BTO Research Report No. 89

THE ROOSTING BEHAVIOUR OF WADERS AND WILDFOWL IN CARDIFF BAY

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

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EXECUTIVE SUMMARY

1.This is the second study, commissioned and funded by Cardiff Bay Development Corporation, to examine changes in the pattern of roosting behaviour of waders and waterfowl in Cardiff Bay.

2.The aim of the present study was to examine the specific effects of the Phase 1 saltmarsh reclamation that has been completed so far. Alternative high tide roost sites have been created and their effectiveness was studied.

3.Intensive observations of high tide roosts were made during a three month period between January and March 1992. Further observations obtained from work being undertaken by the BTO on the distribution of feeding birds were used where these were relevant. This latter work is also funded by CBDC.

4.The loss of several roost sites was noted. The new pattern of roosting and the use of different areas (including the new artificial sites) was assessed. The pattern of behaviour was related to the species and the height of the tide.

5.The species that roost in the bay have adapted to the change of available roost sites. Provision of artificial roost areas has proved especially beneficial.

6.Redshank continued to be the species most likely to be affected by the engineering work in the bay. Two of the sites regularly used by Redshank in previous years have become unavailable. This species was found to use an alternative area of saltmarsh for roosting when it remained uncovered. This site will be affected by Phase 2 development work.

7.At higher tides, the newly-formed artificial roost island became the preferred area for roosting. Other species also make use of this island and it has become the most important roost site on high spring tides. Dunlin remaining in the bay on such tides roosted with the Redshank. Curlew which used to leave the bay when the tide rose over 12.5m remained in the bay throughout the tidal cycle and roosted on the new island.

8.The effectiveness of the floating roost platform could not be assessed this year because technical problems delayed its launch.

1. INTRODUCTION

The aim of this project was to assess the effects of the Phase 1 development and PDR works on roosting behaviour in Cardiff Bay. This is the second report on the roosting behaviour of waders and wildfowl in Cardiff Bay. The previous report (Donald & Clark, 1991) discussed in some detail many theoretical aspects of roosting behaviour in relation to the Phase 1 development and these will only be summarized briefly here. Cardiff Bay Development Corporation (CBDC) has produced alternative roost sites within the bay to mitigate against the loss of saltmarsh. The success of these measures is documented.

Communal roosting is common among waders and wildfowl. In winter, when food supplies are limited, these birds may continue feeding throughout the tidal cycle if mudflats remain uncovered. On spring tides, when feeding areas become covered by the tide, the birds will move to higher ground to roost until such time that feeding can be resumed on the falling tide. Some possible advantages of communal roosting include a) an increased ability to spot approaching predators, b) an opportunity for the roosting flock to assess its size and respond by moving to other feeding areas if it is becoming too large, c) 'dissemination of information' about feeding areas whereby less experienced birds follow experienced birds out of a roost. References for these theories may be found in the previous report (Donald & Clark, 1991). Whatever the evolutionary reasons, secure roosts are essential for wading birds and wildfowl, and may determine whether or not an area is used by such birds even if the food supply is plentiful.

2. METHODS

During the period from January to March, 1992, detailed observations were made on the formation of high tide roosts by waders and wildfowl in Cardiff Bay. Eleven days were chosen for intensive studies with observations being made continuously for two hours either side of high tide and a further twelve high tides were observed for shorter periods of time. The 24 daytime roost observations were chosen to cover a wide range of tide heights, from 9.7m to 13.7m including eleven neap tides and thirteen 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.)

For each intensive daytime observation, roost formation was monitored continuously from two hours preceding high tide to two hours after high tide. Observation of the north end of the bay was made from the PDR work mound, giving views of all the main roost sites. As roosts started to develop on the rising tide, their positions were recorded at 20 minute intervals. This continued through the period of high tide until the roosts started to break up on the falling tide. The same practice was followed for the twelve shorter observations, but only for the two hours leading up to high tide. Factors that may affect the formation of roosts, such as the weather and disturbance by persons or birds of prey were noted for each roost observation.

Estimations of the actual tide heights at high tide were obtained from the Harbour Master in Cardiff Docks. These values were also used in calculating the height of 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 ie. Redshank, Curlew, Dunlin, Teal and Shelduck. These species used areas that may be affected by the Phase 1 land claim and the PDR construction work.

In addition to the day-time observations, all of the identified roosts as well as several other potential roosts were visited at night on spring tides. Observations were confined to determining the location of a night-time roost and to the identification of the species involved, as counts were not practical.

3. RESULTS

The Phase 1 work that has occurred since the field studies described by Donald & Clark, (1991a) has resulted in changes to some of the sites that were used by roosting birds. This has affected the pattern of roosting by birds remaining in the bay at high tide. The sites identified as roost sites during the 1991 study are shown in Figure 3.1.1. The current study identified ten sites regularly used as roosts by birds at high tide and these are shown in Figure 3.1.2.

The changes that have occurred to the 1991 roost sites, a description of the current roost sites and an outline of their use by roosting birds is given below.

Quantitative details of the use of these sites is contained in the species accounts (Section 3.2).

3.1 Roost Sites

Area A.

This area remains unchanged.

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.

Most of the area was covered by tides in excess of 11.0m although there were raised muddy banks of the creek which remain exposed for longer.

Redshank and Dunlin feeding on the mud used the upper areas and creek banks to roost on some neap tides. Teal also gathered on the creek banks. Oystercatchers that roosted in the bay on neap tides used this area. As it became uncovered on falling spring tides, birds formed temporary roosts. Area A remained virtually undisturbed, only the occasional bird of prey upsetting roosts.

Area B. (1991)

Part of this area of saltmarsh has been covered by the reclamation of land adjacent to the Hamadryad Hospital for amenity use and by the infill site at the west end of Windsor Esplanade. This is part of the Phase 1 development. Further sections of the saltmarsh have been covered by the extending bank associated with the PDR work. At the same time, the old South Glamorgan Canal has been partly filled in, covering large parts of the mud banks that had been previously used by roosting birds. Area B roost site has been considerably reduced in area and much of it altered in nature. The Phase 1 mound by the Hamadryad Hospital is, at present, an undisturbed site and although not replacing the saltmarsh beneath as an alternative roosting site, may have limited use in the short-term.

This area is now treated as three separate sites, **Areas B1**, **B2** and **I**, described below.

Area B1.

This area consists of the remains of the South Glamorgan Canal on the northwest side of the

PDR development taking place on the eastern bank of the River Taff and the saltmarsh on its northwestern side.

It was covered by tides in excess of 11.4m.

This area was little used as a roost site. Small numbers of Teal were seen. Very occasionally Redshank formed pre-roosts on the rising tide, but did not remain until high tide. This area was subject to considerable human disturbance from the PDR construction work.

Area B2.

This is the saltmarsh enclosed by the PDR bank on the eastern side of the River Taff and the western end of Windsor Esplanade.

Tides higher than 12.3m covered this section of saltmarsh.

The muddy creeks in the saltmarsh were important sites for Redshank, Dunlin and Teal on moderate spring tides that covered the mud of Areas A and J, but did not cover the saltmarsh. The banks at the mouth of the main creek formed the most important roost area for these birds on neap and low spring tides. Pre-roosts often formed here on rising tides and birds frequently returned here to roost on falling tides. Disturbance was limited to areas adjacent to the PDR bank. Teal were present on this area at night on spring tides.

Area C.

This area remains unchanged.

It is the saltmarsh south of Windsor Esplanade, as far east as the artificial high tide roost island (E).

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

This area, which did not suffer any noticeable disturbance, was used mainly by Curlew and a limited number of Shelduck and Mallard on tides that covered the mud area adjacent to this part of the saltmarsh. Although remaining uncovered after Area B2 on rising tides, other species did not regularly use this area for roosting. On occasions when birds were pushed off the high tide roost island by disturbance, Redshank and Dunlin were seen to fly into this area of saltmarsh, if it was still uncovered. At night, Teal could be found on this area on rising spring tides, when they moved into the north eastern corner. Also at night, Snipe could be heard to call as parts of the saltmarsh became inundated.

Area D.

This old wooden jetty has been removed and is thus no longer available as a roost for Redshanks on high spring tides.

Area E.

The existing mound has been improved for use as a high tide roost.

It is the artificially raised and protected high tide roost island at the eastern end of Area C, near the Graving Docks (See Figure 3.1.3). The area adjacent to the Graving Docks has been levelled and access by the public from Stuart Street and Bute Esplanade has ben prevented by the building of new fences. Further protection from disturbance is afforded by the raised banks on the north end of the Island, which obscure views from the closest vantage points, and by the deep channels surrounding the island. The latter fill on spring tides of around 12.0m or more, the tide heights at which the island may be used by birds. A secure roost island has thus been produced which is very well protected from human disturbance.

This area remains uncovered at all heights of tide.

The upper gravel surface was used by curlew and shelduck as the saltmarsh at Area C became covered on spring tides. The eastern slopes, facing the docks, were used by Redshank and Dunlin on spring tides. This area formed the main roost area when the saltmarsh at Areas B1, B2 and C was partly or completely covered. At night , on spring tides, the roost was used by Redshank, Curlew and Dunlin. There is virtually no disturbance of this area, other than by an occasional bird of prey or loud noises from the inner harbour and adjacent areas.

Area F.

Considerable changes have occurred to the mound that forms part of the PDR works on the west side of the River Taff. It has been raised and extended and is in continual day-time use by workmen. The changes and the disturbance mean that this is no longer available as a secure area for roosting birds, especially Redshank. The remaining saltmarsh and the adjacent mud are relatively unaffected and are now referred to as **Area F1**.

Area F1.

This 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. This area of saltmarsh and mud remains partly uncovered on low and moderate neap tides. Redshank and Dunlin feeding on the mud may form small roosts on the open mud or edges of the saltmarsh. Variable numbers of Shelduck may roost, either on the mud or the edge of the saltmarsh. Snipe were also present in this area of saltmarsh. The north-west side of this area receives disturbance from people using the car park for Red House public house, but this seems to have little effect on the birds. No birds were observed using this area at night on a spring tide, although Snipe could easily have been overlooked.

Area G.

This area remains unchanged.

Almost all of this area of saltmarsh is covered by tides higher than 13.5m.
It consists of the remaining area of saltmarsh east of the River Taff to the north of the South Glamorgan Canal, and west of the new mound adjacent to the Hamadryad Hospital (part

of the Phase 1 development). On most tide heights, this area was not used as a roost site by many birds. Redshank feeding on the adjacent mud sometimes formed pre-roosts on the western edge of the saltmarsh or, on lower neap tides, roosted briefly on the exposed mud. A small number of Snipe also used this area. As this section of saltmarsh forms part of the PDR work site, there is no disturbance from members of the public and it is rarely disturbed by workmen. At night on spring tides a few Redshank were found here.

Area H.

This area remains 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. At least part of the sloping concrete side to Ferry Road remained uncovered on all but the highest spring tides.

This was mainly used by small groups of roosting Turnstones. On moderate spring tides, the sloping concrete surface on the edge of Ferry road was also used by the Turnstone. Although there is heavy public use of the road, the Turnstone seemed little affected. When they were disturbed, the group invariably flew out of sight into the River Ely estuary. On neap tides, numbers of Shelduck using the adjoining mud for feeding frequently formed roosts on the open mud. Occasionally, Oystercatchers also roosted on the open mud when it remained exposed on neap tides.

Area I.

This is a new area (see Area B above).

It is the artificial raised mound west of the Hamadryad Hospital, part of the Phase 1 development. The mud bank was just beginning to become covered with freshly germinating grass.

It remains uncovered by the tide at all times.

This was used by Lapwings on tides of sufficient height to cover the mud alongside Area G. Although there was virtually no disturbance, the Lapwing flock was easily put to flight. On one occasion, the south slope of the mound was used by the Redshank roosting in the bay. This area was not being used by roosting birds when visited at night on a spring tide.

Area J.

This area remains unchanged, but it has become a roost area on some low neap tides.
It consists of the upper mudflats on the southern edge of saltmarsh south of Windsor Esplanade (Area C).

It is covered by tides higher than 11.0m.

Feeding birds moved to the upper edge on the rising tide and have roosted there. This area was regularly used for roosting by Curlew and occasionally by some Shelduck, Redshank and Dunlin. The only disturbance noted was by birds of prey.

Artificial Floating Roost Platform.

This is a wooden platform with a raised area in the centre. The whole platform is mounted on large plastic drums to give it buoyancy (Figure 3.1.4). It is anchored off of Ferry Road in an area sheltered from buffeting by wave action.
It is afloat at high tide on all heights of tide.

Because of technical problems, the platform was not in place until the beginning of March, 1992. By the end of the study period, the birds roosting in Cardiff Bay had not had time to adjust to the presence of the platform and it had not been used. Observations during autumn and winter of 1992/93 would determine how effective it may be.

Open Water.

At high tide, large proportions of the roosting Shelduck and Mallard and more variable proportions of the roosting Teal could be found on the open water. Often the Shelduck were scattered over the whole bay, but at other times, a large flock was located on the western part of the bay near Ferry Road. When Teal were forced to leave the saltmarsh as it became covered, they mainly stayed in the vicinity of the water covering Area C. A small group of roosting Pochard also used the open water at the north end of the bay. Very little disturbance from water craft was noted during the period of study.

