



British Trust for Ornithology

BTO Research Report No. 137

**THE ROOSTING BEHAVIOUR
OF WADERS AND WILDFOWL
IN CARDIFF BAY:
WINTER 1993/94**

Authors

D.K. Toomer & N.A. Clark

Report of work carried out by
The British Trust for Ornithology
under contract to
Cardiff Bay Development Corporation

May 1994

© Copyright British Trust for Ornithology/Cardiff Bay Development Corporation

The National Centre for Ornithology, The Nunnery, Thetford, Norfolk, IP24 2PU.
Registered Charity No. 216652

LIST OF CONTENTS

	Page No
LIST OF FIGURES	3
EXECUTIVE SUMMARY	5
1. INTRODUCTION	7
2. METHODS	9
3. RESULTS	11
3.1 Roost Sites	11
3.2 Species Accounts	15
3.2.1 Shelduck	15
3.2.2 Teal.....	16
3.2.3 Dunlin	17
3.2.4 Curlew	17
3.2.5 Redshank	18
3.2.6 Other Species	20
4. DISCUSSION AND CONCLUSIONS	23
ACKNOWLEDGEMENTS	25
REFERENCES	27
FIGURES	29

LIST OF FIGURES

	Page No.
Figure 2.1 The proportion of tide height classes on all observation days.....	29
Figure 3.1 Roost sites identified in Cardiff Bay for 1994	30
Figure 3.2.1.1 The distribution of high tide roosts used by Shelduck in Cardiff Bay.....	31
Figure 3.2.1.2 The distribution of roosting Shelduck in relation to tide height in Cardiff Bay.....	32
Figure 3.2.2.1 The distribution of high tide roosts used by Teal in Cardiff Bay.....	33
Figure 3.2.2.2 The distribution of roosting Teal in relation to tide height in Cardiff Bay.....	34
Figure 3.2.3.1 The distribution of high tide roosts used by Dunlin in Cardiff Bay.....	35
Figure 3.2.3.2 The distribution of roosting Dunlin in relation to tide height in Cardiff Bay.....	36
Figure 3.2.4.1 The distribution of high tide roosts used by Curlew in Cardiff Bay.....	37
Figure 3.2.4.2 The distribution of roosting Curlew in relation to tide height in Cardiff Bay.....	38
Figure 3.2.5.1 The distribution of high tide roosts used by Redshank in Cardiff Bay.....	39
Figure 3.2.5.2 The distribution of roosting Redshank in relation to tide height in Cardiff Bay	40
Figure 3.2.5.3 The distribution of roosting flocks of Redshank on different heights of tide in Cardiff Bay.....	41

EXECUTIVE SUMMARY

1. This is the fourth study, commissioned and funded by Cardiff Bay Development Corporation (CBDC), to examine changes in the pattern of roosting behaviour of waders and wildfowl in Cardiff Bay.
2. The aim of the present study was to examine the effects of the final phase of the saltmarsh reclamation and the construction work associated with the Peripheral Distributor Road (PDR). The use of the alternative high tide roost island that was created in 1991/92 was monitored.
3. Intensive observations of high tide roosts were made during the autumn and winter of 1993/94. Further observations obtained from work being undertaken by the BTO on the distribution of feeding birds, also funded by CBDC, were used where these were relevant.
4. Further changes to areas previously used as roost sites were noted as well as increased disturbance to other areas. The new pattern of behaviour was related to the species and the height of the tide. The Phase 2a reclamation was completed without affecting the most ornithologically important areas.
5. The species that roost in the bay have continued to adapt to the change of available roost sites. The artificial high tide roost island continued to be one of the most important roost sites on high spring tides. It was used less exclusively during the current study, with the sides of the reclamation areas providing alternative roost sites.
6. Redshank continued to be the species most likely to be affected by the engineering work in the bay. The gathering and roosting sites used by Redshank in the previous year have been subjected to only limited disturbance and change. Parts of the reclamation sites, including one new area, were used by roosting birds on some high tides.
7. At high spring tides during winter, the artificial roost island remained the preferred area for roosting and was used by all species that roosted on terrestrial sites. During the autumn, the sides of two of the saltmarsh reclamation sites were used by roosting Redshank when the saltmarsh was covered. On most high spring tides during the winter, all of the Redshank and Curlew roosted on the artificial roost island. The new reclamation site was used by Redshank on spring tides during two of the winter observation days. Curlew roosted outside of the study site on four spring tides. Most of the Dunlin that fed in the bay left to roost at high tide. Those remaining roosted with the Redshank, using the artificial roost island on high tides.
8. The saltmarsh reclamation work has been completed. There will be some disturbance from work associated with completion of the PDR which could affect roosting areas. Plant colonisation of the artificial roost island could also affect the suitability of this roost site. Further monitoring will be necessary to assess the importance of both of these changes.

