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The Effects on Waterbirds of Dredging at the Cardiff Bay Barrage Report for 2003/2004

Authors

S.J. Holloway, M.J. Grantham, M.P. Collier & N.H.K. Burton

March 2004

Report of work carried out by The British Trust for Ornithology
under contract to Cardiff Harbour Authority

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British Trust for Ornithology

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EXECUTIVE SUMMARY

1. This study reports the impact of maintenance dredging on the birds utilising mudflats within and adjoining the outer harbour of the Cardiff Bay barrage using data collected in January 2004 and February 2004. Results are compared to those reported in 2002 and 2003. Dredging is required to maintain a channel from the outer harbour to the sea and to prevent sediment build up within this harbour. Dredging has taken place in August 2000, May 2001, February/March and August 2002, February and August 2003 and, during the period of study, took place between 25 January and 10 February 2004. Dredging is normally undertaken twice a year. Within the outer harbour, mudflats reform naturally after dredging.

2. Cardiff Bay was formed by the combined estuaries of the Rivers Taff and Ely and is situated at the mouth of the larger Severn Estuary. The bay was impounded by a barrage constructed at its mouth in November 1999. The mudflats that now adjoin the Cardiff Bay barrage historically formed part of the intertidal mudflats of the bay.

3. Data are presented for the months of January 2004, before dredging commenced, and February 2004, after dredging operations had been completed.

4. Eight waterbird species were recorded using the mudflats affected by dredging in January 2004 and February 2004. These included three of the 10 species of wildfowl and wader that had been recorded on the equivalent mudflats prior to barrage construction – Shelduck, Mallard and Curlew – and five species of gull – Black-headed Gull, Common Gull, Lesser Black-backed Gull, Herring Gull and Great Black-backed. These species, and also Cormorant, Mute Swan, Oystercatcher and Redshank had been recorded on these mudflats during previous periods of fieldwork.

5. By far the most numerous species on the mudflats affected by dredging were Black-headed Gull and Lesser Black-backed Gull. Aside from these, only Mallard and Herring Gull were recorded in numbers of greater than 10 on any one of these mudflats. Black-headed and Lesser Black-backed Gulls utilised all three mudflat areas, whilst Mallard particularly favoured the area within the outer harbour. These results are very similar to those reported in March 2003.

6. Although the overall numbers of wildfowl and waders using the mudflats affected by dredging are very low, one species found on these mudflats – Mallard – was not recorded on comparative areas of mudflat nearby. Densities of Shelduck, Black-headed Gull and Lesser Black-backed Gull were greater on the comparative mudflats, however.

7. There is only slight evidence for the dredging in January/February 2004 having an effect in the short term on the numbers of birds using the mudflats by the barrage. Numbers of Mallard, Black-headed, and Lesser Black-backed Gulls on these mudflats were lower in February 2004 than in January 2004. In contrast, numbers of Herring Gulls increased in February, whilst Shelduck were recorded on these mudflats in February but not January

8. Average numbers of Mallard and (foraging) Black-headed Gull using the mudflats affected by dredging have been similar over the last three years, while those of Shelduck, Lesser Black-backed and Herring Gull have perhaps increased slightly. Thus, at present, there is no evidence that waterbirds have been affected by the dredging in the longer term. It should be noted, though, that due to the regular dredging that has occurred since the barrage was completed invertebrate food supplies in the areas of mudflats being dredged may have been prevented from developing. This is an inevitable consequence of complying with the statutory requirements of the Cardiff Bay Barrage Act 1993. Overall, however, the numbers of birds that might be affected by dredging are very small in relation to the substantial populations found locally.

9. Further monitoring is recommended in order to allow future assessment of the impacts of dredging over both the short and long term.

1. INTRODUCTION

This study reports the impact of maintenance dredging on the birds utilising mudflats within and adjoining the outer harbour of the Cardiff Bay barrage using data collected in January 2004 and February 2004. Results are compared to and presented in a similar format to those reported previously (Burton & Clark 2002a, 2002b, Burton *et al.* 2003a, 2003b). Dredging is required to maintain a channel from the outer harbour to the sea and to prevent sediment build up within the harbour. Within the outer harbour, mudflats reform naturally after dredging. Initial dredging took place during the construction of the barrage and has since taken place in August 2000, May 2001, February/March and August 2002, February and August 2003 and, during the period of study, between 25 January and 10 February 2004. In future, dredging will typically take place twice a year, usually in February and August.

Data are presented separately for periods immediately before and after dredging, in January and February 2004.