Eastern PDR Bank.

This was not used regularly as a roost probably because the disturbance increased in autumn 1991. Before this it had looked as if it would become a regular roost for Redshank. On two weekends in late winter 1991, when disturbance was minimal, and on two other occasions during the period of study, (while work continued on the PDR site), the PDR bank formed the main roost site for Redshank and Dunlin, as well as a few Shelduck.

Roosts outside Cardiff Bay.

As noted by Donald and Clark (1991a), some species leave the bay to roost when the feeding areas become covered by the rising tide. During the study period, on all but one occasion the Curlew feeding in the bay remained there. On two days, a small group was observed to fly in over the docks from the east, after high tide, to supplement the numbers already roosting in the bay. The majority of the Dunlin feeding in the bay left before high tide to roost elsewhere. The usual roost site of Sully Island, to the west of the bay, supported large roosting flocks during the study period (BTO B.o.E.E. data) In past years, Dunlin flying across the Severn to roost at Clevedon have been observed (Clark, 1990). During the current study period, as part of the ongoing fieldwork for CBDC, Dunlin caught near the Rhymney Estuary were colour-marked. Observations have shown that the Dunlin occurring in Cardiff Bay are also part of the population from the Rhymney Estuary. The finding of a colour-marked Dunlin at Clevedon, confirms that there is some movement across the Severn, but the importance of this as a roost for birds feeding in Cardiff Bay is unknown.

3.2 Species Accounts

3.2.1 Shelduck

During the period of study, between 300-450 Shelduck roosted in the bay. There have been a number of changes to the roosting pattern of Shelduck since the 1991 study, brought about by loss of the east PDR bank as a roost site and the availability of the new roost island, Area E. The majority of the birds roosted on the open water, frequently widely dispersed throughout the bay. The main roost sites for those groups not roosting on the open water are shown in Figure 3.2.1.1. The use of these sites in relation to tide height is given in Figure 3.2.1.2. The height at which each area is covered by the rising tide and therefore is unavailable for roosting birds is also shown. On neap tides, when Area J and the mud adjacent to Area H were not completely covered, scattered roosting flocks formed. These numbered up to 100 birds on Area H and 85 birds on Area J. When these areas became covered, roosts formed at the east end of Area C, but were rarely larger than 50 in number. However, during a windy period of March, a large proportion of the Shelduck present in the bay moved on to the saltmarsh to roost.

The main change in the pattern of roosting compared with 1991 was the use of the artificial island (Area E). On spring tides over 12.0m, the roosting birds moved onto the top and eastern side of this with in excess of 100 birds frequently present. During some observations, it was noted that Shelduck would move off the water as the tide was falling and roost on the island, swelling the numbers already there.

Roosting Shelduck were easily disturbed by factors such as loud noises and their departure from a roost invariably disturbed other roosting species.

Donald and Clark, (1991a) stated that one advantage to birds roosting on dry land rather than on the open water was that they could preen feathers that could not be reached while afloat. This does not fully explain the pattern of roosting observed during the current study. Over half of the population of Shelduck in the bay remained roosting on the water whatever the height of the tide.

A number of birds always roosted on the saltmarsh if this remained uncovered. However, night

visits did not locate Shelduck and they were assumed to be on the water. Observations on other estuaries have shown that Shelduck often leave their day-time feeding areas and roost in the centre of estuaries at night (Clark *et al*., 1990).

One unusual pattern of roosting behaviour that was noted on several occasions was for birds to start roosting on the mud in quite large numbers as the tide was rising and then suddenly resume feeding again.

Shelduck occasionally used other areas within the bay to roost. Reasonable numbers were found on the end of the PDR mound east of the River Taff on two tides and small numbers (5-10) were found in a variety of other roosts at different times (eg.Area I).

The most important land roost sites Shelduck were the saltmarsh of Area C while this remained exposed, and the artificial roost island when the saltmarsh was covered.

3.2.2 Teal

The pattern of roosting behaviour in 1992 was very similar to that of 1991. 150-200 Teal regularly roosted in the bay. Earlier changes to the roosting pattern of Teal had already been noted in the 1991 report. Previous observations had suggested a regular use of the South Glamorgan canal for day and night roosting, (Ferns, 1987) . In 1991, the canal was used for roosting primarily at night. Large areas of the canal have since been affected by the Phase 1 development and formation of the PDR banks, and the remaining part of the canal was only used by a small number (5-10) of roosting Teal during part of the neap tide cycle in 1991/92. There was no obvious pattern of feeding and roosting by the Teal, with at least some birds roosting during most parts of the tidal cycle. The bulk of the population in the bay, however, did roost during most high tides. Teal regularly roosted at low tide on the east bank of the River Taff (sector 13, Figure 3.1.2).

The position of high tide roosts is shown in Figure 3.2.2.1 and the use of these sites in relation to tide height in Figure 3.2.2.2. With the rising tide, a large part of the Teal population moved nearer the saltmarsh at Areas B2 and C. On neap tides below 10m, birds roosted on the muddy banks of the creek emerging from the saltmarsh across the mud of Area A. On higher tides (10-12m), the birds would move into the saltmarsh, using both the banks and the water within the creeks. When the saltmarsh was only partly flooded, good numbers roosted on the water amongst the vegetation, but it was difficult to determine their position as they became lost to sight. On spring tides over 12.0m, the Teal usually took to the water to roost, although they tended to stay near the submerged saltmarsh. On two occasions during the study (tides in excess of 13m) small numbers of birds moved on to the western slope of the artificial roost island E.

At night on spring tides, Teal were found on the water in the saltmarsh of Areas B2 and C. They appeared very active. It has long been known that nocturnal feeding is important in wintering populations (Tamisier, 1972) and the importance of this has been demonstrated more recently in British estuaries (eg. Clark *et al*., 1990).

3.2.3 Dunlin

The pattern of use of Cardiff Bay by Dunlin has been described in ongoing studies for CBDC

(Evans *et al*., 1990; Donald and Clark, 1991b). On most days during the observation period, and at other times observed during other field-work, the number of Dunlin feeding in the bay was far greater than the number that roosted there. However, the pattern was complex, and there were days when many hundreds of birds fed and remained in the bay to roost, as well as days when virtually no Dunlin were to be found. On two days in December, (outside of the study period), between one and three thousand Dunlin roosted in the bay over the high tide period. On both days the tide height was over 12.0m and with high tide being near to dawn, there was no disturbance from the PDR work. On these days, roosts formed in the saltmarsh of Area B2 and on the end of the PDR mound west of the River Taff. The overall complex pattern appears to be unrelated to tide height during the study period, with similar tide heights within a short time period yielding very different results. When there were good numbers of Dunlin feeding in the bay, the common pattern was for the majority of birds to leave before high tide and roost elsewhere. Observation of flocks leaving the bay showed them to fly to the south-west, presumably to roost on Sully Island, a known roost area for Dunlin.

During the study period, between 100-700 Dunlin roosted in the bay, except on four days in February when no roosting birds were located.(Figure 3.2.3.1). These roosting flocks occurred on all tide heights. On neap tides, when the upper reaches of the mud remained uncovered, feeding would continue as high tide approached, but on most days during the observations, some or all of the birds roosted over high tide. The positions of the roosts used during the study period are shown in Figure 3.2.3.2 and the position of these flocks in relation to tide height is given in Figure 3.2.3.3. The main roost site observed in the 1991 was the banks of the South Glamorgan Canal. This has been changed considerably and subjected to continued disturbance from the PDR work and is no longer used.

With neap tides lower than 10.5m, mud remained exposed south of the main saltmarsh near Windsor Esplanade. Dunlin would be pushed up the shore with the rising tide and would continue to feed or roost in the muddy gully from the creek that runs across Area A. On two occasions small numbers of roosting birds were found on Area J and on the mud adjacent to Area F . On tide heights that covered the mud of Areas A and J, birds would move up the creek gully, into the saltmarsh to roost (Area B2). On tides higher than 12.0m, the Dunlin flock that remained in the bay moved to the east slope of the artificial roost island, Area E. Frequently, the Dunlin roosted with the Redshank. This area was used even on some of the highest tides of the year. This is in contrast with 1991, before the roost island had been built, when Dunlin normally left the bay.

At night on spring tides, Dunlin were found roosting on the east slope of Area E and on one occasion, on a particularly high tide, several hundred were found to be roosting on the north edge of the PDR raised bank near the position where it crosses the South Glamorgan Canal.

3.2.4 Curlew

As in 1991, about 50-120 Curlew were present in the bay and normally roosted there. Pre-roosts formed early, several hours before high tide, on the exposed mud at Area J. The roosts used during the study period are shown in Figure 3.2.4.1 and the use of these sites in relation to tide height in Figure 3.2.4.2. With neap tides below 10.5m, when part of Area J remained uncovered, roosts remained throughout high tide and the birds dispersed to

feed two or three hours after the peak of the tide. On tides of heights greater than 10.5m, but less than 12.0m, the pre-roosting flock moved up the mudflat onto the saltmarsh at Area C. Unlike the situation in 1991, Curlew did not leave the bay when the saltmarsh became covered, but roosted on the artificial high tide roost island, Area E. The bulk of the roosting flock took up position on the top of the island, with smaller numbers on the eastern slope. No other areas were used by roosting Curlew during the study period. The creeks in the saltmarsh at the east end of Area B2 no longer held roosts at tides of intermediate heights, unlike in 1991. On one day during the period of intensive study, no Curlew were found in the bay, either roosting or feeding. The tide height was 12.4m. There was no obvious explanation of this, but the usual number had returned the following day.

3.2.5 Redshank

This species was likely to be most affected by the Phase 1 developments and the PDR work that has taken place during 1991, as its main roost sites identified in the previous study have been covered or altered. Figures 3.1.1 and 3.1.2 show that the main changes to have occurred are to 1991 Areas B (near the South Glamorgan Canal), D and F. These were all identified as important roost sites for Redshank in 1991.

Colour marking of Redshank in 1990/91 showed that the Redshank that were feeding in the bay rarely left to roost or feed elsewhere (Donald and Clark, 1991). Continuing work by the BTO for CBDC has involved colour-marking Redshank at Rhymney, to the east of Cardiff Bay. Any interchange of birds from Cardiff Bay and elsewhere would be likely to involve birds wintering at Rhymney. Observations have confirmed that there is little movement between these populations and that the Cardiff Bay population remain site-faithful for feeding and for roosting during the winter period. It is therefore important for these birds to find alternative roosting areas within the bay when their traditional roost sites are lost.

During the winter, there was a fairly constant population of Redshank numbering 350-450, declining through March. This represents a population comparable to that found in the previous study. The numbers roosting in Cardiff Bay during the study period are shown in Figure 3.2.5.1. The roost sites used during the current study are shown in Figure 3.2.5.2 and the position of the roosting flocks in relation to tide height in Figure 3.2.5.3.

On high spring tides, the Redshank usually roosted as a single flock, but on neap tides, roosting birds used more than one site on several occasions. On tides below 10.0m, when considerable areas of mud remained uncovered, some birds continued to feed throughout the tidal cycle. On these tides, roosting groups were found on the mud adjacent to Areas F1 and G and on Area A. At tide heights between 10-12m, when varying amounts of mud and saltmarsh were becoming covered, different areas of saltmarsh were used for roosting by Redshank. As the mud at Area A became covered, the Redshank moved along the creek gully and into the saltmarsh at Area B2 to roost. With increased height of tide, the Redshank moved to higher levels of saltmarsh or to other roost sites. Above 12m, tides the preferred site for roosting during the study period was on the east slope of the artificial roost island, Area E. (Exceptions to this pattern occurred on one day when the roosting flock was located on the south slope of the new Phase 1 mound adjacent to the Hamadryad Hospital, Area I, and on two occasions when all or part of the roosting flock was found on the eastern PDR mound.)

In 1991 the South Glamorgan Canal was important for the formation of roosts on the rising tide. On higher tides pre-roosts would move elsewhere as the area became covered. As this site has become unsuitable, Area B2 has become the location of pre-roosts. Redshank often returned there from other roost sites as the tide receded.

At night, on spring tides, visits revealed the use of several sites and it appears that the Redshank do not necessarily roost in one flock. Roosting birds were found in the saltmarsh at the eastern edge of Area G and on the muddy north edge of the PDR bank on the east side of the River Taff. On other visits, Redshank were located in the saltmarsh at the western end of Area C and , on more than one occasion, on the east slope of the artificial roost bank, Area E, which was the preferred roost site for day-time roosting on high spring tides. The construction site near the western PDR mound that was found to be used in 1991 was not used during the current study period. There was no night-time disturbance and some other factor must have resulted in the Redshank adopting other sites for roosting at night.

For direct comparison with 1991, observations made every 20 minutes during the whole range of tide heights were pooled. The percentage use of different areas by roosting groups of Redshank for different heights of tide is shown in Figure 3.2.5.4 using 146 day-time observations. At tide heights below 9.0m Redshank were seen roosting on the mud of Area A. With increasing tide height, the roosting birds moved to Area B. Area A continued to be used during higher tides, as there was a pronounced bank of mud on the side of the creek gully where it emerged from the saltmarsh which remained uncovered for considerable time. Although birds continued to feed over much of Area A as the tide rose, Redshank gathered on this raised area to pre-roost on many occasions. When the sea level rose above 11.5m the birds were found to roost on the artificial roost island, Area E, this area being used almost exclusively when the tide rose over 12.5m. Area G can be seen from Figure 3.2.5.4 to hold roosting birds at heights of tide from 8.0-12.0m. However, almost all of these observations came from the three study days in March, this

area being little used during the study period in January and February.