1. INTRODUCTION

This is the fourth report on the roosting behaviour of waders and wildfowl in Cardiff Bay in relation to the Peripheral Distributor Road (PDR) development and land reclamation work.

Some of the theoretical aspects of roosting behaviour have been discussed and reviewed in the previous reports (Donald & Clark, 1991a; Toomer & Clark, 1992a; Toomer & Clark, 1993a).

Since the first report in 1991 on the roosting behaviour for the winter 1990/91, there have been considerable changes to some areas at the north end of the bay. Some of these changes have directed areas that were previously used as roosting sites by waders and wildfowl wintering in the bay. From the studies for winter 1991/92 and 1992/93, it was clear that the birds roosting in the bay had continually modified their roosting behaviour as various sites were affected by development.

The creation of a raised site that became cut off from the land at high spring tide, the high tide roost island, was shown to have compensated for the loss of structures that had previously served as secure roosts on such tides.

2. METHODS

To enable direct comparison between years, the methods used for the current study were the same as those described in the two previous reports. They will be described again here for completeness, although it is recommended that this report is read in conjunction with the reports for the winters of 1990/91, 1991/92 and 1992/93 (Donald & Clark, 1991a; Toomer & Clark, 1992a; Toomer & Clark, 1993a).

During the period from September 1993 to March 1994, observations were made on the formation of high tide roosts by waterfowl in Cardiff Bay. Sixteen days were chosen for intensive study during the period from November to March, allowing the monitoring of a wide range of tide heights. A further 23 less intensive observations were made during the autumn and winter of 1993/94. As this study was taking place during the same time period as further work monitoring the distribution and movement of the waterfowl found in Cardiff Bay, a comprehensive picture was obtained of the roosting behaviour for the autumn and winter of 1993/94.

The tide heights of the 16 intensive observation days ranged from 9.5m to 12.3m and included seven neap and nine spring tides. (For Cardiff Bay, neap high tides are considered to be less than 10.85m above Chart Datum and spring tides over 10.85m above Chart Datum.) The less intensive observations made were mainly spring tides in order to re-assess the effectiveness of the artificial high tide roost island. The proportions of tides of varying heights observed during the study are shown in Figure 2.1a and b.

Potential roost sites were identified before the start of the study. The partial completion of the PDR across the River Taff made restricted the view of some of these areas from observation points that had been used in the previous studies. Access to the PDR above the River Taff allowed observation of the roost sites adjacent to that part of the river as well as most of the rest of the bay. The east side of the high tide roost island and the eastern inner harbour area were out of view from this observation point, although it was possible to monitor movement of birds to that general area. To ensure that full and accurate data were obtained, observations were made from the dock side at high tide on all study days and several full observations were made from this point. As roosts started to develop on the rising tide, their positions were recorded at 20 minute intervals. This was continued through the period of high tide until the roosts started to break up on the falling tide. For the additional observations, the positions of the final roosts at high tide were recorded. All other information relevant to roost formation, such as the weather and disturbance by birds of prey, was noted for each roost observation.

The actual tide height at high tide on each day of observation was obtained from the Harbour Master in Cardiff Docks. These values were also used in calculating the height of the tide for each 20 minute period with the aid of Admiralty conversion charts. This information was then used to determine which roost sites were used at different tide heights during the tidal cycle.

All roosting birds were noted but detailed observations were confined to those species that previous BTO fieldwork had shown to roost regularly in the bay *i.e.* Redshank, Curlew, Dunlin, Teal and Shelduck. These species previously used areas that had been affected by the Phase 1 and Phase 2 land claim and the PDR construction

work.

3.RESULTS

Since the winter of 1990/91, considerable changes have continued to take place at the north end of Cardiff Bay. These changes are the result of land reclamation by infill on areas adjacent to Hamadryad Hospital and the west end of Windsor Esplanade and from work associated with the PDR itself. The changes from autumn 1990 to spring 1993 and the effect these have had on roosting birds have been documented by Donald & Clark, 1991a and Toomer & Clark 1992a; 1993a. Further changes have occurred since that time, resulting in continued changes in the pattern of roosting behaviour of waders and wildfowl. The increase in frequency of low flying helicopters that was noted in the previous report (Toomer & Clark, 1993a) did not continue and this source of disturbance was reduced considerably.

The areas identified as roosting sites during the current study are shown in Figure 3.1. All areas used by roosting birds in the winter 1992/93 were used during the winter 1993/94 and one new roost site was used for the first time.

The results are given below in two sections. Firstly, the current roost sites and any changes that have occurred to their nature and use by roosting birds since the winter 1992/93 are described below. Secondly, details of the use of these sites by roosting birds is given in the species accounts (Section 3.2). For Dunlin, Curlew and Redshank the position of spring tide and neap tide roosts is shown on the roost distribution maps. As only part of the Shelduck and Teal populations roosted on land over the high tide period, the size of the roosting flocks are indicated on the distribution maps.

