

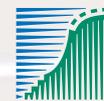
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# Waterbirds around the world

A global overview of the conservation,  
management and research of the  
world's waterbird flyways

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*Cover photography:* Whooper Swans *Cygnus cygnus* arriving at Martin Mere, England. Photo: Paul Marshall.  
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## The impact of the Cardiff Bay barrage on wintering waterbirds

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Cardiff Bay (51°27'N, 3°10'W), a 200 ha area of intertidal mudflats and saltmarsh at the mouth of the Severn Estuary in the UK, was enclosed by a barrage on 4 November 1999. The consequent inundation of the bay has created a freshwater lake that now forms the centre point for the redevelopment of Cardiff's former docklands.

This paper provides an overview of results from 14 years of monitoring which aimed to determine the impacts of this habitat loss on the waterbirds that formerly wintered in the bay. Peaks of 310 Shelduck *Tadorna tadorna*, 120 Oystercatcher *Haematopus ostralegus*, 790 Dunlin *Calidris alpina*, 120 Curlew *Numenius arquata* and 300 Redshank *Tringa totanus* occurred in the bay in the winter immediately before barrage-closure; both Dunlin and Redshank had declined in number over the 10 pre-barrage years.

Between 1989 and 2003, waterbird numbers were monitored both in the bay and neighbouring areas. The results of these counts were used to show how the waterbird community changed following closure and whether displaced birds were able to re-locate to neighbouring sites.

Impacts on the movements and survival of Redshank were also monitored through colour-ringing and radio-tracking. Prior to closure, individual Redshank were highly site-faithful to the bay both within and between winters (Burton 2000) and were thus seen as being particularly at risk from its loss. Over 450 Redshank were individually colour-ringed in the bay in the five years preceding closure. Twenty Redshank were additionally radio-tagged there in October 1999. Following closure, birds were also caught to look at changes in their body condition.

The inundation of the bay resulted in the loss of all of the mudflats, but left a fringe of saltmarsh. Although the new freshwater lake is used by some waterbirds, the overall numbers and diversity of species have been greatly reduced. The loss of species' diversity (from a mean of 26.5 to 22 waterbird species per year) has been due, primarily, to a loss of waders, which now only use the site as an occasional high tide roost.

Almost all the Shelduck, Oystercatcher, Dunlin, Curlew and Redshank that formerly used the bay were displaced by its inundation. Counts in the first winter following closure indicated that some displaced Shelduck, Oystercatcher and Curlew settled at adjacent sites within 4 km - the Rhymney Estuary and Orchard Ledges. However, these increases were not sustained in following winters. It was not possible to determine whether displaced Dunlin were able to settle elsewhere due to an ongoing decline of the local population (unpubl. data).

Observation of colour-ringed and radio-tagged birds supported the evidence from counts that most Redshank were also displaced to the Rhymney Estuary, though in the winter

following closure, some displaced Redshank were also recorded at other sites up to 19 km away. The loss of birds from the bay could have accounted for the overall increase in numbers observed at Rhymney over the four winters subsequent to closure (Burton *et al.* 2006). Displaced colour-ringed birds using this area were seen on mudflats by the River Rhymney and Cardiff Heliport. Radio-tracking had shown that the Heliport mudflats were formerly used only at night (Burton & Armitage 2005), probably due to disturbance during the day from helicopters.

Although count data suggested that Redshank displaced from Cardiff Bay were able to settle at Rhymney, analysis of biometric data revealed that adult Redshank from the bay had difficulty in maintaining their body condition in the first winter following closure. Adults which were displaced from Cardiff Bay to Rhymney were significantly lighter than those that they joined (Burton *et al.* 2006).

Most significantly, the survival rate of adult Redshank displaced from Cardiff Bay declined between the two years prior to closure and the three following years. Given that there was no significant change in the annual survival rate of Rhymney-based Redshank over this time, it seems likely that this was a direct consequence of the birds' displacement (Burton *et al.* 2006).

The results of this study indicate that waterbirds may have difficulty in settling in new areas following habitat loss. Birds displaced by the inundation of Cardiff Bay only moved to the nearest available alternative sites. There was reduced survival in the population of displaced birds of at least one species. Initial increases in numbers at neighbouring sites were not sustained.

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