The ornithological significance of these mudflats was assessed in previous reports (Burton & Clark 2002a, 2002b) by comparing counts made between August 2001 and March 2002 with historic data collected prior to the construction of the barrage and with concurrent count data from two adjacent areas of mudflat.

Cardiff Bay was formed by the combined estuaries of the Rivers Taff and Ely and is situated at the mouth of the larger Severn Estuary. The bay was impounded by a barrage constructed at its mouth in November 1999. The Severn Estuary is ornithologically important because of the populations of waterbirds (i.e. grebes, cormorants, herons, rails, wildfowl, waders, gulls and terns) that it supports in winter and as a result is designated as a Special Protection Area (SPA). Some of the mudflats beside the Cardiff Bay barrage are included in this area.

The Severn Estuary currently holds internationally important numbers of European White-fronted Goose *Anser albifrons albifrons*, Shelduck *Tadorna tadorna*, Gadwall *Anas strepera*, Dunlin *Calidris alpina* and Redshank *Tringa totanus* (Pollitt *et al.* 2003) and Cardiff Bay itself formerly held nationally important numbers of Dunlin (Burton *et al.* 2003). (Sites are considered internationally important for a species if they regularly hold at least 1% of the individuals in a population of that species. Sites within Britain are considered nationally important for a species if they regularly hold 1% or more of the estimated British population of that species.) Current national importance thresholds for the waterbird species referred to in this report are shown in Appendix 1.

2. METHODS

Figure 2.1 shows the areas subject to maintenance dredging and Figure 2.2, the numbered mudflat count areas that have been surveyed between August 2001 and February 2004. Areas B2 and B3 include remnants of the mudflats of the bay that were dissected by the building of the barrage. Accretion of sediments has enlarged these mudflats and also occurs naturally within the barrage's outer harbour – 'mudflat' B5. (This area would also previously have formed part of the bay's intertidal area). Dredging of these three mudflats is required to allow continued passage of boats from the barrage gates to the sea. Two further areas of mudflat – areas B1 and B4 – were also surveyed to provide comparative counts. Mudflat B1 was similar to B2, both being entirely muddy, whilst mudflats B3 and B4 contained a mix of mud and rocky substrate. The five mudflats were 4.8, 11.9, 7.0, 19.8 and 3.3 ha in size, respectively.

The waterbirds using mudflats B1-B5 were counted at hourly intervals (relative to low tide) over the time that the mudflats were exposed, twice in both January and February 2004. (Counts were undertaken on 22-23 January and 18-19 February). The mudflats became exposed between 3 and 2 hours before low tide and became inundated again 2 to 3 hours afterwards. The counts made in January were before dredging took place, whilst those in February were made after dredging operations had finished.

Counts of area B5 within the barrage's outer harbour included birds on the water and on the small area of mudflat that formed at low tide.

The mean numbers and densities of waterbirds recorded on mudflats B1-B5 at low tide were tabulated for both January and February. Further tables provide information on the mean bird hours recorded per tidal cycle (i.e. the sum of the average number of birds each hour) on mudflats B1-B5 and the peak numbers of each species recorded on each mudflat. By tabulating the data in this way, it is possible to assess whether the numbers of birds occurring on the mudflats after the periods of dredging differed from those that occurred on the mudflats prior to the dredging operations.

3. RESULTS

Table 3.1 reports the mean numbers and densities of waterbirds recorded on mudflats B1-B5 at low tide in January 2004 and February 2004. Table 3.2 indicates the overall usage of mudflats B1-B5 through the tidal cycle and Table 3.3, the peak numbers of birds recorded on each mudflat.

A total of eight waterbird species were recorded using the mudflats affected by dredging, i.e. B2, B3 and B5, in January and February 2004. These included three species of wildfowl and wader that had been recorded on the equivalent mudflats prior to barrage construction (Burton & Clark 2002a, 2002b) – Shelduck *Tadorna tadorna,* Mallard *Anas platyrhynchos* and Curlew *Numenius arquata*. In addition, five species of gull – Black-headed Gull *Larus ridibundus*, Common Gull *L. canus,* Lesser Black-backed Gull *L. fuscus*, Herring Gull *L. argentatus* and Great Black-backed Gull *L. marinus* were also recorded on these mudflats. These species, and also Cormorant *Phalacrocorax carbo,* Mute Swan *Cygnus olor*, Oystercatcher *Haematopus ostralegus,* and Redshank *Tringa totanus* had been recorded on these mudflats during the previous fieldwork (Burton *et al.* 2003b).