3.1Roost Sites

Reference should be made to Figure 3.1.

Area A

It consists of the upper mudflats on the southern edge of the saltmarsh at the western end of Windsor Esplanade. Areas adjacent to the creeks from the saltmarsh remained uncovered on neap tides.

This area has remained unchanged since autumn 1990.

Most of the area was covered by tides in excess of 11.0m, although there were raised muddy banks of the creeks where they emerged from the saltmarsh which remained exposed for longer. As in previous winters, these parts were particularly important as gathering areas for waders as the lower areas of mudflats became covered on the rising tide. Some Teal frequently pre-roosted there before swimming into the creek. When the creek banks remained uncovered at neap tide, several species would roost there, including Redshank, Dunlin, Oystercatchers and Cormorants and on falling spring tides, birds that returned to this area occasionally formed temporary roosts. The formation of such post-high tide roosts had been more frequent during the winter 1990/91. This area remained virtually undisturbed.

Area B

Area B is an area of saltmarsh and creeks enclosed by the PDR bank on the eastern side of the River Taff and the western end of Windsor Esplanade.

This general area underwent considerable change after the winter 1990/91. Originally this area included part of the old South Glamorgan Canal, the banks of which were important roosting areas. Early work on the PDR divided this area in two and subsequent development covered the old canal and immediately adjacent areas. The north part of this area, immediately west of Windsor Esplanade, was designated as part of the Phase 2a landfill site. Originally, the area of reclamation was expected to cover a much larger part of this area, but the landfill was completed without extending any further south than the line of Windsor Esplanade. This left a large part of this original area unchanged, including the important creeks.

Tides higher than 12.3m covered this section of the saltmarsh.

This continued to be an important area for roosting birds. The muddy creeks within the saltmarsh and their banks were used by roosting waders and Teal on moderate spring tides that covered the mud on areas A and J but did not cover the saltmarsh. The larger creek at the eastern end of this area was still the most important part of this area. Waders and Teal moved onto the raised creek banks as the tide covered the mudflats where they would either pre-roost before moving further into the saltmarsh or remain there over the high tide period if the saltmarsh remained uncovered. There was limited disturbance from work on the adjacent PDR to the west and from the completion of the Phase 2a landfill at the northern limit of this area. The western part of the area, ornithologically important in winter 1990/91, was little used by pre-roosting and roosting birds.

Area C

It is the saltmarsh south of Windsor Esplanade extending to the eastern extremity that remains unchanged from previous years.

The whole of this area was covered by tides higher than 13.0m.

This area remained virtually free from disturbance. This part of the saltmarsh was relatively high with taller vegetation and lacked any sizeable creeks. On tides that covered the mud area adjacent to this section of saltmarsh, the central part was used by Curlew and a limited number of Shelduck and Mallard used the periphery. Dunlin and Redshank had not used this area much during the two previous winters, but both species were observed roosting along the raised front edge on a number of study days.

Area E

This is the artificial high tide roost island near the northeast end of Area C created in 1992. The area was artificially raised and the surfaces graded. The top surface had been colonised by plants during the spring and summer of 1993 and it was strimmed in early autumn to remove the tall vegetation. The natural and cut deep channels and raised banks protect this area from intrusion by humans at spring tides higher than 12.0m and from visibility from the shore.

This area remains uncovered at all heights of tide.

This recently modified area was an important roost area throughout the previous two winters. The sloping east surface was used by roosting waders and Shelduck. The top surface was not used as frequently as it had been in the previous winters, possibly because of the growth of vegetation. There was virtually no disturbance of this area other than by birds of prey.

Area F

This area has remained essentially unchanged since autumn 1990.

It is the saltmarsh and adjacent mud in the corner formed where the PDR development on the western side of the River Taff meets Ferry Road. The upper reaches of this area remain uncovered on low and moderate neap tides. Waders, and less frequently Shelduck, that feed on the adjacent mudflats may form small roosts on the open mud or edges of the saltmarsh. Although the PDR development borders this area to the north, the disturbance has been limited because of the distance from the most sensitive part of this area.

Area G

There has been limited change to this area since the previous report.

The large area of saltmarsh that formed this area was partly covered by the Phase 1 landfill. Most of the remaining saltmarsh of this area was then covered by the Phase 2 landfill which also raised the surface above the level of high spring tides. The landfill work was completed before the current winter's study. The remaining strip of saltmarsh is covered by tides in excess of 13.0m. The muddy raised bank of the River Taff and the remaining strip of saltmarsh were used by very few roosting birds during the current study. The sloping side of the infill was used by roosting Redshank during autumn but were not used during the winter. There was still some disturbance from the PDR work at the southern end of this area.

Area H

This area remained unchanged.

It consists of the rocky boulder strip adjacent to Ferry Road and the mud immediately to its east. The mud and boulders were covered by moderate neap tides but almost all tide heights left the sloping concrete side to Ferry Road uncovered. There was disturbance from passing vehicles and people.