Care must be taken in interpreting Figure 3.2.5.4 because the proportions of observations in each tide-height class are not equal, with far fewer observations for the lower and higher end of the tidal range. The proportions of observations for each tidal class are shown in Figure 3.2.5.5. However, Figure 3.2.5.4 does show the overall pattern of use of areas at different tide heights by Redshank.

3.2.6 Other Species

Several other species were found to roost in Cardiff Bay during the study period.

Between 100-200 Lapwing were found in the bay during the study period. These appeared to spend most of the daytime roosting. It is known that Lapwing feed nocturnally especially in conditions of good visibility (full moon), but the population in Cardiff Bay was rarely seen feeding diurnally even at periods of new moon. Throughout the day and at neap high tides, the Lapwing roosted on the exposed mud west of Area G. On spring high tides, the roosting group used the western facing slope or the top of the Phase 1 mound by the Hamadryad Hospital (Area I). This is in contrast to observations made in 1991, when the flock left the bay if the saltmarsh of Area G became covered. The roosting flock was easily disturbed. On two occasions, the main group of birds roosted on the end of the PDR bank on the west side of the Taff, together with groups of Shelduck and Redshank. At night, no birds were located and it must be assumed that they left the bay.

In contrast to 1991, very few Grey Plover wintered in Cardiff Bay. Small numbers (3-5) were observed only occasionally during the ongoing fieldwork for CBDC, when they were feeding on the open mud, or roosting high up on the exposed mud of Area J on neap tides. During the period of study on roosting behaviour, Grey Plover were observed on one occasion, roosting on the upper reaches of Area A. This group did not remain until high tide as it was disturbed by other bird movements and left the bay.

Oystercatchers feeding on the mud in the bay roosted on some occasions. All or part of the flock that moved up the mud with the rising tide (30-60 birds) roosted on the exposed mud of Area A, usually near the raised banks of the creek, or near to the saltmarsh on Area J. On spring tides, when the mud became covered, Oystercatchers usually roosted outside the bay, but on one occasion, a roost formed on the undisturbed end of the PDR mound east of the River Taff.

Turnstone behaviour was similar to that reported in 1991, with between 15 and 45 birds feeding and roosting along the boulders adjacent to Ferry Road, Area H. On spring tides, the flock roosted high up on the sloping concrete surface on the side of the road. The roosting pattern was not consistent and the group of birds using the area to feed was observed to fly west into the Ely Estuary on a number of occasions, apparently unrelated to tide height or other external factors. The east PDR bank was used by a group of roosting Turnstone on one spring tide.

Throughout the period of study, there was a regular group of up to 15 Pochard that roosted on the water in the vicinity of the western edge of the saltmarsh at the north end of the bay.

Snipe were found in small numbers in the saltmarsh of Area G and Area C. Even when the areas were observed as they became completely inundated, few birds were seen to leave (5-7). Because of its habits, this species is extremely difficult to locate and the actual numbers could well be higher. On leaving these areas of saltmarsh, the birds roosted on any nearby edge that remained uncovered and undisturbed. The saltmarsh at Area F1 was constantly observed as it became covered on one high spring tide. Twenty-eight birds were seen to leave the saltmarsh, either flying onto the nearby raised edge or flying west over Ferry Road and out of the bay to roost. On tides of heights that do not displace these birds, they must be assumed to continue feeding or to roost in the areas of saltmarsh.

Other species that were seen to roost in the bay on isolated days and in small numbers (1-5) included Heron, Knot and Bar-tailed Godwit.

4DISCUSSION AND CONCLUSIONS

The previous studies have shown the importance of areas at the north end of Cardiff Bay for roosting birds. In particular, the PDR mound to the west and the saltmarshes adjacent to Windsor Esplanade, in the vicinity of the South Glamorgan Canal, and between the River Taff and the Hamadryad Hospital and the PDR mound on the west side of the River Taff have been affected in some way during the last twelve months by Phase 1 developments or PDR work. It was stated in the 1991 report that the effects of such changes could not be easily predicted. The current report shows the ways that birds have adapted so far, but it is still very difficult to predict the effects of further change to the roosting sites.

The species that were most likely to be affected, Redshank, Dunlin, Shelduck, Teal and Curlew, do not appear to have shown any significant decline in numbers compared to findings in 1991. In fact, the numbers of Dunlin and Redshank roosting in the bay, if anything, show a slight increase.

The changes to the South Glamorgan Canal, the western PDR mound and the area of saltmarsh adjacent to the Hamadryad Hospital has resulted in these areas becoming unimportant as roost areas. Birds that inevitably have been displaced from these areas have found alternative sites within the bay.

Because of their tendency to feed and roost in the same general locality and their 'reluctance' to leave their overwintering area, Redshank would seem the species most likely to be affected by any changes. Redshank no longer use the area around the South Glamorgan Canal to roost. The area around the mouth of the creek that emerges at the western end of Windsor Esplanade has now taken over as the preferred pre-roost and roost site on many lower tide heights. The nearby Phase 1 work has not noticeably affected this area, but Phase 2 development work will. It is difficult to predict what effect this further loss of roosting habitat will have on the population of Redshank in the bay. The use made of the western PDR mound for roosting on high spring tides in 1990/91 was always going to be a temporary situation. The creation of the high tide roost island at the eastern end of the saltmarsh in front of Windsor Esplanade has provided a safe and satisfactory permanent alternative that has readily been used by the Redshank on high tides and at night. This could well assume even more importance as the Phase 2 developments proceed, as long as it remains undisturbed. Certainly, the Redshank that are found in the bay have been very adaptable to the sort of changes to roosts that have occurred so far.

The changes have not significantly altered the number of Dunlin that use areas of the bay to roost. This species is under less pressure than Redshank as the majority of Dunlin have always left the bay to roost at other sites. Birds that do remain in the bay to roost have very much followed the pattern shown by Redshank in response to the changes.

Because of their preferred roosting sites, Shelduck, Teal and Curlew were always less likely to be affected by the recent changes. The provision of the high tide roost island has, however brought about some changes to the pattern of roosting of these species. The Curlew feeding in the bay made use of the island on tide heights that cover the saltmarsh. In the previous study, before the formation of this safe roost, Curlew left the bay to roost elsewhere when the saltmarsh became inundated. Although Shelduck roost on the open

water, large numbers of birds were found to roost for several hours on top of the island under certain circumstances. A third to half of the population in the bay used the island on spring tides. The Teal population has been little affected by the changes so far, although even some of these used the island's western slopes on a few occasions.

To summarize, the overall effects of the Phase 1 and PDR work so far has been to change the sites of roosting of some of the species in the bay, without reducing the populations present. The species described in this report have adapted well without apparent adverse effects. The artificial roost site provided has successfully compensated for the loss of some of the previously used sites and is now one of the most important areas for roosting on high spring tides. Without the provision of such a site, some of the birds using Cardiff Bay for feeding might have been forced to leave when the saltmarsh was covered by high tide. The floating roost platform was unfortunately in place too late this winter to determine its effectiveness. With increasing changes to the potential roost areas from the continuing PDR work and Phase 2 development, even more pressure will be brought on remaining areas. An alternative such as the floating platform may in future form an important part of compensatory measures to reduce possible damage to the bird populations of Cardiff Bay, until such time that the barrage is built.

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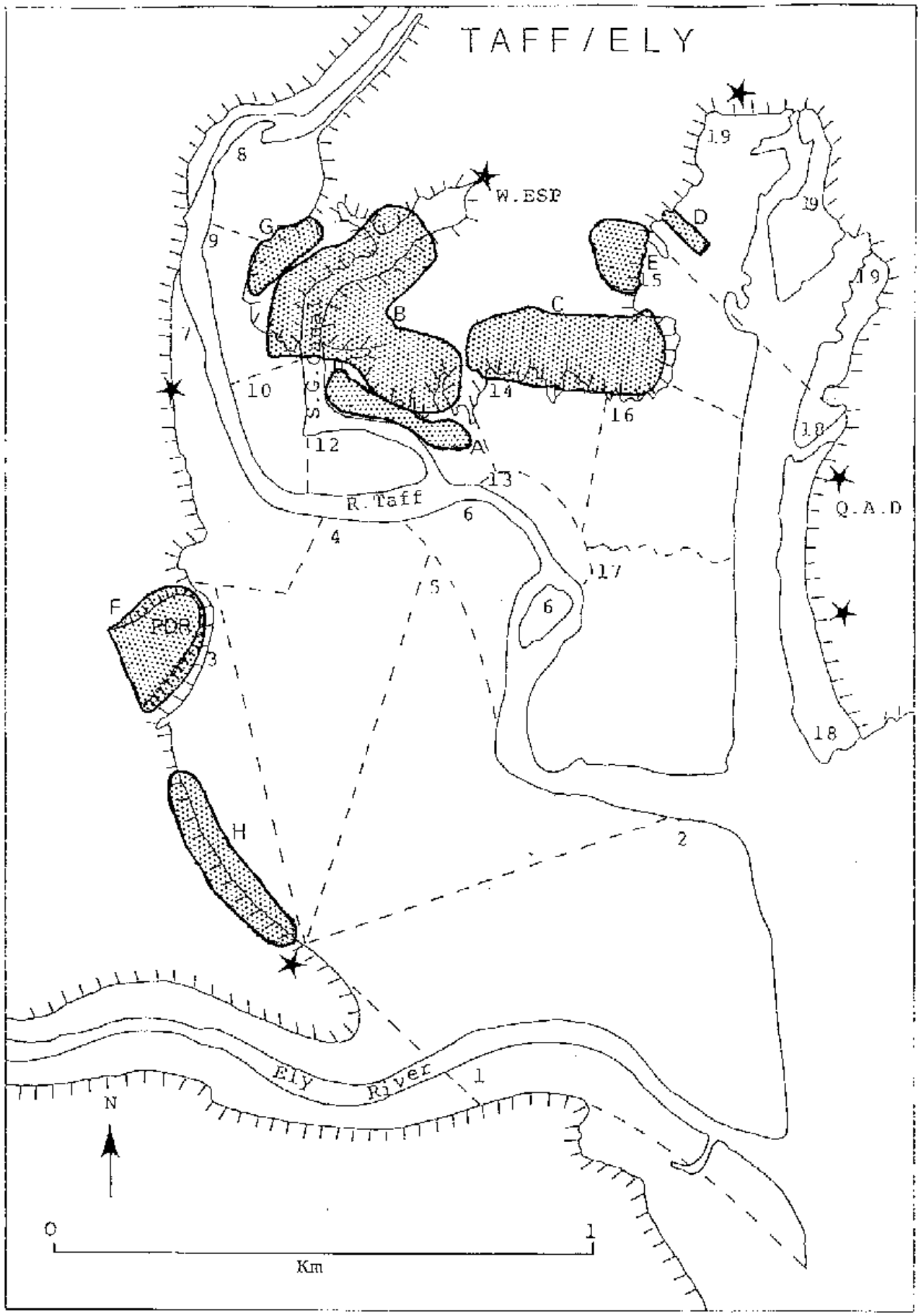

Figure 3.1.1 Roost sites identified in Cardiff Bay for 1991. Stars denote observation points. Numbers refer to count areas used in ongoing fieldwork for CBDC.