By far the most numerous species on the mudflats affected by dredging were Black-headed Gull and Lesser Black-backed Gull. Aside from these, only Mallard and Herring Gull were recorded in numbers of greater than 10 on any one of these mudflats (Table 3.3). Tables 3.1 and 3.3 show that Black-headed and Lesser Black-backed Gulls utilised all three mudflats, whilst Mallard particularly favoured mudflat B5, within the outer harbour. The latter mudflat was also used by Black-headed, Common, Lesser Black-backed, Herring and Great Black-backed Gulls.

Gulls were particularly associated with the channel and seaward edge of mudflats, whilst other species were found higher up the mudflats. Typically, the overwhelming majority of the birds that were recorded on these mudflats were feeding.

Table 3.1 also allows comparison to be made between the densities found on the mudflats affected by the dredging (B2, B3 & B5) and those found on mudflats B1 and B4, which have not been affected by dredging. During the counts of January and February 2004, Shelduck were only recorded in February (post-dredging operations), and occurred in much higher densities at low tide on mudflats B1 and B4 than on mudflats B2, B3 and B5. In contrast, no Mallard were recorded on mudflats B1 or B4. No waders were recorded on any of the mudflats at low tide.

In comparison to mudflats B2, B3 and B5, mudflats B1 and B4 held higher low tide densities of both Black-headed and Lesser Black-backed Gulls. Conversely, the density of Herring Gulls was higher on mudflats B2, B3 & B5 than on mudflats B1 and B4 in January (before dredging operations commenced), but during the February counts (post-dredging operations), the highest densities were on mudflats B1 and B4. No other species of gull were recorded on the mudflats at low tide.

The possible short term effects of dredging can be examined by comparing the numbers of birds in January 2004 (prior to dredging) with those of February 2004 (post-dredging). Mallard decreased in number and were confined to a single mudflat (B5) in February, whilst Shelduck were recorded for the first time after the dredging operations. Occasional Curlew were also recorded on mudflat B3 (in both January and February), and also mudflat B4 (January only – Tables 3.2 and 3.3), though none at low tide. No other species of wader was recorded during either January or February 2004, whereas very small numbers of both Oystercatcher and Redshank were noted during the previous years.

Both Black-headed and Lesser Black-backed Gulls showed an overall decline on the mudflats affected by dredging in February. In contrast, the total numbers of Herring Gulls actually increased in February 2004, after the dredging. Only occasional Common and Great Black-backed Gulls used the mudflats affected by dredging.

The longer term effects of dredging can be evaluated by comparing the counts on the mudflats affected by dredging from this winter with those from the previous two. Numbers of Black-headed Gulls

across the tidal cycle were similar in February 2004 (following dredging operations) to those in February 2002, though less than those in February 2003 when a large number of birds were recorded roosting on mudflat B2 (Tables 3.2; Burton *et al.* 2003b). Overall numbers of Lesser Black-backed and Herring Gulls, particularly on mudflat B3, were higher in February 2004. Peak numbers were also greater on mudflat B5. Numbers of Mallard were similar to those in previous winters, while those of Shelduck were similar to those in February 2002 and higher than those in February 2003. Fewer waders were recorded in 2004 than in the previous two years' study.

4. ASSESSMENT OF THE ORNITHOLOGICAL IMPORTANCE OF THE STUDY AREA AND THE POTENTIAL IMPACT OF DREDGING

A total of eight waterbird species were recorded using the mudflats affected by dredging, i.e. B2, B3 and B5, in January and February 2004. These included three species of wildfowl and wader that had been recorded on the equivalent mudflats prior to barrage construction (Burton & Clark 2002a, 2002b) – Shelduck, Mallard, and Curlew. In addition, five species of gull – Black-headed Gull, Common Gull, Lesser Black-backed Gull, Herring Gull and Great Black-backed Gull were also recorded on these mudflats. These species, and also Cormorant, Mute Swan, Oystercatcher and Redshank had been recorded on these mudflats during previous fieldwork (Burton *et al.* 2003b).

The report for 2001/02 found that the densities of Shelduck, Mallard, Oystercatcher, Curlew and Redshank were less than those found in the four years immediately prior to construction of the barrage and that five species of wildfowl and wader recorded in those years were absent (Burton & Clark 2002b). However, though the overall numbers of wildfowl and waders using the mudflats affected by dredging are now very low, one species found on these mudflats in January/February 2004 – Mallard – was not recorded on comparative areas of mudflat nearby. Densities of Shelduck, Black-headed Gull and Lesser Black-backed Gull, were greater on the comparative mudflats, however. These findings are similar to those of August 2001 to March 2003 (Burton & Clark 2002a, 2002b, Burton *et al.* 2003a, 2003b).