Turnstones that fed along the seaweed covered stones and others that would fly in from feeding sites elsewhere occasionally roosted there, but much less frequently than during the two previous winters.

Area J

This area remains essentially unchanged.

It is the area of upper mudflats on the southern edge of the saltmarsh south of Windsor Esplanade (Area C).

It is covered by tides higher than 11.0m.

Curlew formed roosts on this area when it remained uncovered on low neap tides. It was also used as a pre-roosting area for Curlew on most higher tides. Several other species used this area for pre-roosting. The only disturbance was from birds of prey.

Area K

This area became more important as a pre-roosting and roosting area during the 1992/93 winter.

It is the muddy creeks and adjacent mudflats on the side of the River Taff on the south side of the west PDR mound.

The creeks are full at tide heights greater than 9.4m and the adjacent mudflats are covered by tides in excess of 10.5m.

It was not used as frequently during the current study as it was in the winter 1992/93. Waders still gathered on the bank of the River Taff on the rising tide. Dunlin and Redshank moved up the sides of the creek as the tide rose and congregated on the flatter surfaces of the immediately adjacent mudflats before moving to other roosts. Although parts of this area remain uncovered on low neap tides it was only used by pre-roosting waders during the current study. It was virtually free from disturbance.

Area L

The use of this area had increased in the winter 1992/93 but it was not used so frequently during the current study.

It is the area of muddy creeks and associated saltmarsh edges immediately south of the artificial high tide roost island (Area E) and north of the saltmarsh of Area C. It was used as a pre- and post-roost site by Redshank and Dunlin on some tides when these species used the high tide roost island over the high tide period. It was used over the high tide period by these species on several moderate spring tide observation days. This area was free from all disturbance other than birds of prey.

Area M

This is a new roosting area.

It is the southwest sloping surface of the Phase 2a landfill area, west of Windsor Esplanade. The surface is compacted soil and the area remains uncovered on all tides. It was used by Redshank on several high spring tides when the saltmarsh was completely covered and by Dunlin on one occasion. This area was free from all disturbance other than birds of prey.

Open Water

Variable proportions of Shelduck, Teal and Mallard populations roosted on the open water of the bay. The size and positions of the roosting flocks varied with tide height. There was relatively little disturbance on the open water.

Roosts outside Cardiff Bay

Most of the birds that feed within the area of Cardiff Bay also roost there over high tide. Dunlin continued to be the main exception, their use of Sully Island to the west and of Peterstone Great Wharf to the east have been discussed in previous reports (Donald & Clark, 1991a; Toomer & Clark, 1992a; Toomer & Clark, 1993a).

3.2 Species Accounts

3.2.1 Shelduck

A few Shelduck returned to Cardiff Bay in the autumn with the main overwintering population returning in early winter. They fed on the mudflats as soon as these became exposed and continued feeding until the rising tide again covered these areas. Between 230-300 Shelduck roosted in the bay during the study period, compared with 230-400 in 1992/93 and 300-450 in 1991/92. When the rising tide covered the feeding grounds, the majority of birds roosted on the open water, usually distributed around the north and west parts of the bay. Up to a third of the Shelduck population roosted on land on some observation days. The sites used by the roosting Shelduck are shown in Figure 3.2.1.1 and the use of these roost sites in relation to tide height is shown in Figure 3.2.1.2.

On neap tides, when Area J was not covered, 10-60 Shelduck that had been feeding on adjacent mudflats roosted at the east end until the tide receded. Area A, which had also been used previously, was not used during the current study. Commonly, many of the Shelduck remaining on the exposed mudflats of Areas A, F, H and J on low neap tides continued to feed throughout the high tide period. With increasing tide height, when feeding areas became covered, some of the Shelduck moved onto the saltmarsh. Although some birds moved well into the saltmarsh, the majority were located along the front raised edge from the east end of Area C as far west as Area B. Between 20-100 birds roosted there on some tides, but usually the majority of birds roosted on the open water. The high tide roost island was used by some roosting Shelduck when the saltmarsh became covered, but less frequently and by fewer birds than the previous winter. The top surface was not used by many roosting birds as it had been previously, the majority of birds being found on the sloping east side. It is possible that the growth of vegetation on the top surface had changed it sufficiently to reduce its use by Shelduck, even though the surface was strimmed in October.

There were minor changes in the pattern of roosting of Shelduck. Area J was the only area of mudflat used by land-roosting on neap tides and there was a reduced use of the high tide roost island. The front part of the saltmarsh, Area C, was the most important land roost site while it remained uncovered.

3.2.2 Teal

There was very little change in the roosting behaviour of Teal compared with the two previous winters. The maximum number of roosting birds observed in the bay was 350, a reduction compared with the 1992/93 maximum of 440. The roost sites regularly used by Teal are shown in Figure 3.2.2.1 and the use of these sites in relation to tide height is shown in Figure 3.2.2.2.