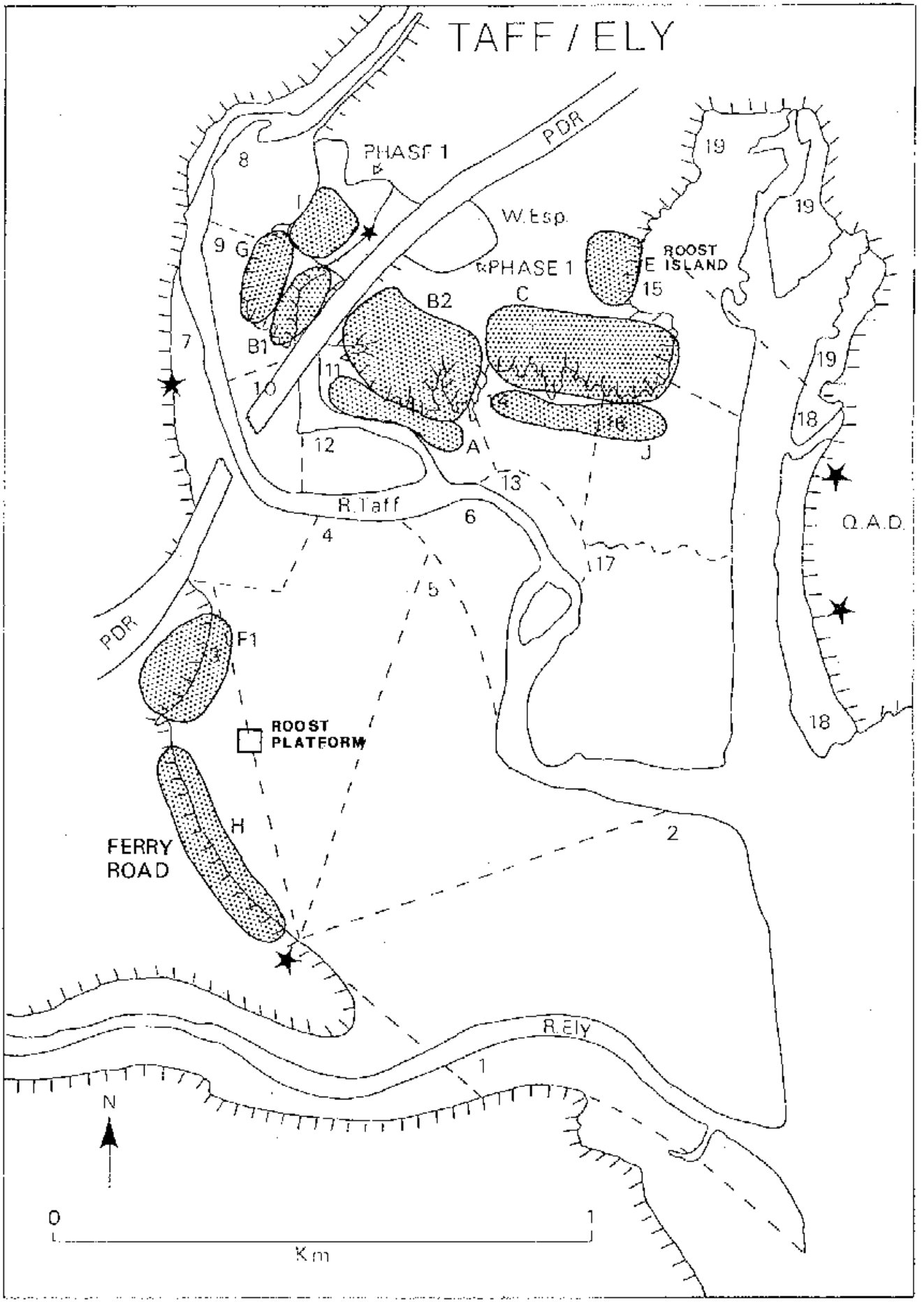

Figure 3.1.2 Roost sites identified in Cardiff Bay for 1992. Stars denote observation points. Numbers refer to count areas used in ongoing fieldwork for CBDC.

ROOST ISLAND

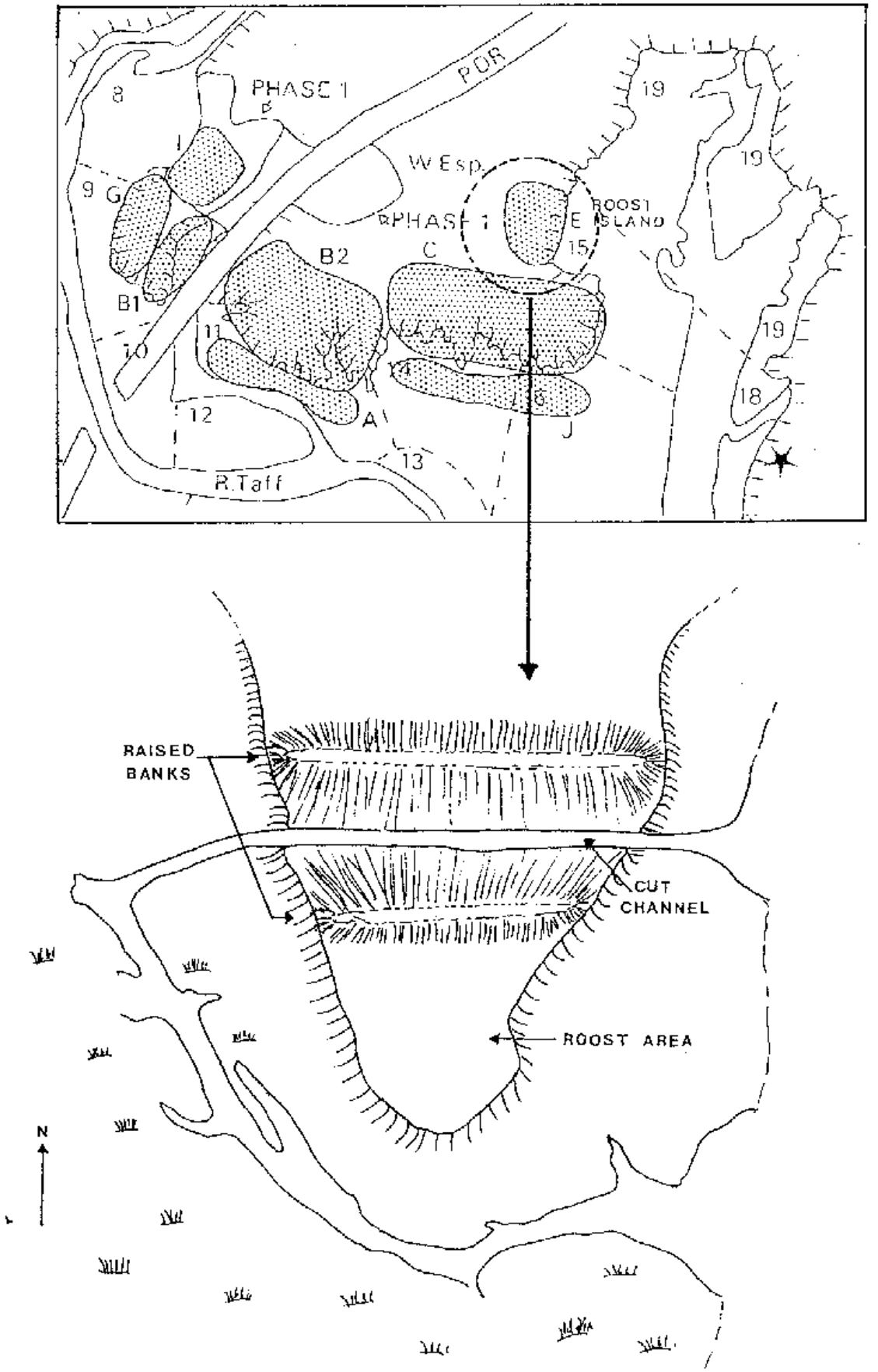

Figure 3.1.3

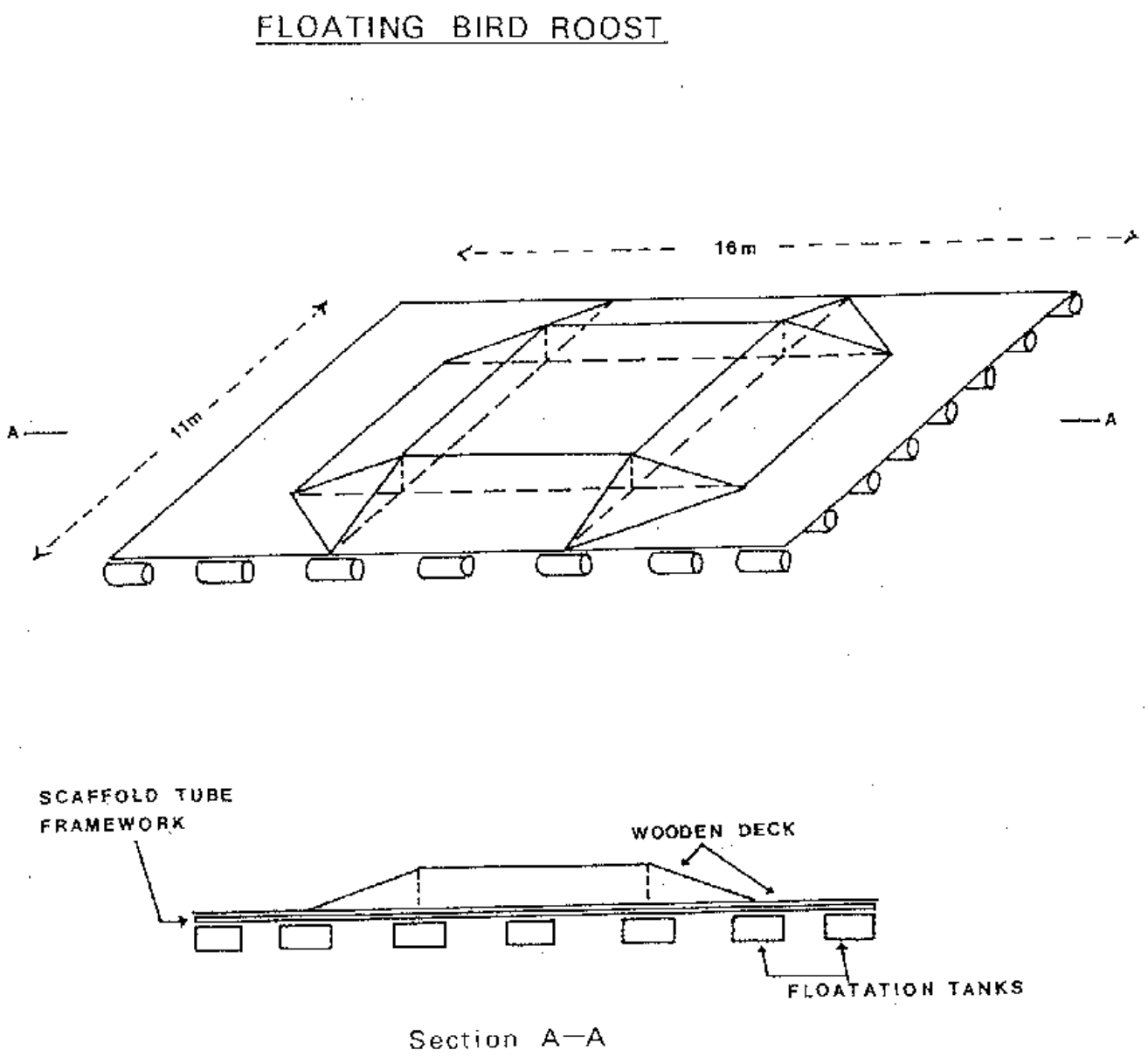

Figure 3.1.4 The structure of the floating roost platform.

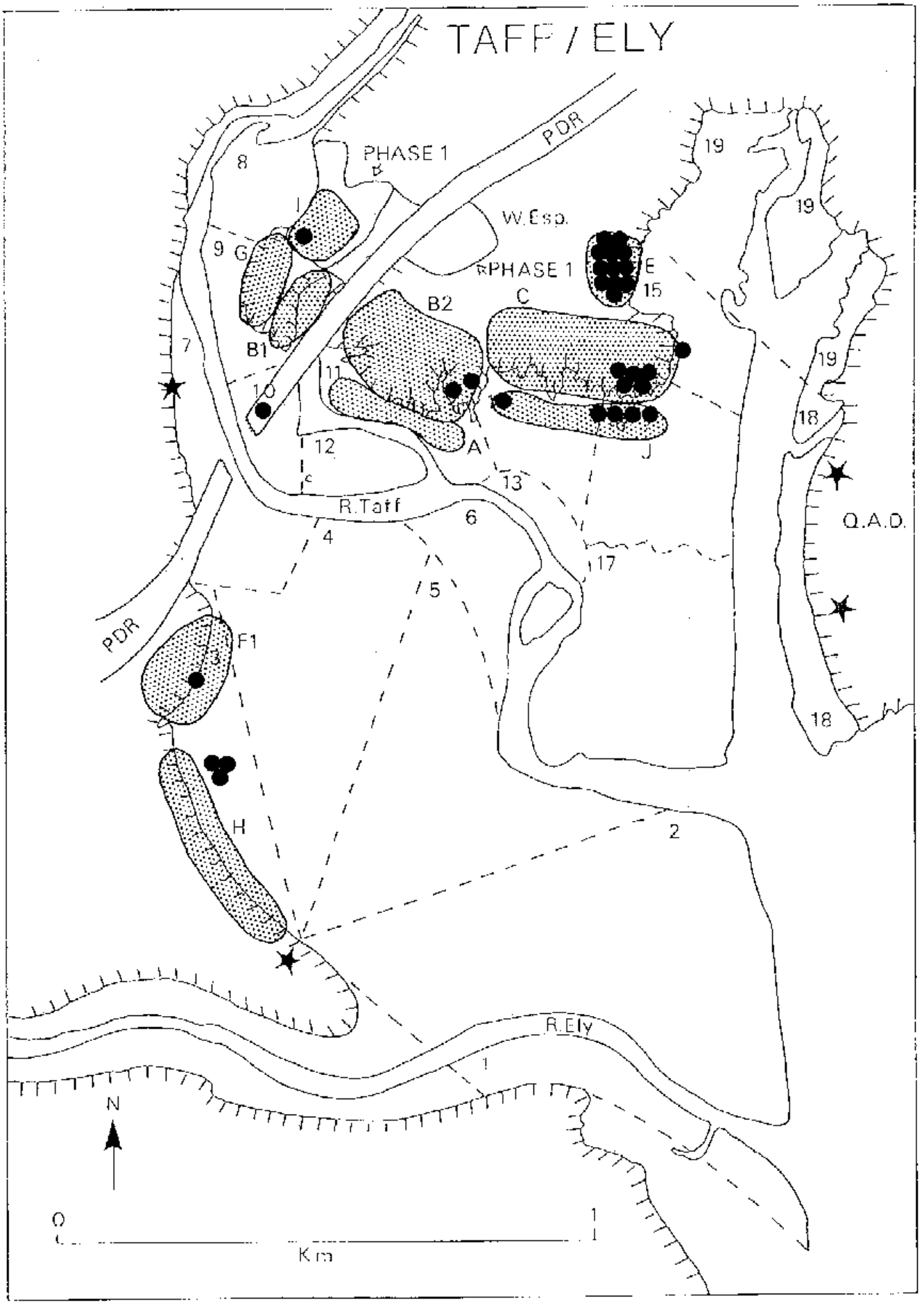

Figure 3.2.1.1 Roost sites used by Shelduck flocks in Cardiff Bay. Only sites used by flocks of over twenty birds are shown.