The report for 2002/03 found little evidence that densities of waterbirds had been affected in the short term by the dredging undertaken in August 2002. Indeed, numbers of the three most numerous species – Mallard, Black-headed and Lesser Black-backed Gull – at low tide and across the tidal cycle were higher on average than over August to March as a whole. In contrast, numbers of foraging Black-headed and Lesser Black-backed Gulls on these mudflats were lower than average in February 2003, though large numbers of roosting birds were recorded.

There is, likewise, only slight evidence for the dredging in between January and February 2004 having an effect on the numbers of birds using the mudflats in the short term. Although numbers of Mallard, Black-headed Gull and Lesser Black-backed Gull decreased on the mudflats affected by the dredging after the dredging operations had taken place, Herring Gulls increased in number in February, whilst Shelduck were recorded in February but not January.

There are several possible explanations for these post-dredging changes. It is possible that the dredging in January/February may have made some food resources temporarily more available to species such as Shelduck, although the numbers of birds involved were very small. The general decrease in the numbers of Black-headed and Lesser Black-backed Gulls after the dredging in February 2004 (and during dredging in February 2003) may have been a result of some of the birds beginning to move back to their breeding areas. It is also possible, though, that the decline in gull and Mallard numbers in February was linked to a short-term decline in food resources, possibly as a result of dredging disturbance. However, as the levels of the food resources in the water and sediments are currently not being measured, it is not possible to say for sure.

Average numbers of Mallard and (foraging) Black-headed Gull using the mudflats affected by dredging have been similar over the last three years (allowing for the presence of a large flock of roosting Black-headed Gulls in February 2003), while those of Shelduck, Lesser Black-backed and Herring Gull have perhaps increased slightly. Thus, at present, there is no evidence that waterbirds have been affected by the dredging in the longer term. It should be noted, though, that due to the regular dredging that has occurred since the barrage was completed invertebrate food supplies in the areas of mudflats being dredged may have been prevented from developing. This is an inevitable consequence of complying with the statutory requirements of the Cardiff Bay Barrage Act 1993. As reported previously, densities of wader and wildfowl species on the mudflats affected by dredging are lower than those found prior to construction of the barrage (Burton & Clark 2002b). Overall,

however, the numbers of birds that might be affected by dredging are very small in relation to the substantial populations found locally (see Burton *et al.* 2003).

Further monitoring is recommended in order to allow future assessment of the impacts of dredging over both the short and long term.

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References

Burton, N.H.K. & Clark, N.A. (2002a) *The Effects on Waterbirds of Dredging at the Cardiff Bay Barrage Interim Report January 2002.* BTO Research Report No. 276 to Cardiff Harbour Authority. BTO, Thetford.

Burton, N.H.K. & Clark, N.A. (2002b) *The Effects on Waterbirds of Dredging at the Cardiff Bay Barrage Report for 2001/02.* BTO Research Report No. 285 to Cardiff Harbour Authority. BTO, Thetford.

Burton, N.H.K., Holloway, S.J. & Clark, N.A. (2003a) *The Effects on Waterbirds of Dredging at the Cardiff Bay Barrage Report for April to December 2002.* BTO Research Report No. 309 to Cardiff Harbour Authority. BTO, Thetford.

Burton, N.H.K., Holloway, S.J. & Clark, N.A. (2003b) *The Effects on Waterbirds of Dredging at the Cardiff Bay Barrage Report for August 2002 to March 2003.* BTO Research Report No. 314 to Cardiff Harbour Authority. BTO, Thetford

Burton, N.H.K., Rehfisch, M.M. & Clark, N.A. (2003) *The effect of the Cardiff Bay barrage on waterbird populations. Final report.* BTO Research Report No. 343 to the Council of the City and County of Cardiff. BTO, Thetford.

Pollitt, M.S., Hall, C., Holloway, S.J., Hearn, R.D., Marshall, P.E., Musgrove, A.J., Robinson, J.A. & Cranswick, P.A. (2003) *The Wetland Bird Survey 2000-01: Wildfowl and Wader Counts.* BTO/WWT/RSPB/JNCC, Slimbridge.