A large proportion of the Teal population roosted on the open water at most tide heights. As the tide rose, part of the population moved towards the north end of the bay, near to the saltmarsh, while the rest remained nearer the middle of the bay on the open water. Some birds collected on the raised muddy banks of the creek emerging from the saltmarsh, but at all tide heights some birds swam into the creek in the saltmarsh. On neap tides, some Teal roosted on these muddy banks over the high tide period and on two observation days, 60-100 birds roosted on the upper edge of the mudflats to the east, Area J. With an increase in tide height, Teal moved further up the creek into the saltmarsh. When the saltmarsh was partially covered by the tide, many of the Teal remained there roosting on the water amongst the vegetation and frequently these were joined by some of the population that had been on the open water. On high spring tides, almost all the Teal roosted on the open water at the northern end of the bay.

3.2.3 Dunlin

The somewhat unpredictable pattern of behaviour of Dunlin in Cardiff Bay has been apparent from ongoing studies for CBDC on the distribution of waders and wildfowl (Evans *et al.*, 1990; Donald & Clark, 1991b; Toomer & Clark, 1992b; Toomer & Clark, 1993b). Variable numbers of Dunlin fed in the bay and of these, variable numbers remained to roost. The distribution of roost sites used over high tide on neap and spring tides and the use of these in relation to tide height is shown in Figure 3.2.3.1 and 3.2.3.2.

The overall pattern of roosting behaviour was very similar to that observed during the previous two winters. The number of Dunlin feeding in the bay varied from none on some days to in excess of 4,000. The common feeding area was on the mudflats south of the PDR work and to the west of the River Taff. On some rising tides, this feeding population would move to the mudflats east of the river, nearer the saltmarsh at the north of the bay. While such mudflats remained uncovered, many of the Dunlin continued feeding but on several neap tides 100-1500 birds roosted over the high tide period. The areas used were Areas F, A, and at the front edge of the saltmarsh of Areas B and C. Area K had been used as a roosting area during the previous winter and although Dunlin were observed to move up the creeks onto this area, no roosts over high tide were observed here during the study period. Dunlin still pre-roosted here on some days before flying to other feeding or roosting areas.

With further increase in tide height, the majority of the Dunlin flew out of the bay on most observation days. Birds remaining flew to the saltmarsh at the north of the bay and roosted on the banks of the creeks of Area B or along the front raised edge of this area and Area C. Area L, which had been used regularly during the previous winter, was used by roosting Dunlin on three observation days only. On high spring tides when the saltmarsh was completely covered, between 20-400 roosted on the side of the high tide island with the Redshank roosting in the bay. On one high tide, the 100 plus birds remaining in the bay roosted with the Redshank on the south sloping surface of the new Phase 2a landfill, Area M.

The preferred roosting areas were similar to the previous winter, with the saltmarsh creek banks being used while these remained uncovered, and the high tide roost island being used on higher spring tides. Areas K and L were used less by Dunlin in the current study.

3.2.4 Curlew

A changed pattern of roosting behaviour was established for Curlew after the creation of the high tide roost island. This has been described in the two previous reports. That pattern continued during the current study. A maximum of 165 birds were observed roosting in the bay.

The roost sites used by Curlew on neap and spring tides is shown in Figure 3.2.4.1 and the relationship between use of these sites and tide height is given in Figure 3.2.4.2.

Two to three hours before high tide, the majority of the Curlew that had been feeding in the bay started to pre-roost on the mudflats to the south of Area J. Part of the population

of birds that fed on the Orchard Ledges site immediately to the east of the mouth of Cardiff Bay, were observed to fly into the bay and to join the other Curlew pre-roosting on the mudflats. On low neap tides, when the upper mudflats remained uncovered, Curlew roosted there over the high tide period. The preferred site was Area J. The birds formed loose groups at the eastern end of this area and on days when the wind was from the west, moved further up the shore to the east of the saltmarsh. No roosts or pre-roosts were observed on Area A during the current study. With increasing tide height, Curlew moved onto the saltmarsh, Area C. This often occurred before the mudflats were completely covered and the Curlew moved immediately into the longer vegetation of the saltmarsh. On high spring tides, the high tide roost island was again the preferred roosting area. The top surface had been used extensively by roosting Curlew during the two previous winters, as well as the east sloping side. There was less use of the top during the current study, possibly resulting from changes produced by the growth of vegetation.

During the first year of the study, Curlew left the bay to roost elsewhere on five out of 10 of the observed high spring tides. For each of the two winters following the creation of the high tide roost island, Curlew were absent from the bay at high spring tide on one occasion only. During the current study, Curlew were absent from the bay at high spring tide on four out of 10 observation days.