SHELDUCK

Position of Roosting Flocks at High Tide

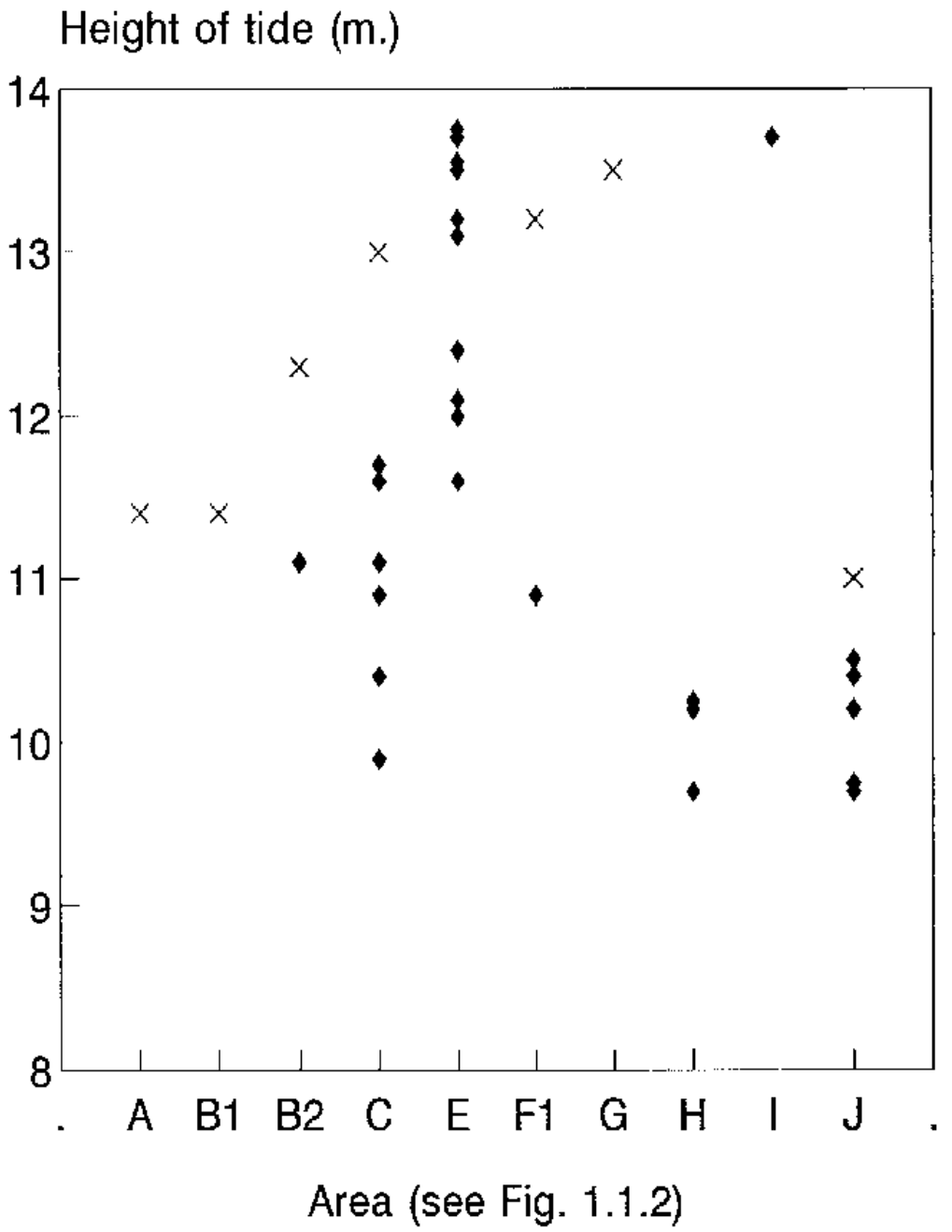

Figure 3.2.1.2
The distribution of roosting Shelduck in relation to tide height. More than one roost was used on some tides. X=Area covered.

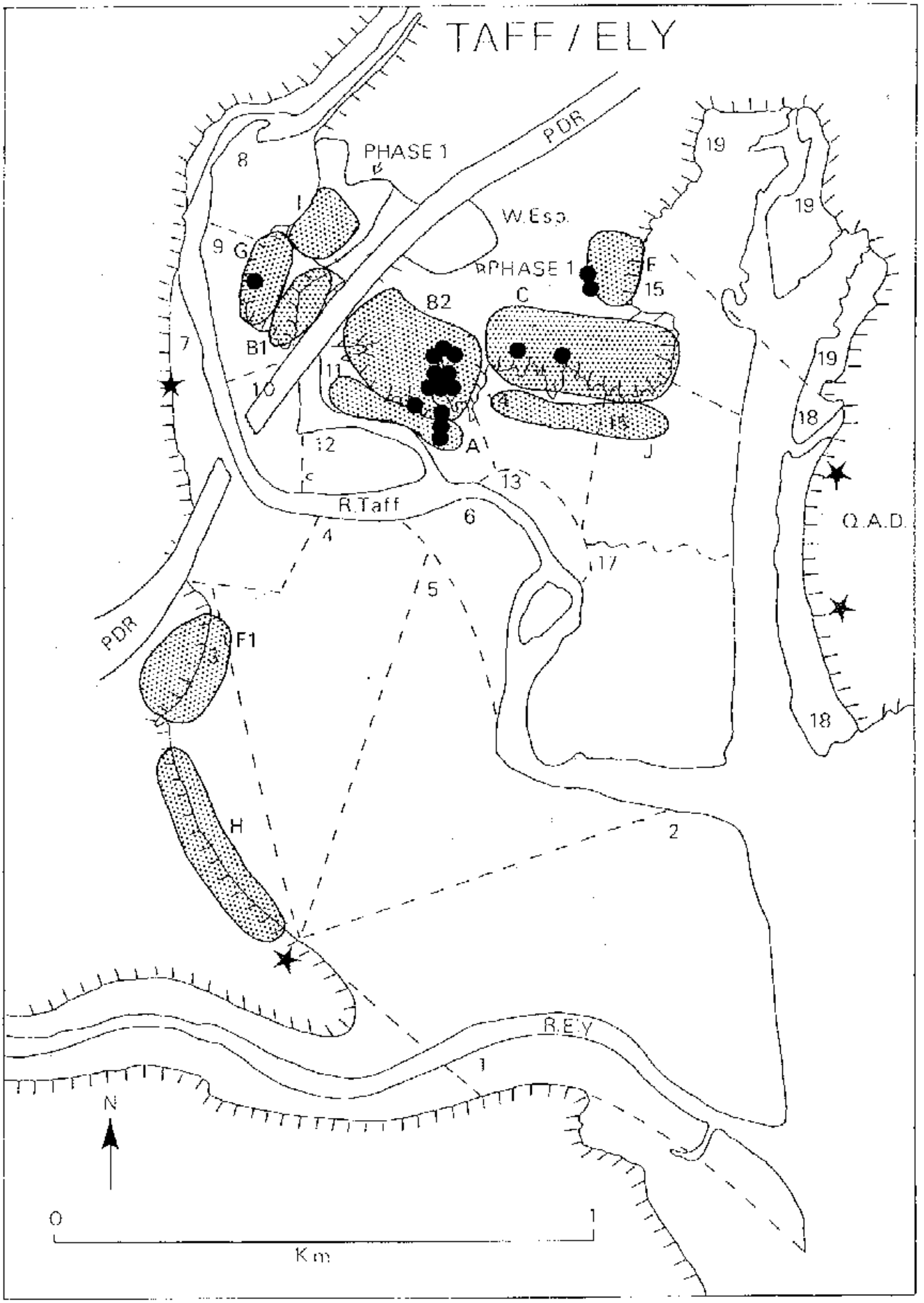

Figure 3.2.2.1 Roost sites used by Teal flocks in Cardiff Bay. Only sites used by flocks of over twenty birds are shown.

TEAL

Position of Roosting Flocks at High Tide

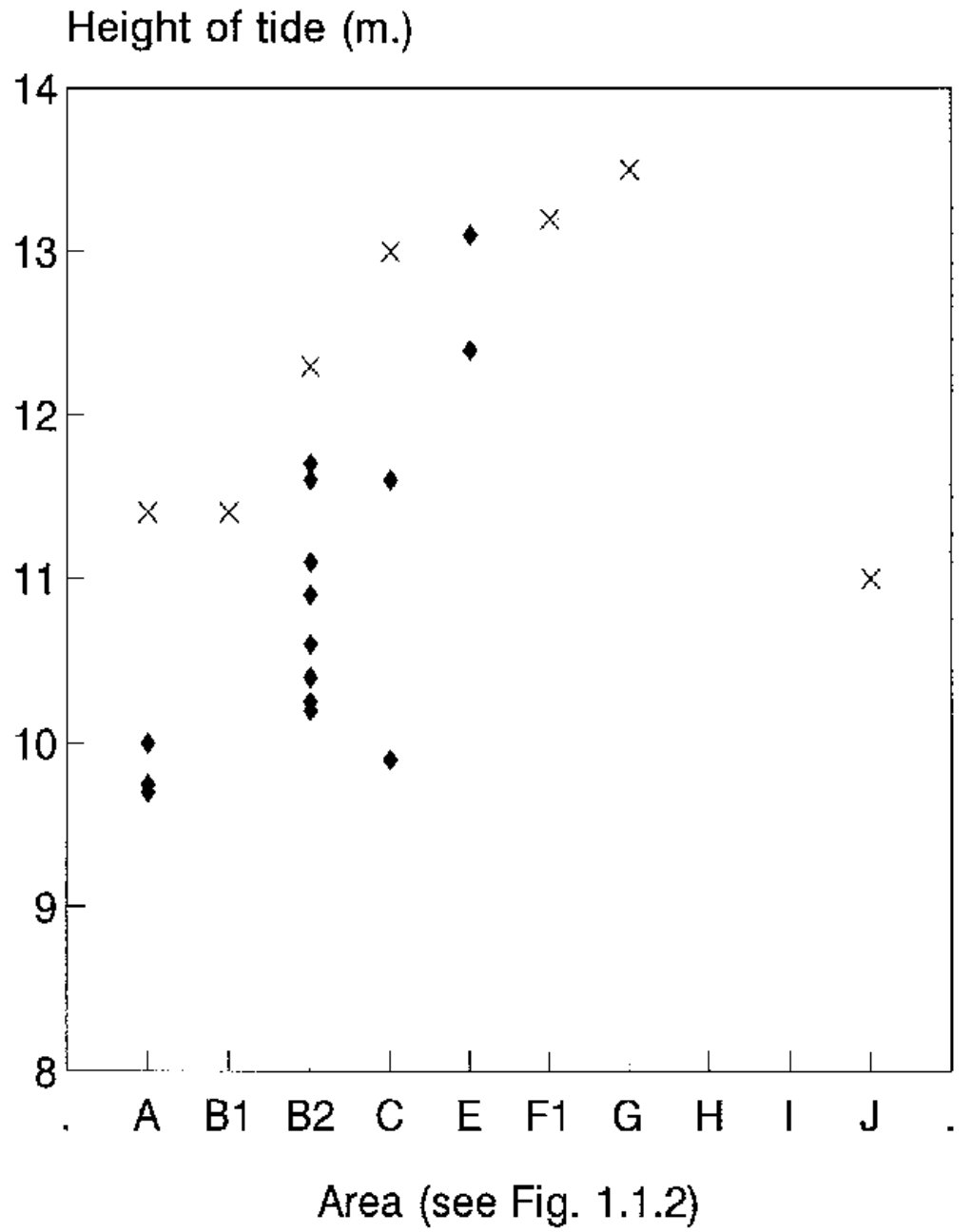

Figure 3.2.2.2
The distribution of roosting Teal in relation to tide height.
More than one roost was used on some tides. X=Area covered.