	Jan 2004		Feb 2004	
	n	d	n	d
Cormorant				
Mudflat B2	0	0	0	0
Mudflat B3	0	0	0	0
Mudflat B5	0	0	0	0
Mudflat B1	0	0	0	0
Mudflat B4	0	0	0	0
Mudflats B2,B3,B5	**0**	**0**	**0**	**0**
Mudflats B1, B4	**0**	**0**	**0**	**0**
Mute Swan				
Mudflat B2	0	0	0	0
Mudflat B3	0	0	0	0
Mudflat B5	0	0	0	0
Mudflat B1	0	0	0	0
Mudflat B4	0	0	0	0
Mudflats B2,B3,B5	**0**	**0**	**0**	**0**
Mudflats B1, B4	**0**	**0**	**0**	**0**
Shelduck				
Mudflat B2	0	0	0	0
Mudflat B3	0	0	1.0	0.14
Mudflat B5	0	0	0	0
Mudflat B1	0	0	3.0	0.63
Mudflat B4	0	0	14.5	0.73
Mudflats B2,B3,B5	**0**	**0**	**1.0**	**0.05**
Mudflats B1, B4	**0**	**0**	**17.5**	**0.71**
Mallard				
Mudflat B2	0	0	0	0
Mudflat B3	1.0	0.14	0	0
Mudflat B5	4.0	1.21	0.5	0.15
Mudflat B1	0	0	0	0
Mudflat B4	0	0	0	0
Mudflats B2,B3,B5	**5.0**	**0.23**	**0.5**	**0.02**
Mudflats B1, B4	**0**	**0**	**0**	**0**
Oystercatcher				
Mudflat B2	0	0	0	0
Mudflat B3	0	0	0	0
Mudflat B5	0	0	0	0
Mudflat B1	0	0	0	0
Mudflat B4	0	0	0	0
Mudflats B2,B3,B5	**0**	**0**	**0**	**0**
Mudflats B1, B4	**0**	**0**	**0**	**0**
Curlew				
Mudflat B2	0	0	0	0
Mudflat B3	0	0	0	0
Mudflat B5	0	0	0	0
Mudflat B1	0	0	0	0
Mudflat B4	0	0	0	0
Mudflats B2,B3,B5	**0**	**0**	**0**	**0**
Mudflats B1, B4	**0**	**0**	**0**	**0**

Table 3.1 Mean low tide numbers (n) and densities (d) (birds/ha) of waterbirds using mudflats near the Cardiff Bay barrage at low tide in January 2004 and February 2004.

Only species recorded since August 2001 at low tide on mudflats affected by dredging (shown italicised) are included. Figures in bold are total numbers and densities for mudflats B2, B3 and B5 combined and for mudflats B1 and B4 combined.

	Jan 2004		Feb 2004	
	n	d	n	d
Redshank				
Mudflat B2	0	0	0	0
Mudflat B3	0	0	0	0
Mudflat B5	0	0	0	0
Mudflat B1	0	0	0	0
Mudflat B4	0	0	0	0
Mudflats B2,B3,B5	**0**	**0**	**0**	**0**
Mudflats B1, B4	**0**	**0**	**0**	**0**
Black-headed Gull				
Mudflat B2	27.0	2.27	1.5	0.13
Mudflat B3	1.0	0.14	8.5	1.21
Mudflat B5	7.0	2.12	0.5	0.15
Mudflat B1	2.5	0.52	10.0	2.08
Mudflat B4	97.5	4.92	8.5	0.43
Mudflats B2,B3,B5	**35.0**	**1.58**	**10.5**	**0.47**
Mudflats B1, B4	**100.0**	**4.07**	**18.5**	**0.75**
Common Gull				
Mudflat B2	0	0	0	0
Mudflat B3	0	0	0	0
Mudflat B5	0	0	0	0
Mudflat B1	0	0	0	0
Mudflat B4	0	0	0	0
Mudflats B2,B3,B5	**0**	**0**	**0**	**0**
Mudflats B1, B4	**0**	**0**	**0**	**0**
Lesser Black-backed Gull				
Mudflat B2	0	0	10.5	0.88
Mudflat B3	3.5	0.50	1.5	0.21
Mudflat B5	2.0	0.61	0.5	0.15
Mudflat B1	0	0	7.0	1.46
Mudflat B4	47.5	2.40	9.0	0.45
Mudflats B2,B3,B5	**5.5**	**0.25**	**12.5**	**0.56**
Mudflats B1, B4	**47.5**	**1.93**	**16.0**	**0.65**
Herring Gull				
Mudflat B2	0	0	0	0
Mudflat B3	2.5	0.36	0	0
Mudflat B5	0	0	0	0
Mudflat B1	0	0	3.0	0.63
Mudflat B4	1.5	0.08	3.5	0.18
Mudflats B2,B3,B5	**2.5**	**0.11**	**0**	**0**
Mudflats B1, B4	**1.5**	**0.06**	**6.5**	**0.26**
Great Black-backed Gull				
Mudflat B2	0	0	0	0
Mudflat B3	0	0	0	0
Mudflat B5	0	0	0	0
Mudflat B1	0	0	0	0
Mudflat B4	0	0	0	0
Mudflats B2,B3,B5	**0**	**0**	**0**	**0**
Mudflats B1, B4	**0**	**0**	**0**	**0**

Table 3.1 Continued.