As the mudflats became uncovered with the receding tide, Curlew left their high tide roost positions and moved to the mudflats south of Area J where the majority resumed roosting, frequently until three hours before low tide.

3.2.5 Redshank

When studies of the roosting behaviour in Cardiff Bay started, Redshank was identified as the most likely to be affected by the PDR and landfill work. Unlike some other species, Redshank require roost sites near to their feeding areas. The Cardiff Bay population of Redshank forms a discreet group with very little interchange with other nearby populations especially in mid-winter (Donald & Clark, 1991b; Toomer & Clark, 1992b; Toomer & Clark, 1993b; Toomer & Clark, 1994). It was observed that the Redshank altered their pattern of roosting as sites became affected. The main saltmarsh creek of Area B became the preferred roost while the saltmarsh remained uncovered and the high tide island was used on most high spring tides.

Further construction work in the bay during 1993 have not directly affected either of these sites, but has produced a new range of surfaces that remain uncovered at high tide and are relatively undisturbed.

During the autumn, the number of Redshank in the bay was 500-550, reducing to about 350 during the winter.

The roost sites used by Redshank during the study period and the relationship of their use to tide height is given in Figures 3.2.5.1 and 3.2.5.2. Area K had been used by roosting Redshank during low neap tides in winter 1992/93. This area was only

used by pre-roosting birds during the current study. It was noted in the previous report that feeding Redshank formed three loose groups, one in the south part of the bay, one in the inner harbour area and one on the inner Taff, north of the PDR. Large numbers of Redshank were observed on the mudflats of the inner Taff during the autumn and early winter, but fewer birds were then seen for the rest of the study period. The sides of the landfill area above the strip of saltmarsh (Area G) were used by a large proportion of roosting birds on several spring tides during the autumn and early winter, although on other occasions with similar tide heights the high tide roost island was used. This area was not used by roosting birds after the early part of winter. By mid-winter the roost island was used on all high spring tides

On high spring tides, when the saltmarsh was covered, the high tide roost island was used, but not as exclusively as during the two previous winters. During the early part of the winter, Redshank roosted on Area G (see above). A new roost area used by all of the roosting Redshank on three observation days and by part of the roosting population on one other day was Area M. This newly-formed sloping surface on the side of the landfill area provided a surface similar to the side of the high tide roost island and was equally secure and free from disturbance.

On low neap tides Redshank gathered in the inner harbour, near Area L, in the creeks from the Taff at Area K, and on the banks of the creeks that emerged from the saltmarsh (Area A). Many birds continued to feed if the mudflats remained uncovered for the period of high tide. Low neap tide roosts were located on a number of exposed mudflats (see Figures 3.2.5.1 and 3.2.5.2), usually involving 50-100 birds. With an increase in high tide height, birds initially moved either to the creek banks of Area B or to the edge of the saltmarsh at Area L before moving to their final roosting position. The creek in the saltmarsh (Area B) was still a preferred high tide roost area while the saltmarsh remained uncovered, but quite frequently part of the roosting group was observed to spread along the raised front edge of the saltmarsh of Areas B and C with more birds located at Area L.

Figure 3.2.5.3 shows the results of identifying roost and pre-roost positions every 20 minutes through tidal cycles of differing heights. The number of observations for each tide height class are given in Figure 3.2.5.3 and the inevitable imbalance must be borne in mind when interpreting this figure. There is a clear pattern of use of roost site with some notable changes compared with the previous winter. At low tides, while mudflats remained uncovered, several areas were used for pre-roosting and roosting, with no clear preference. Area B became important with increasing tide height, but a great variety of areas were used. While the saltmarsh remained uncovered, Areas B and C were the main roosting and pre-roosting areas. At tide heights that covered the saltmarsh, three areas were used, the high tide roost island (Area E) as well as the sides of the landfill areas (Areas G and M).

3.2.6 Other Species

Several other species occurring in Cardiff Bay during the winter remained there to roost

over the high tide period.

One or two Cormorants were usually present in the bay throughout the tidal cycle, feeding along the River Taff. As the tide rose, these birds moved to the mouth of the creeks emerging from the saltmarsh (Area A) to pre-roost or to roost. The small number of birds was joined by others flying in from outside of the bay, bringing the total to 20-25 birds. As the muddy creek banks were covered by higher tides, some of the birds moved to the front edge of the saltmarsh, Areas B and C. Most birds flew out of the bay to roost on spring tides.

Fewer Mallard were observed on most study days during the current winter, although over 100 birds were seen roosting on the open water in January. Open water was the preferred area for the majority of the Mallard. 10-30 birds roosted on land when the feeding areas were covered. The only site used during the current study was Area C, with roosting Mallard moving onto the front edge before moving further into the saltmarsh.

The usual small group of Pochard (15-40) was present in the bay over the high tide period from December to the end of the study period. The group was observed to move to the north of the bay as high tide approached and to roost on the open water near to the saltmarsh, Area B. On one neap tide, 22 birds moved out of the water onto the edge of the muddy banks of the creek emerging from the saltmarsh.