DUNLIN

Number of birds Roosting in Cardiff Bay

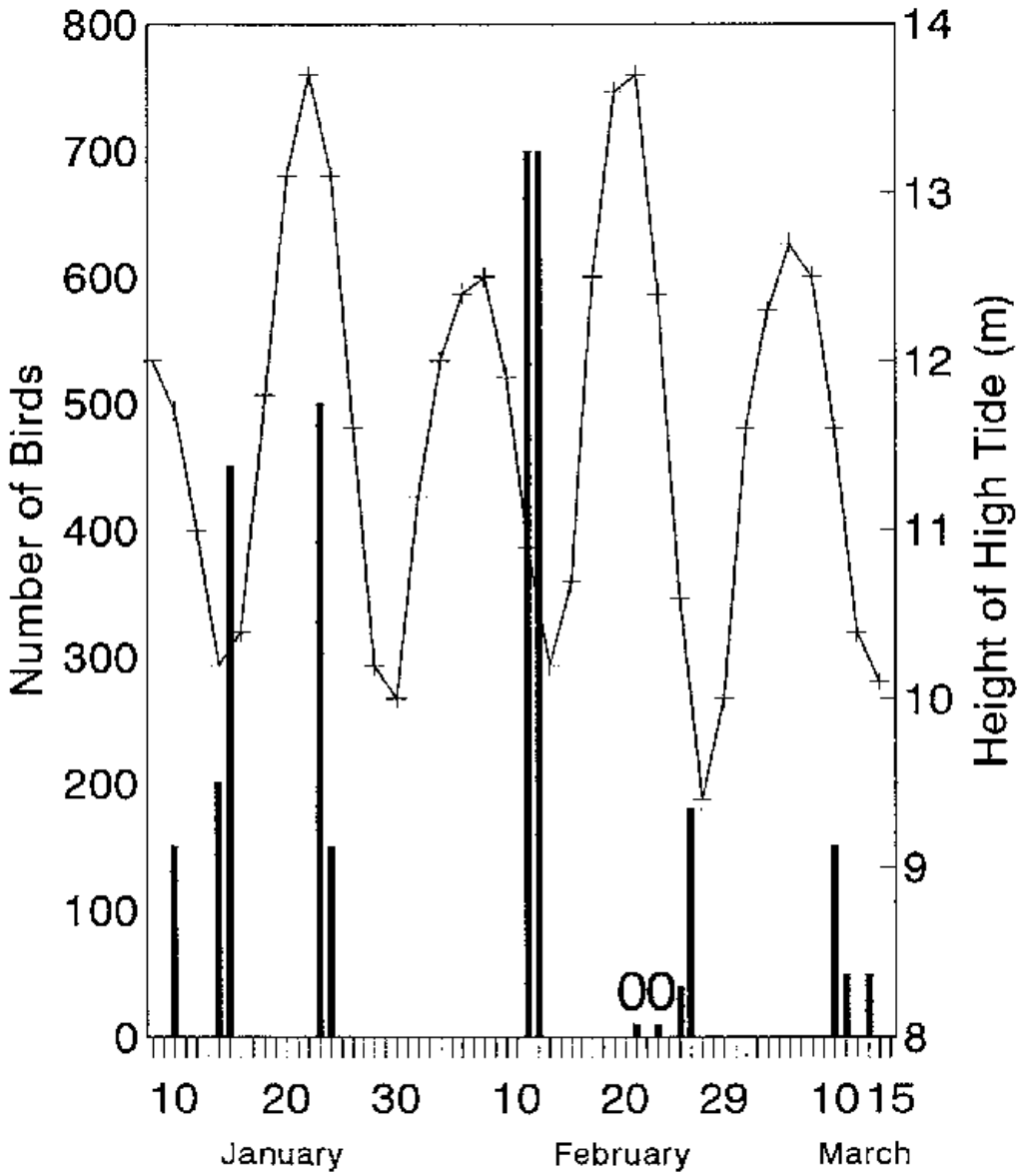

Figure 3.2.3.1

The number of Dunlin roosting in Cardiff Bay in relation to tide height. Only numbers noted on the main observation days are shown. Bars=numbers of birds. --+-- =tide height.

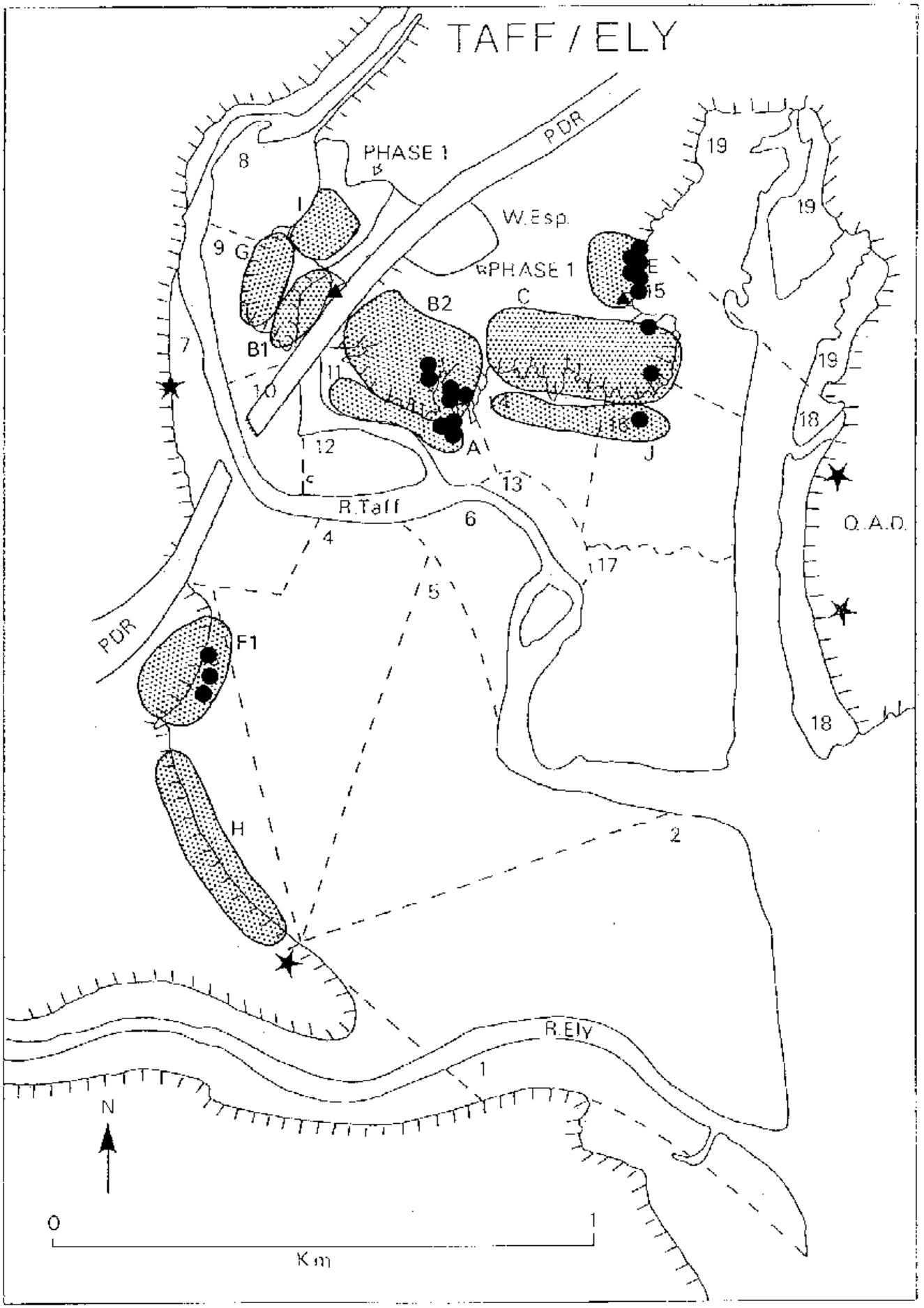

Figure 3.2.3.2 Roost sites used by Dunlin flocks in Cardiff Bay. Only sites used by flocks of over twenty birds during the study period are shown. Triangles represent night roosts.

DUNLIN

Position of Roosting Flocks at High Tide

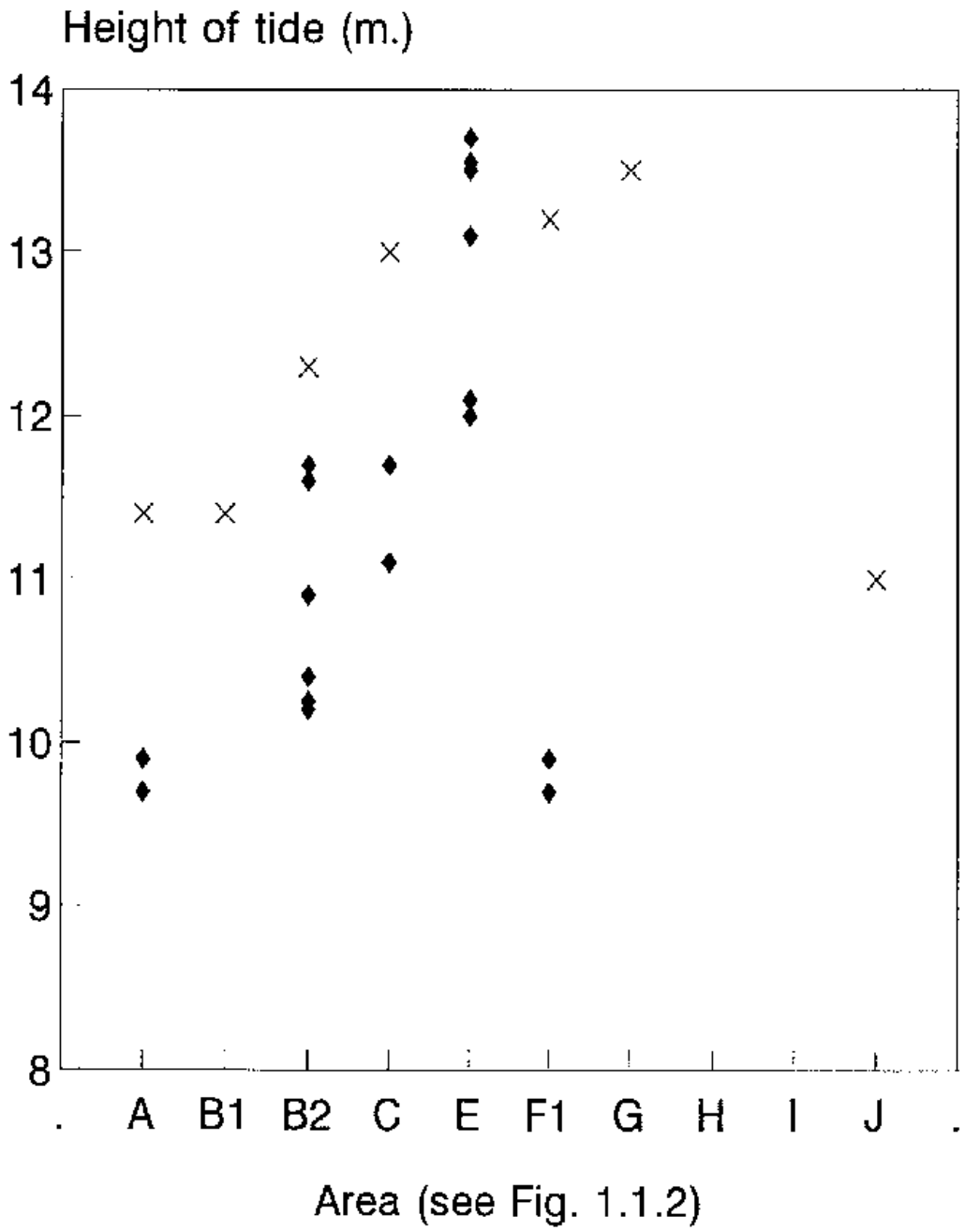

Figure 3.2.3.3
The distribution of roosting Dunlin in relation to tide height.
More than one roost was used on some tides. X=Area covered.