	Jan 2004	Feb 2004
Cormorant		
Mudflat B2	0	0
Mudflat B3	0	0
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	0	0
Mute Swan		
Mudflat B2	0	0
Mudflat B3	0	0
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	0	0
Shelduck		
Mudflat B2	0	3.0
Mudflat B3	0	5.0
Mudflat B5	0	0
Mudflat B1	0	27.0
Mudflat B4	0	72.5
Mallard		
Mudflat B2	0	0
Mudflat B3	15.5	0
Mudflat B5	36.5	19.5
Mudflat B1	0	0
Mudflat B4	0	0
Oystercatcher		
Mudflat B2	0	0
Mudflat B3	0	0
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	0.5	0
Curlew		
Mudflat B2	0	0
Mudflat B3	1.0	1.0
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	1.5	0
Redshank		
Mudflat B2	0	0
Mudflat B3	0	0
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	0	0

Table 3.2 Mean numbers of bird hours per tidal cycle recorded on mudflats near the Cardiff Bay barrage in January 2004 and February 2004.

Only species recorded since August 2001 on mudflats affected by dredging (shown italicised) are included.

	Jan 2004	Feb 2004
Black-headed Gull		
Mudflat B2	260.0	53.5
Mudflat B3	106.5	85.0
Mudflat B5	285.5	122.0
Mudflat B1	15.5	93.5
Mudflat B4	515.5	139.5
Common Gull		
Mudflat B2	0.5	0
Mudflat B3	0	0
Mudflat B5	0	1.0
Mudflat B1	0	0
Mudflat B4	30.0	0
Lesser Black-backed Gull		
Mudflat B2	17.5	37.0
Mudflat B3	14.5	10.0
Mudflat B5	80.5	15.5
Mudflat B1	1.5	28.0
Mudflat B4	170.0	64.0
Herring Gull		
Mudflat B2	0	2.5
Mudflat B3	2.5	21.0
Mudflat B5	2.5	3.0
Mudflat B1	0	4.0
Mudflat B4	26.0	29.5
Great Black-backed Gull		
Mudflat B2	0	0.5
Mudflat B3	0	0
Mudflat B5	1.5	0
Mudflat B1	0	0.5
Mudflat B4	9.5	2.0

Table 3.2 Continued.

	Jan 2004	Feb 2004
Cormorant		
Mudflat B2	0	0
Mudflat B3	0	0
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	0	0
Mute Swan	0	0
Mudflat B2	0	0
Mudflat B3	0	0
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	0	0
Shelduck		
Mudflat B2	0	4
Mudflat B3	0	2
Mudflat B5	0	0
Mudflat B1	0	16
Mudflat B4	0	28
Mallard		
Mudflat B2	0	0
Mudflat B3	14	0
Mudflat B5	30	12
Mudflat B1	0	0
Mudflat B4	0	0
Oystercatcher		
Mudflat B2	0	0
Mudflat B3	0	0
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	1	0
Curlew		
Mudflat B2	0	0
Mudflat B3	1	1
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	1	0
Redshank	0	0
Mudflat B2	0	0
Mudflat B3	0	0
Mudflat B5	0	0
Mudflat B1	0	0
Mudflat B4	0	0

Table 3.3 Peak numbers of waterbirds recorded on mudflats near the Cardiff Bay barrage in January 2004 and February 2004.

Only species recorded since August 2001 on mudflats affected by dredging (shown italicised) are included.

	Jan 2004	Feb 2004
Black-headed Gull		
Mudflat B2	182	32
Mudflat B3	153	46
Mudflat B5	169	120
Mudflat B1	13	70
Mudflat B4	630	60
Common Gull		
Mudflat B2	1	0
Mudflat B3	0	0
Mudflat B5	0	2
Mudflat B1	0	0
Mudflat B4	60	0
Lesser Black-backed Gull		
Mudflat B2	35	17
Mudflat B3	10	3
Mudflat B5	65	9
Mudflat B1	3	20
Mudflat B4	153	21
Herring Gull		
Mudflat B2	0	2
Mudflat B3	5	20
Mudflat B5	3	4
Mudflat B1	0	0
Mudflat B4	40	19
Great Black-backed Gull		
Mudflat B2	0	1
Mudflat B3	0	0
Mudflat B5	2	0
Mudflat B1	0	1
Mudflat B4	15	2

Table 3.3 Continued.