A small group of Oystercatchers flew into the bay to feed two to three hours after low tide on several observation days. On seven days 10-35 birds remained to roost over the high tide period. While mudflats remained uncovered, the birds roosted on Areas F and J, moving to the muddy edge of Areas B and C when the tide was higher. When these areas were covered, the Oystercatchers left the bay to roost at other sites. There are known alternative roosts 8km to the east of the bay at Peterstone.

Very few Grey Plover have been observed in the bay during the last three winters. Four birds roosted on the muddy edge of Area B over one neap high tide period.

Fewer Lapwing have been observed in the study area during the current and previous winter. The preferred feeding and roosting area had been on the east side of the River Taff, north of the PDR. This area has undergone considerable change. Lapwing were observed roosting on five study days only, when they were located on the landfill site, Area G. On other days, the Lapwing flock spent most of the time on the wing over the high tide period or were absent from the study site.

Knot had been a common winter visitor to Cardiff Bay several years ago. Only one or two birds had been seen during the previous three winters. During the current study period, a flock of 500-1000 Knot were present on some days, feeding on the mudflats. This flock was associated with the Dunlin that fed in the bay and on most days that they were observed, the majority of the birds flew out of the bay before high tide. On two observation days a small number of birds (less than 100) roosted on the muddy front edge of Area C.

Snipe feed and roost in the saltmarsh areas of the bay, but their behaviour makes them very difficult to see. A number of birds were seen moving to higher parts of saltmarsh in

Areas F and C as the tide covered these areas. Except on very high spring tides, all of the Snipe were assumed to roost or continue feeding at these saltmarsh areas. It was not possible to determine the number of Snipe in the bay.

The behaviour of the Turnstone population that feed on nearby areas has been discussed in the previous reports. Some of the Turnstone that had been feeding on the nearby Orchard Ledges were seen to fly into the bay on a number of study days. During the two previous years, a group of 30-50 birds roosted on the edge of Ferry Road, Area H, on spring tides. 10-65 birds were observed using this same high tide roost site on five days during the current study but they were absent on other spring tides.

4. DISCUSSION AND CONCLUSIONS

Reports on the 1991/92 and 1992/93 studies showed that the waders and wildfowl that roosted in Cardiff Bay had responded to the loss and disturbance of roost sites by using alternative sites. This had not been associated with any noticeable reduction in the number of birds remaining in the bay over the high tide period and Curlew remained in the bay to roost on more high spring tides than previously. In particular, the high tide roost island had provided an acceptable alternative safe site for Redshank, Dunlin, Curlew and some Shelduck on such high tides.

Since those studies, there have been further limited changes to areas that have been used by roosting birds in the past. The Phase 2 landfill site north of the River Taff and adjacent to the Hamadryad Hospital has been completed, producing a relatively steep-sided bank immediately above a narrow strip of saltmarsh. This area had already shown a reduction in the size of the roosting population of Lapwing by the winter 1992/93 and this has continued. As was discussed in the last report, because of the small number of birds involved compared with the national wintering population, such change is unlikely to be of importance to the species.

The Phase 2a landfill has also been completed and has stopped in line with the front of Windsor Esplanade. This means that the whole of the saltmarsh creeks, which have been important as roost areas in the past, have remained unaffected. Teal still use these creeks extensively for roosting while the saltmarsh remains uncovered and Redshank and Dunlin use the creek banks on a range of tide heights. They are especially important as a pre-roosting area for these species on higher tides and as a post-roosting area for the waders.

These two landfill areas have also provided new sloping surfaces adjacent to and above the level of saltmarsh areas. Because of their situation they have been free from human disturbance since their completion. Both of these surfaces have been used by birds roosting over the high tide period on high spring tides.

The other work within the bay area has been the continued building of the PDR. Most of this work has been confined to a site that already existed during the previous winter 1992/93 and has therefore not added to any increase in the level of disturbance.

As has been stated earlier, Redshank were most likely to be affected by changes to roosting sites because they are site-faithful and require a roost near to their feeding grounds. There had been considerable changes to sites that had been used by roosting Redshank before the last report. With the loss of old jetties and the PDR mound to the west of the River Taff, the Redshank had taken to using the high tide roost island that had been created for roosting on high spring tides. Although this island still provides a secure area for roosting birds when the saltmarsh is covered, Redshank did not use it exclusively in the current study. New surfaces suitable for roosting on high spring tides, which are as secure as the roost island, have resulted from the landscaping of the edge of the two major areas of landfill. The use of these by Redshank was not predictable. In the autumn, both the roost island and the landfill along the side of the River Taff were used by roosting birds, but the latter site was not used after this time. The new surface on the south edge of the Phase 2a landfill

was used by roosting Redshank during the autumn and winter. There was no pattern to this use, with the roost island also being used on similar tides on other days. These surfaces have provided acceptable alternatives for roosting birds on high spring tides, reducing the possible pressure on other sites. At lower tide heights, Redshank used a larger part of the saltmarsh than had been observed during the two previous winters. Groups of roosting birds were found spread out along a large part of the saltmarsh, rather than being concentrated in the region of the main creek. This is a reversion to the pattern seen in winter 1990/91.