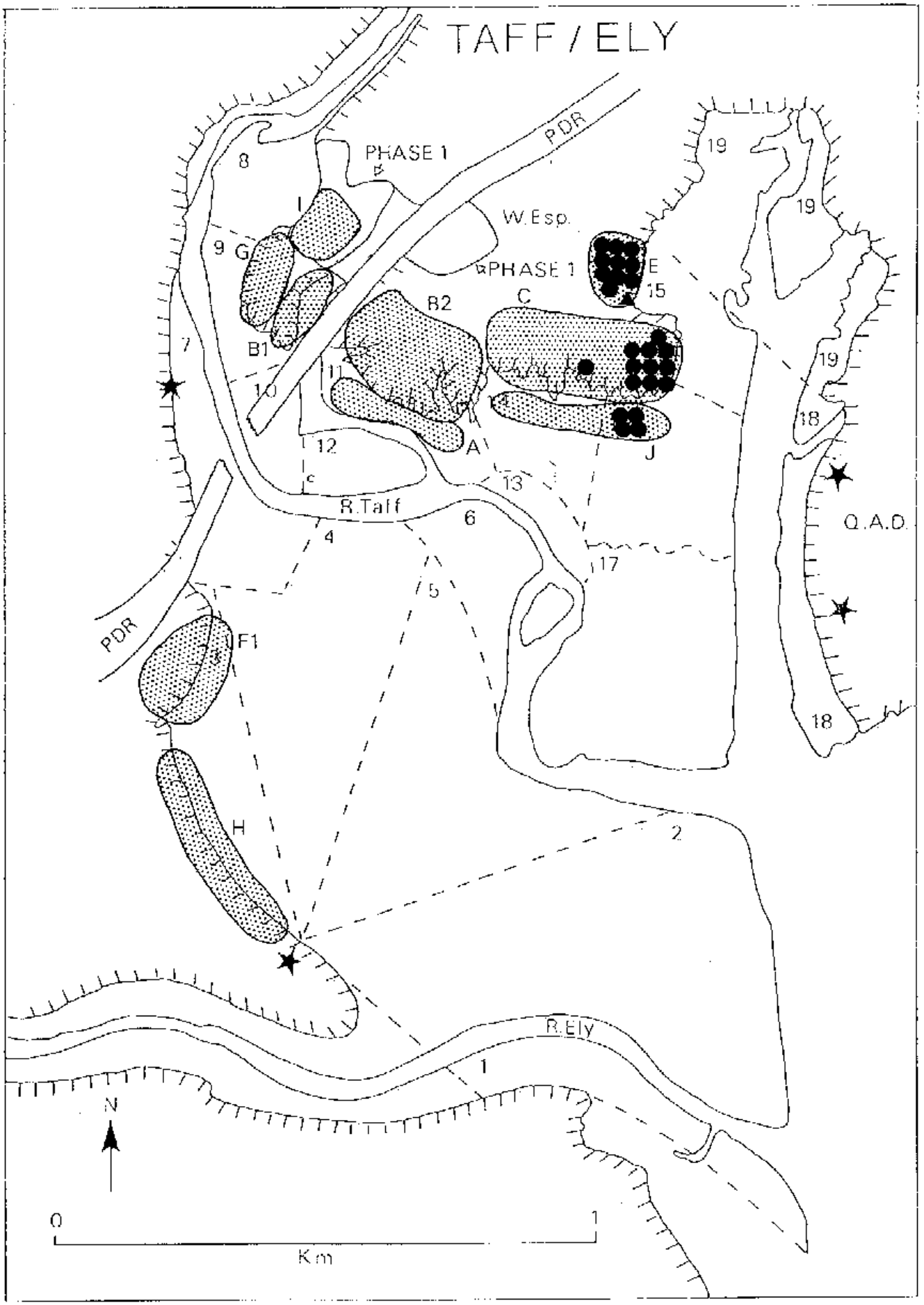

Figure 3.2.4.1 Roost sites used by Curlew flocks in Cardiff Bay. Only sites used by flocks of over twenty birds during the study period are shown. Triangles represent night roosts.

CURLEW

Position of Roosting Flocks at High Tide

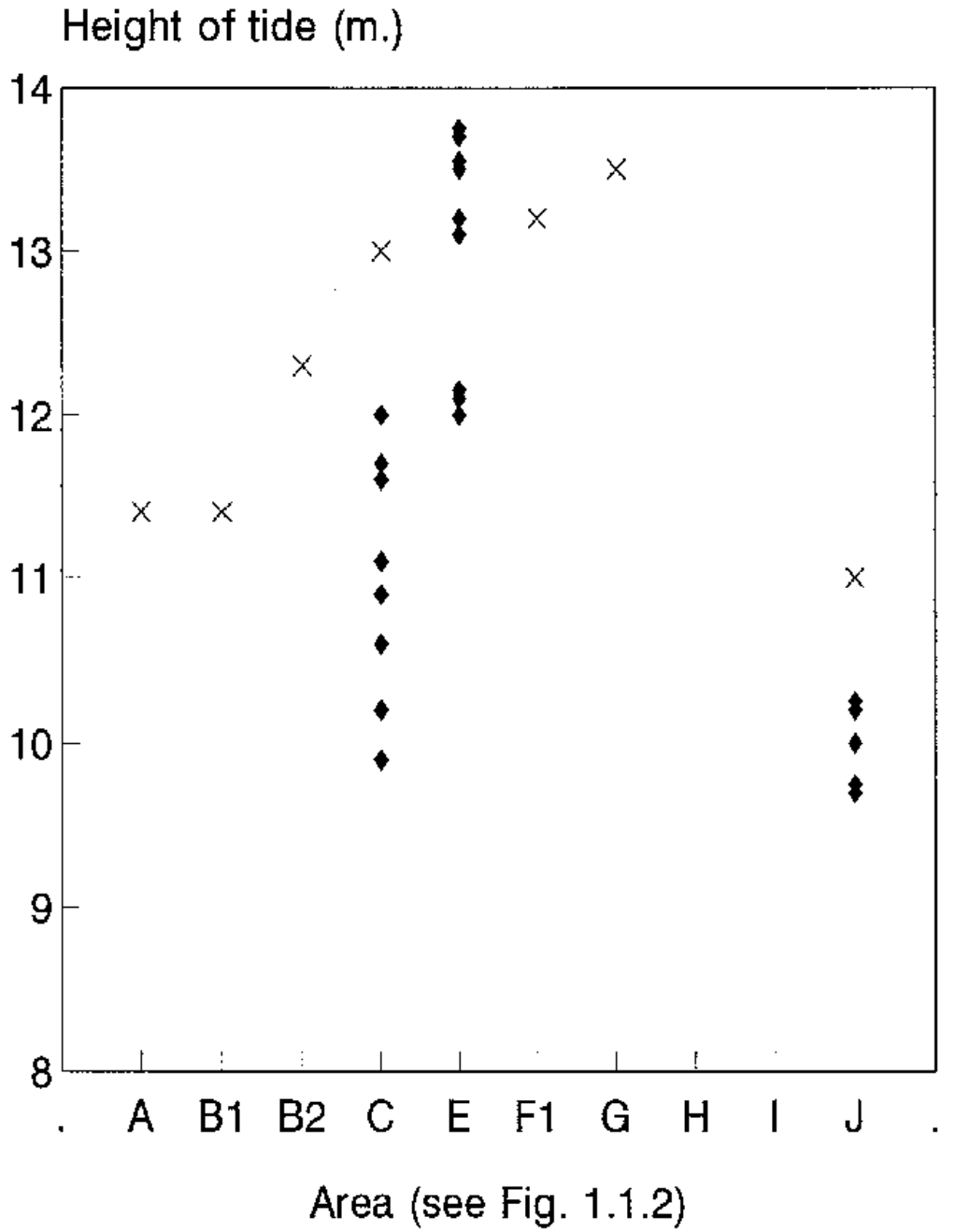

Figure 3.2.4.2
The distribution of roosting Curlew in relation to tide height.
More than one roost was used on some tides. X=Area covered.

REDSHANK

Number of birds Roosting in Cardiff Bay

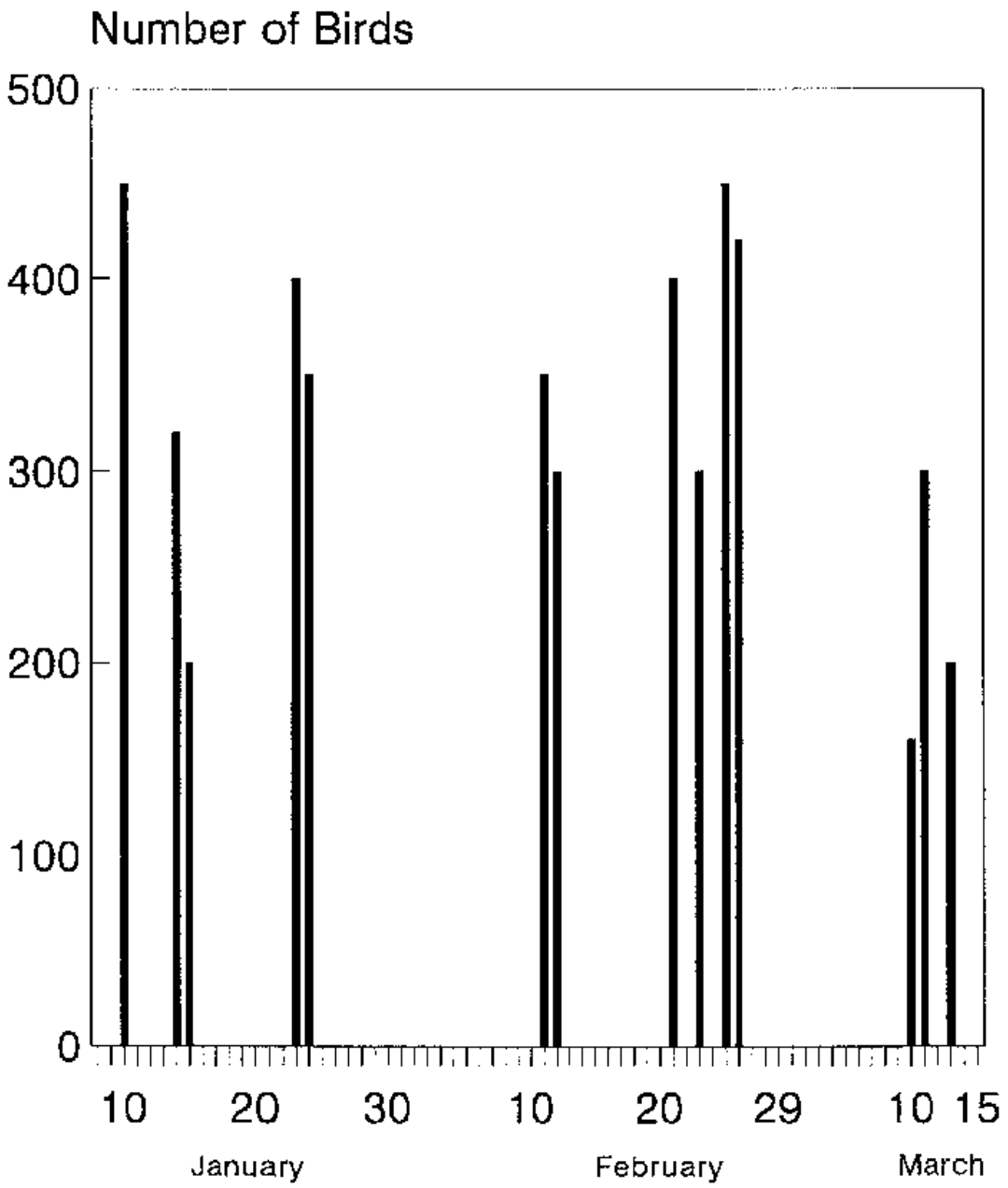

Figure 3.2.5.1
The number of Redshank roosting in Cardiff Bay.
Only numbers noted on the main observation days are shown.

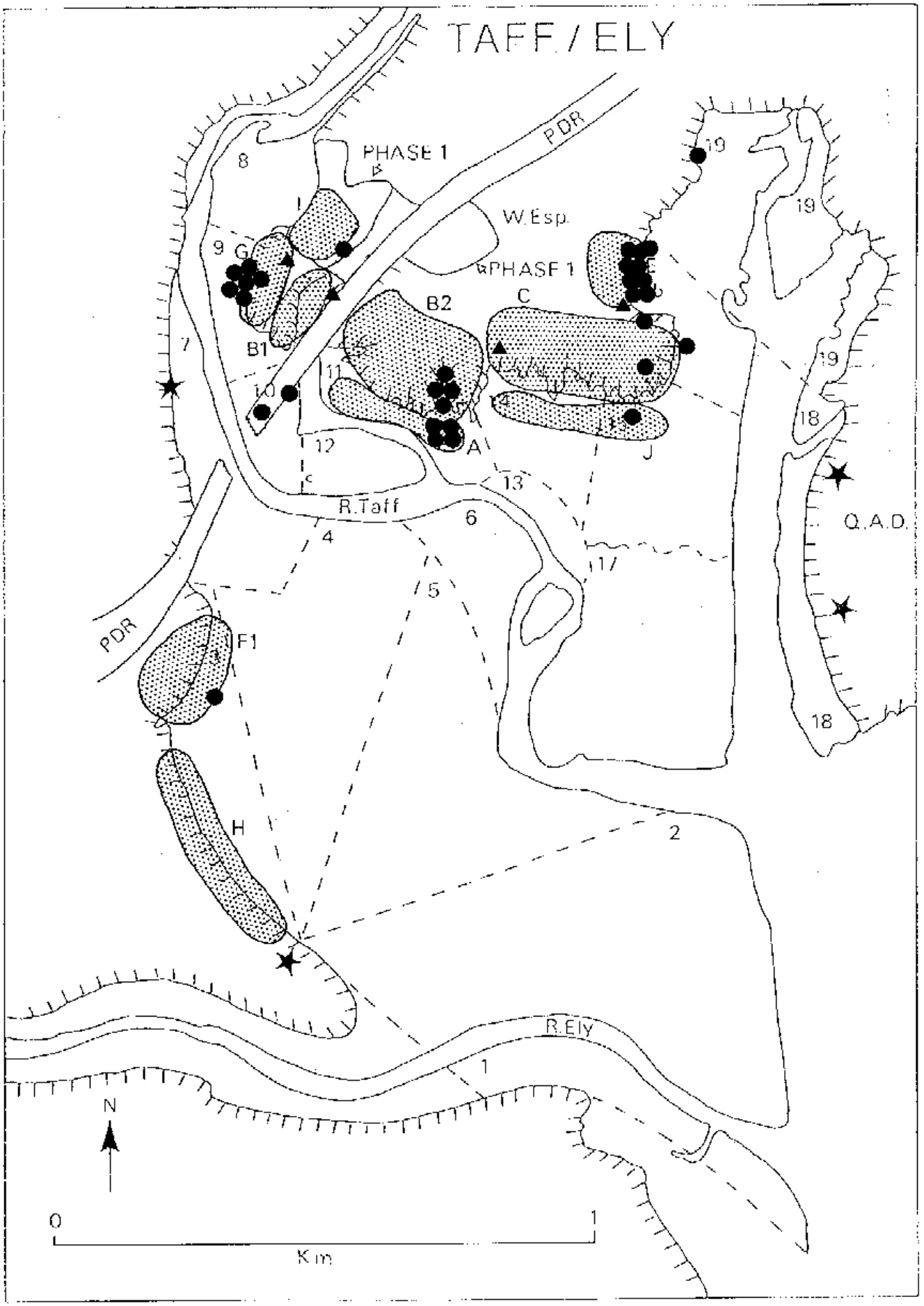

Figure 3.2.5.2 Roost sites used by Redshank flocks in Cardiff Bay. Only sites used by flocks of over twenty birds during the study period are shown. Triangles represent night roosts.