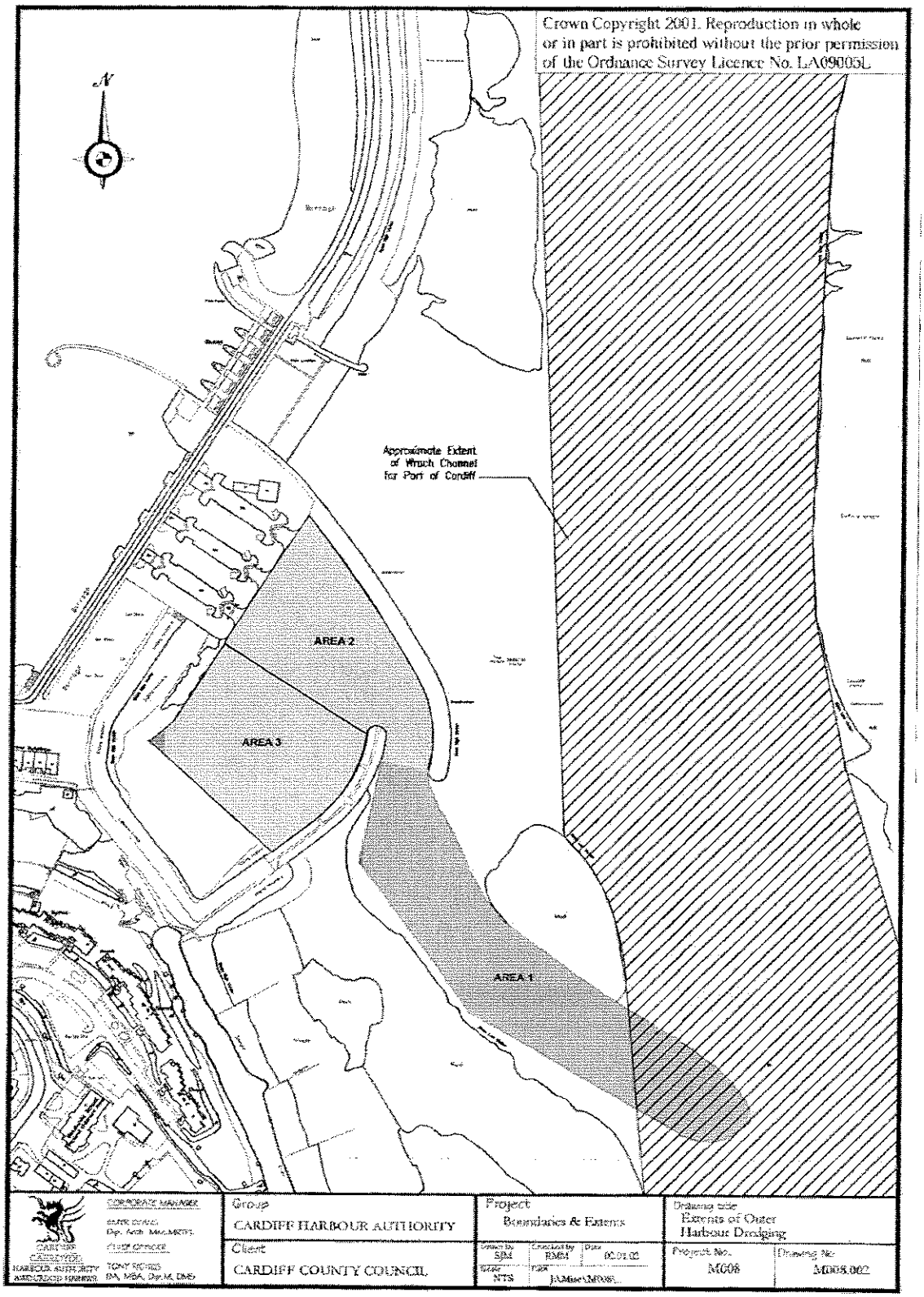

Figure 2.1 The Cardiff Bay barrage showing areas (shaded grey) subject to maintenance dredging.

