower Murray system are listed as Icon Sites under the Murray–Darling Basin Commission's Living Murray Initiative (CSIRO 2008). The area supports around half the waterbirds found in South Australia (CSIRO 2008).

A recent paper comparing survey results for shorebirds or waders (Charadriiformes) across eastern Australia has highlighted dramatic population changes over a 24-year period (Nebel *et al*. 2008). Although shorebirds as a group are suffering a worldwide decline, the crash in Australian populations is by

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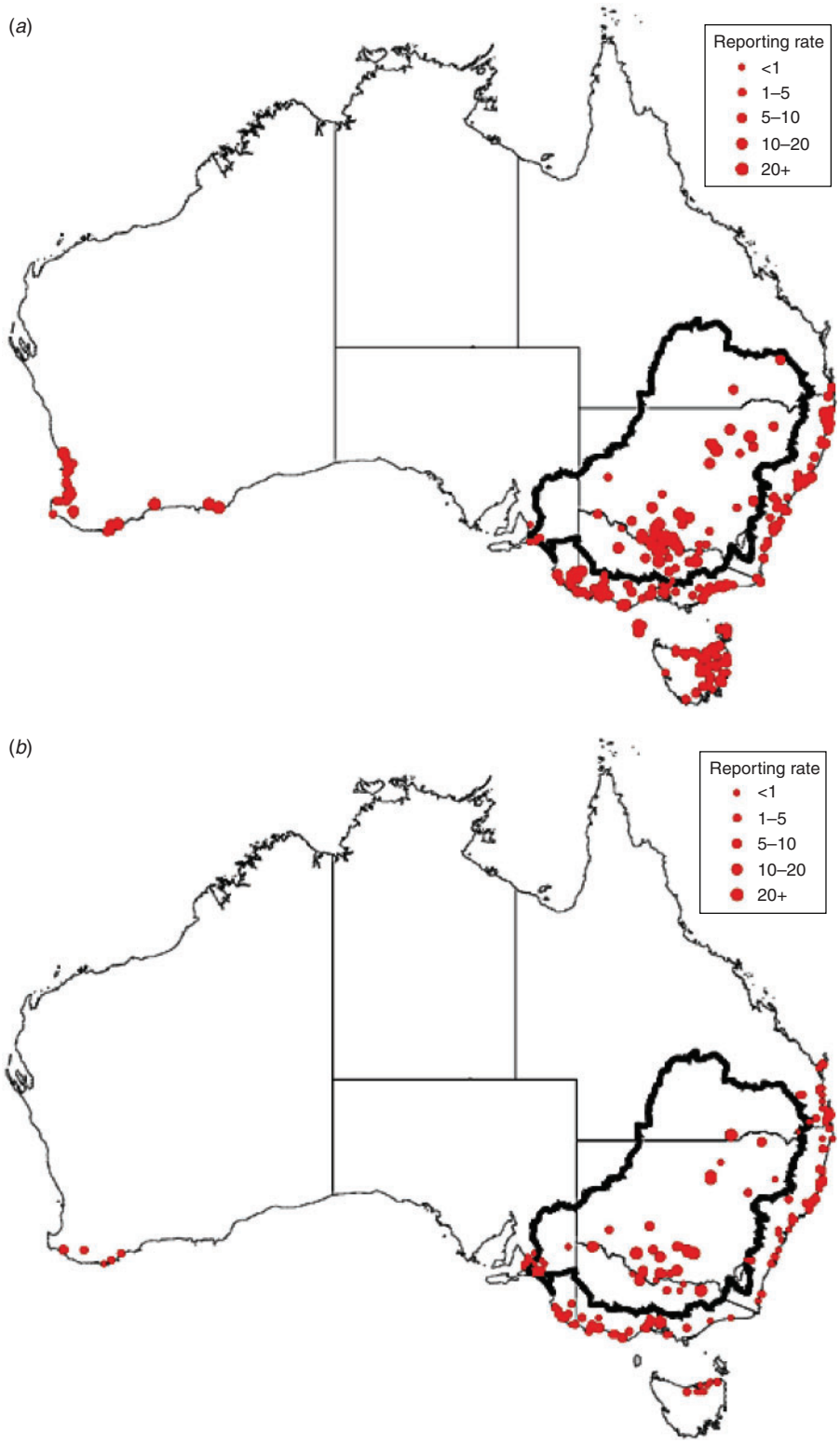

Fig. 1. Australasian bittern (*Botaurus poiciloptilus*) reporting rates from Birds Australia Atlas data from (*a*) 1977–81 within 10-min grids (Blakers *et al*. 1984) and (*b*) 1998–2008 (Barrett *et al*. 2003, using updated atlas data). Outline shows the Murray–Darling Basin catchment area.