REDSHANK

Position of Roosting Flocks at High Tide

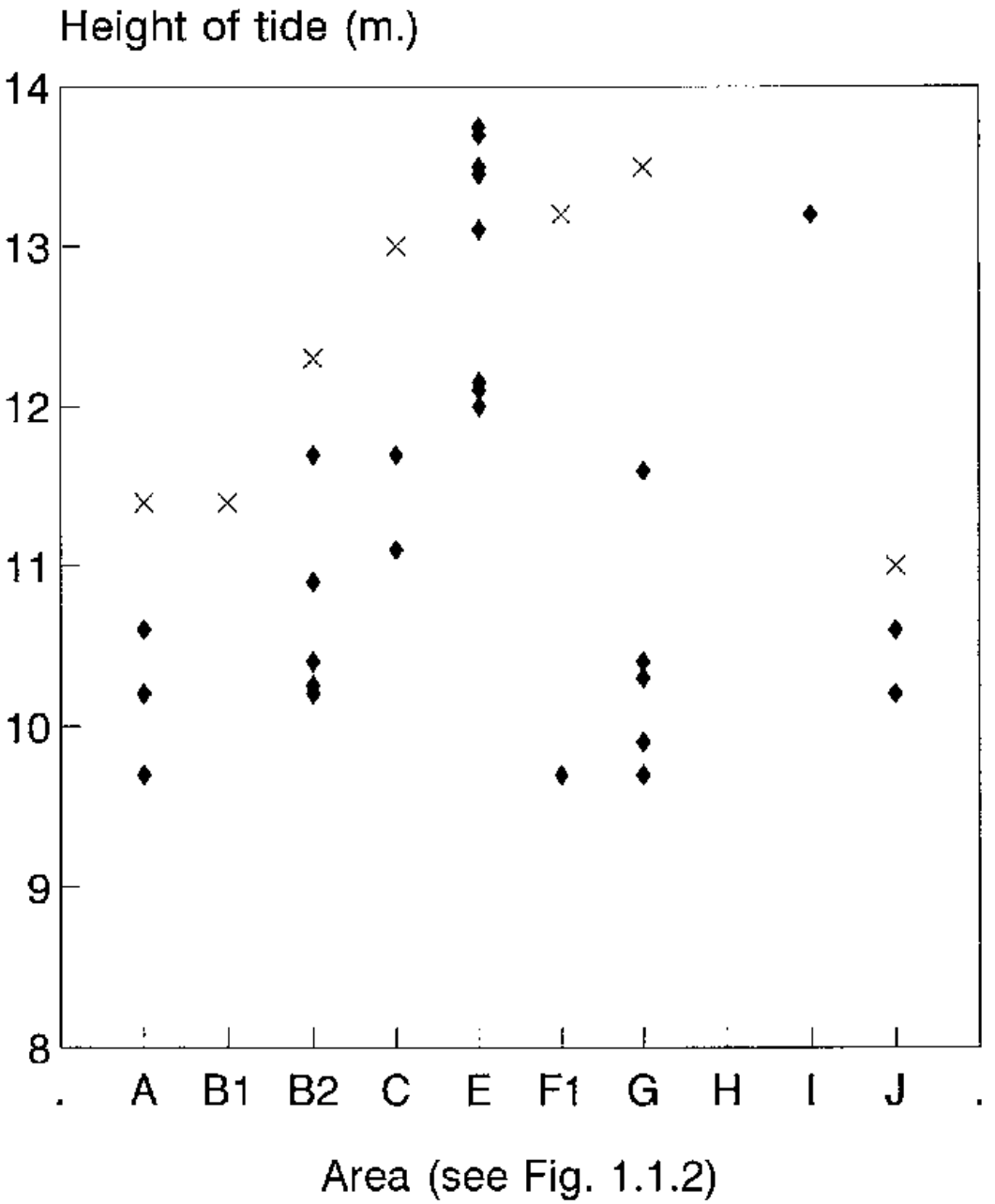

Figure 3.2.5.3
The distribution of roosting Redshank in relation to tide height. More than one roost was used on some tides. X=Area covered.

REDSHANK

The Distribution of the Roosting Flock on Different Heights of Tide

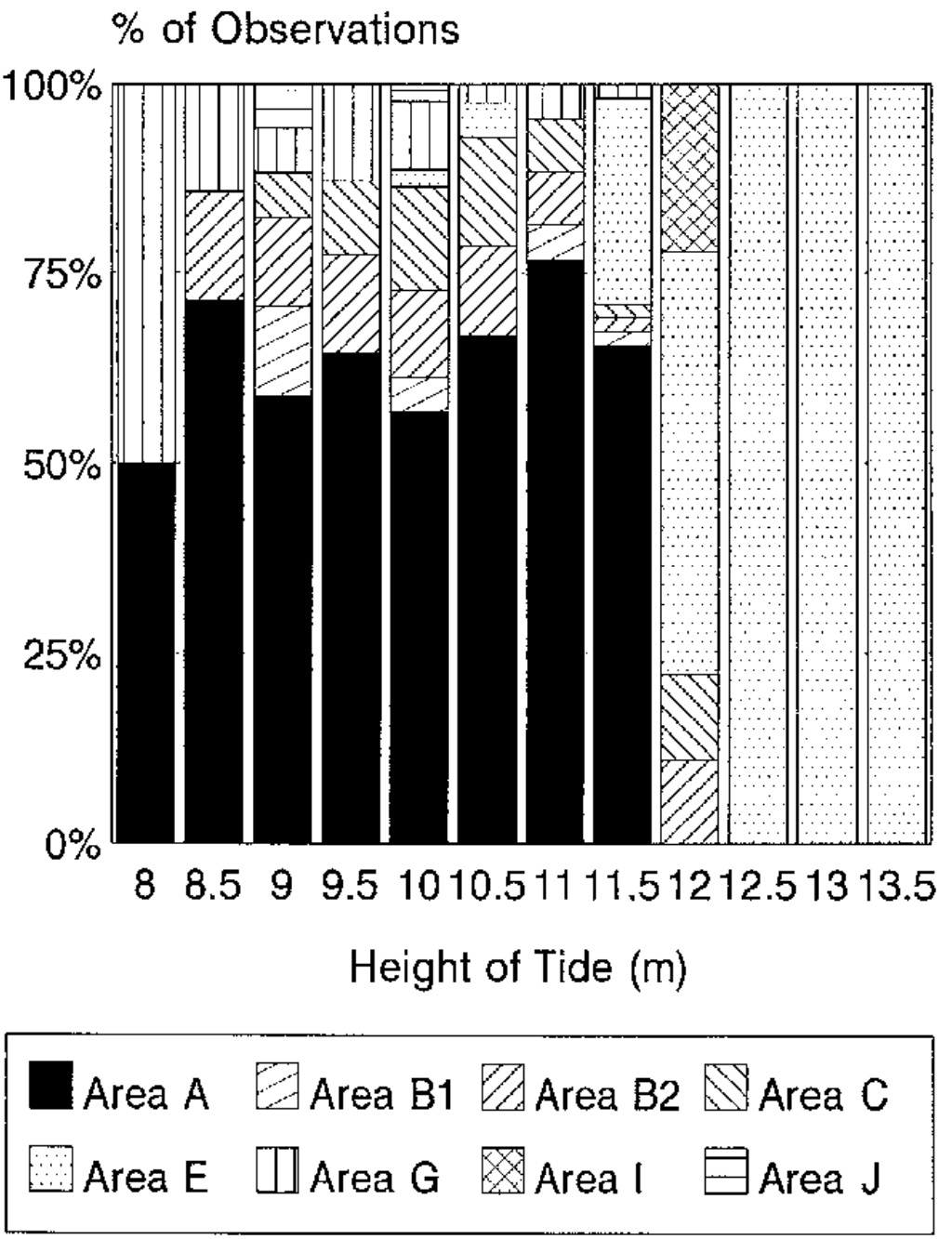

Figure 3.2.5.4

The distribution of roosting flocks of Redshank on different heights of tide. Observations are drawn from both neap and spring tides. Two records when the PDR mound was used are not included.

REDSHANK

The proportion of Observations in Each Tide Height Class

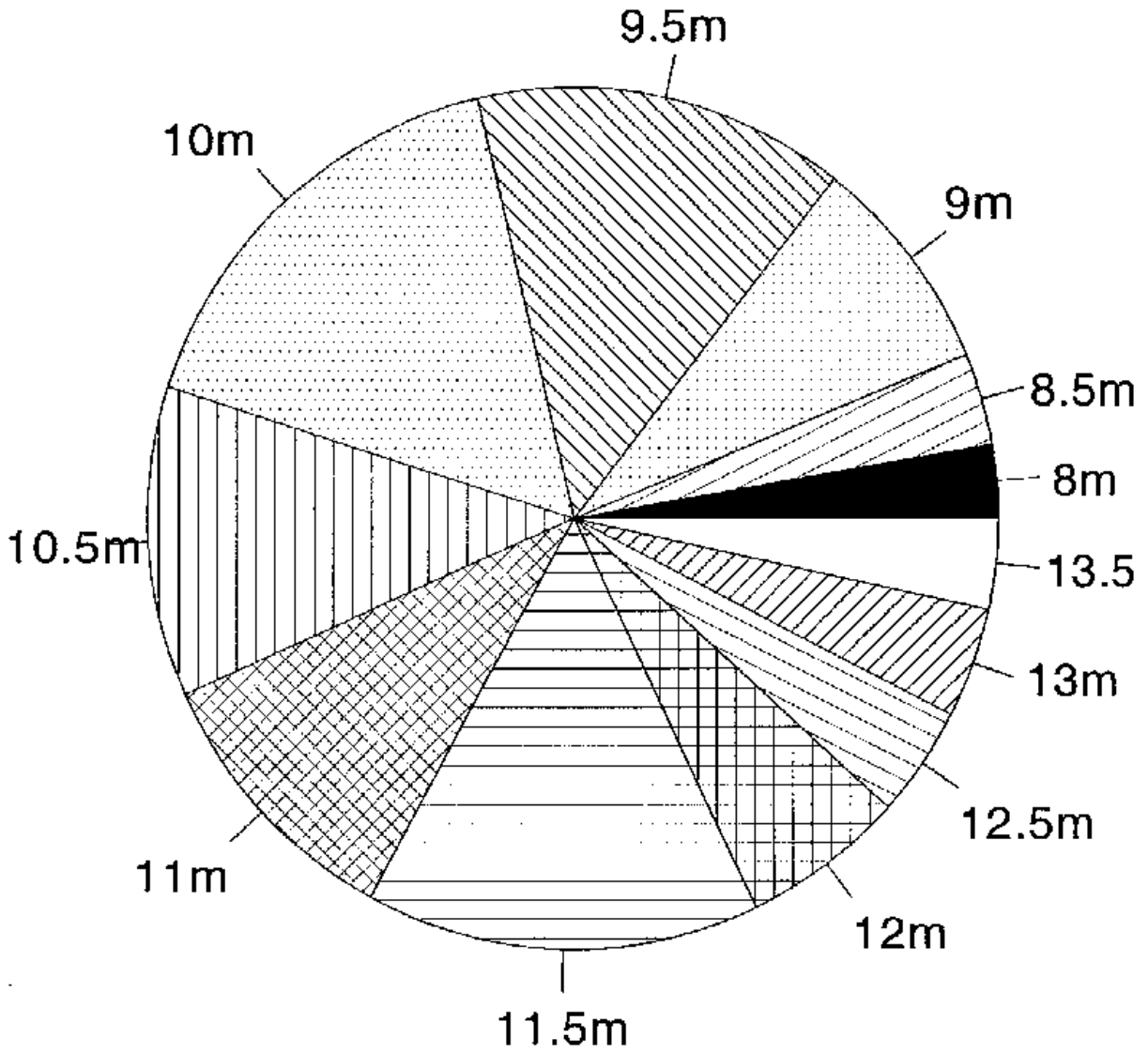

Figure 3.2.5.5
The frequency of tide height classes used in the production of Figure 3.2.5.4
n=146