There has not been any increase in the number of Dunlin roosting in the bay over the high tide period. As in the previous study winters, the roosting Dunlin associated themselves with the Redshank, using the landfill sides and being found spread along the front edge of the saltmarsh. Roosting sites outside of the study area are able to support the Dunlin population, as on a number of days no birds remained in the bay over the high tide period. Any further disturbance associated with the PDR work is therefore unlikely to have any long-term adverse effects on this species.

Curlew had benefited from the provision of the high tide roost island with the birds remaining in the bay on all tide heights during the two previous years. During the current study, Curlew were less predictable and were absent from the bay on several study days. Unlike Redshank and Dunlin, Curlew did not roost on any of the new surfaces provided by the landfill work and restricted themselves to the east end of the saltmarsh and the high tide roost island.

The other main species roosting in the bay, Shelduck, Teal and Mallard, were relatively unaffected by recent developments and showed no major changes in their pattern of roosting.

To summarize, the changes to habitat from the landfill and PDR work since the previous report have not had any major effect on the species and numbers of waders and wildfowl roosting in the bay. Some more minor changes are directly attributable to recent landfill work. There are now several alternative areas that can be used by roosting Redshank and Dunlin when the saltmarsh is covered. This may lead to a long-term reduction in the use of the high tide roost island by these species. Shelduck and Curlew have used the roost island less than during the previous winters. However, the high tide roost island continues to provide a suitable roosting site for Redshank, Dunlin, Curlew and some Shelduck during many high spring tides. The landfill work has now been completed and the remaining saltmarsh should only be affected by limited disturbance from the continuing PDR work. The most sensitive areas of the saltmarsh remain unaffected and roosting birds have generally adapted to the changes. The absence of roosting Curlew on several days cannot be explained, but did not seem to have resulted from factors that affected their roost sites. When the PDR is further advanced, there will be a time of increased disturbance as some of the hardcore material is removed from around the bridge piers. This could affect the waders and wildfowl if it occurs after they have returned from their breeding grounds.

ACKNOWLEDGEMENTS

This report was funded by Cardiff Bay Development Corporation. Thanks to Mrs Pat Forest for her help and cooperation.

Grateful thanks to Mr John Lawton of South Glamorgan County Council for obtaining permission to have access to the PDR site and to DMD for agreeing to this. Thanks to Mr Tom Lawson of DMD for his assistance.

The production of this report was aided by the secretarial help of Miss S Foulger and Miss T Brookes.

REFERENCES

- Donald, P.F. & Clark, N.A. (1991a). *The Roosting Behaviour of Waders and Wildfowl in Cardiff Bay*. BTO Research Report No. 74 to Cardiff Bay Development Corporation.
- Donald, P.F. & Clark, N.A. (1991b). *The Effect of the Cardiff Bay Barrage on Waterfowl Populations. 2. Distribution and Movement Studies*. BTO Research Report No. 83 to Cardiff Bay Development Corporation.
- Evans, J., Clark, N.A. & Donald, P.F. (1990). *The Effect of the Cardiff Bay Barrage on Waterfowl Populations. 1. Distribution and Movement Studies*. BTO Research Report No. 69 to Cardiff Bay Development Corporation.
- Toomer, D.K. & Clark, N.A. (1992a). *The Roosting Behaviour of Waders and Wildfowl in Cardiff Bay*. BTO Research Report No. 89 to Cardiff Bay Development Corporation.
- Toomer, D.K. & Clark, N.A. (1992b). *The Effect of the Cardiff Bay Barrage on Waterfowl Populations. 3. Distribution and Movement Studies*. BTO Research Report No. 104 to Cardiff Bay Development Corporation.
- Toomer, D.K. & Clark, N.A. (1993a). *The Roosting Behaviour of Waders and Wildfowl in Cardiff Bay: Winter 1992/93*. BTO Research Report No. 116 to Cardiff Bay Development Corporation.
- Toomer, D.K., Browne, S.J. & Clark, N.A. (1993b). *The Effect of the Cardiff Bay Barrage on Waterfowl Populations. 4. Distribution and Movement Studies*. BTO Research Report No. 126 to Cardiff Bay Development Corporation.
- Toomer, D.K. & Clark, N.A. (1994). *The Effect of the Cardiff Bay Barrage on Waterfowl Populations. 5. Distribution and Movement Studies*. BTO Research Report to Cardiff Bay Development Corporation. (In preparation).