any standard alarming, with numbers of migratory shorebirds declining on average by 73% and Australian resident shorebird populations declining by 81% (Nebel *et al*. 2008). Of the 10 catchment areas surveyed in this study, those which demonstrated the most severe decline in shorebird numbers are the wetlands within the Murray–Darling Basin that experience the highest level of water regulation, demonstrating the close link between water regulation and declines in bird numbers (Nebel *et al*. 2008). Taking waterbirds as a whole, the impact of water regulation in the lower Murray system and the resulting consequences for abundance of waterbirds appears to come from a variety of sources, but principally loss of habitat, both for foraging and nesting. Within the Coorong area a range of wetland habitats exist owing to complex variations in salinity (Paton *et al*., in press). Over the last 25 years the dramatic declines (up to 94%) in 23 of the 27 most common waterbird species are thought to be due to reduced distribution and availability of key food resources, such as macroinvertebrates and aquatic vegetation, through processes that include sedimentation and algal blooms (Paton *et al*., in press). Other impacts include the loss of artificial wetlands, duck-hunting and other disturbance (Olsen and Weston 2004). Comparison of different waterbird groups within the Lowbidgee floodplain (associated with the Murrumbidgee River and part of the Murray catchment area) over 19 years (1983–2001) shows that a similarly drastic level of decline in abundance has been seen in piscivores (82%), herbivores (87%) and large wading birds (91%), suggesting that many different types of food resources are affected (Kingsford and Thomas 2004). It is notable that species closely associated with wetlands, such as the Australasian bittern (*Botaurus poiciloptilus*), have dramatically declined over the last 30 years in this region (Fig. 1). As Fig. 1 shows, changes in bird numbers within the Murray–Darling Basin can reflect broad-scale national declines in wetland bird species.

Several controversial solutions have been suggested to reverse these trends. One painful solution is to address the need to prioritise wetland areas according to their perceived ‘value’, supporting those that are most vulnerable or show the highest levels of biodiversity, whilst cutting off water supplies to and thus sacrificing others. As an alternative, recent attempts to reduce water removal are now in place through market-based measures to ‘buy back’ water from the intensive water-demanding agricultural systems in this area. The announcement (5 August 2008) that the Australian Federal Government will use $350 million to purchase water in Queensland with a view to ameliorating the environmental destruction downstream, is a hopeful sign. However, in practice water acquisition is a complex task and progress appears to be proceeding more slowly than anticipated (Wahlquist 2009). How much to buy and where to buy it depends on the economic impact, and also on hydrological factors such as water losses during transmission and waterway connections within the entire Murray–Darling system (Mainuddin *et al*. 2007). Institutional factors such as political restrictions on the trade between regions are also vitally important in determining what is feasible. Dispute between State Governments as to their relative investments into the scheme delays vital progress, with the New South Wales Government currently claiming that other States are lagging behind in their contributions to buy back water while Queensland farmers continue to benefit from irrigation. On a more positive note, recent attempts to model the impacts of water acquisition from water-demanding agricultural activities within the Murray–Darling Basin suggest that the economic impact of buying back enough water to achieve a target environmental flow of up to 1500 million m^3 $year^{-1}$ could be minimal, because the water removal would shift agricultural operations into less water-demanding, but more profitable activities (Mainuddin *et al*. 2007). However, whether the retention of this water in the system would effect a change in waterbird numbers depends both on the strategy of where the water is purchased and what proportion of the reclaimed water reaches the areas used by the declining waterbird communities.

Part of the role of a journal such as *Emu – Austral Ornithology* is to highlight important avian conservation issues in the southern hemisphere and to actively seek to impact on national and international policy and decision making. Clearly, if Australian shorebirds and waterbirds are to survive into the next century, an effective national strategy for wetland conservation is needed that integrates water management with wildlife conservation. It is perhaps ironic that one of the conclusions of the Meeting of the State Government Representatives on Bird Protection (Anonymous 1908) was that legislation for bird protection should be established nationally, but enforced by each State, because of differences in State legislation and the difficulties in overcoming these. It seems it has taken 100 years to develop an integrated national water management strategy that transcends State boundaries and effectively considers wetland conservation and the environmental impacts on Australian bird populations along with purely economic factors in the decision-making process. In view of the drastic declines seen in waterbird populations, it is vital that this water management strategy quickly starts to reverse the impacts on the Australian avifauna and in particular the waterbirds using Australia’s fragile wetlands.

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