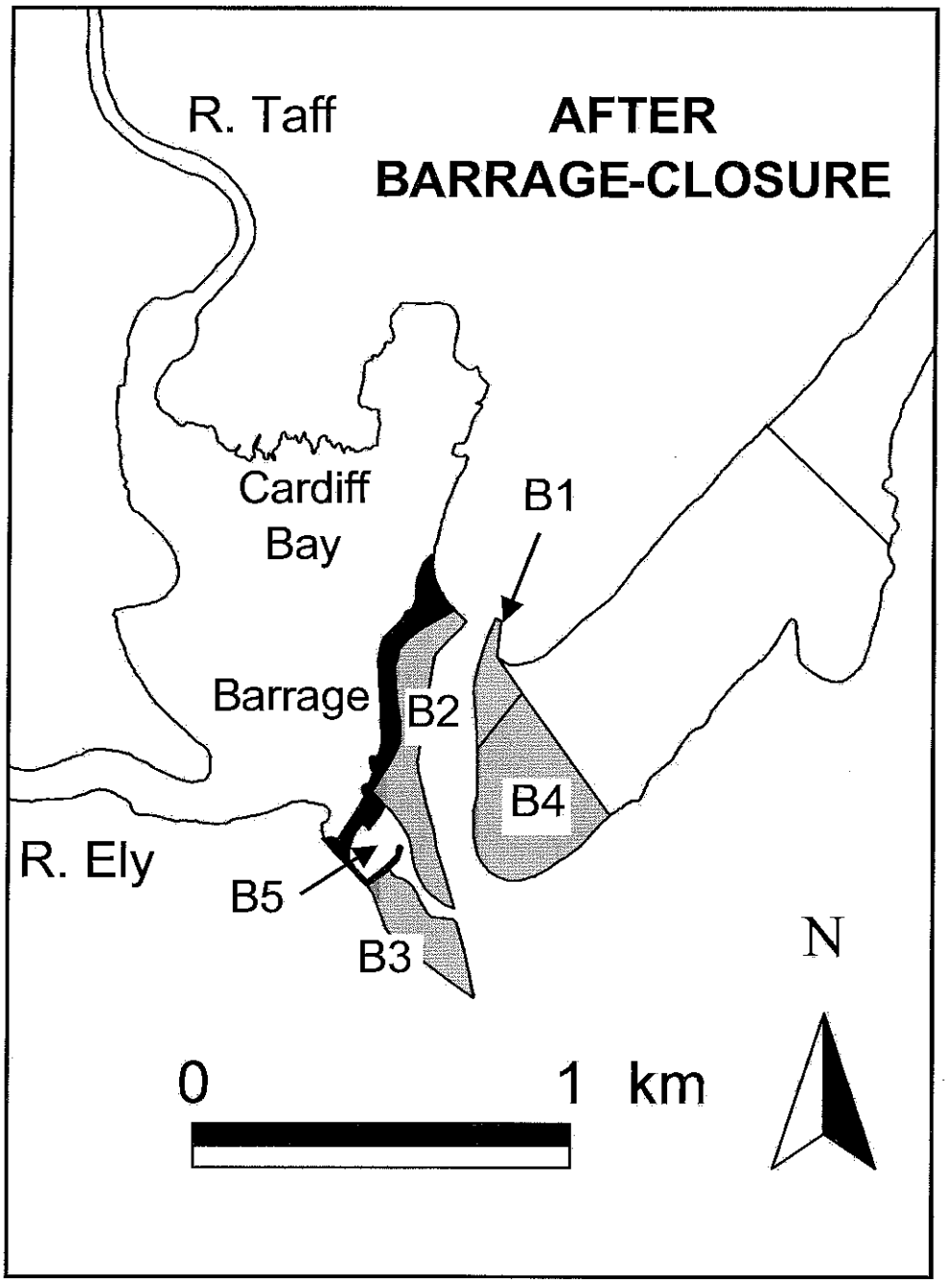

Figure 2.2 The Cardiff Bay barrage showing numbered mudflat count areas (shaded grey) used between August 2001 and February 2004.

Appendix 1 National importance thresholds for waterbird species referred to in this report (taken from Pollitt *et al.* 2003).

Cormorant *Phalacrocorax carbo*	130
Mute Swan *Cygnus olor*	260
European White-fronted Goose *Anser albifrons albifrons*	6000
Shelduck *Tadorna tadorna*	750
Gadwall *Anas strepera*	300
Mallard *Anas platyrhynchos*	5000
Oystercatcher *Haematopus ostralegus*	3600
Dunlin *Calidris alpina*	5300
Curlew *Numenius arquata*	1200
Redshank *Tringa totanus*	1100
Black-headed Gull *Larus ridibundus*	19000
Common Gull *Larus canus*	9000
Lesser Black-backed Gull *Larus fuscus*	500
Herring Gull *Larus argentatus*	4500
Great Black-backed Gull *Larus marinus*	400