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North Morecambe Project, Baseline Ornithological Survey, 1991/92 and 1992/93 Winters.

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1. EXECUTIVE SUMMARY

The development of the North Morecambe Gas Field in the Irish Sea necessitates laying a new pipeline to connect the Gas Field with an expansion of the existing Barrow Gas Reception Terminal. The pipeline will traverse Walney Island and the South Walney and Piel Channel Flats SSSI.

The intertidal flats around Walney Island form part of the Morecambe Bay complex which is one of the most important estuaries in Britain for its wintering waders and wildfowl.

This report comprises a summary of two winters fieldwork by the British Trust for Ornithology for British Gas studying the behaviour of feeding and roosting waders and wildfowl in the vicinity of the pipeline route. This report is a supplement to a joint BTO and Natural History Museum report (George *et al.* 1992).

Several counts were carried out at low tide of the number, species and behaviour (feeding or roosting) of waders and wildfowl on the intertidal flats between Barrow-in-Furness and Piel Island. This was to provide data on the general distribution of birds in the area and in doing so put more detailed studies adjacent to the pipeline route into context. The results of this showed that at low tide Roosecote Sands was of particular importance for feeding Shelduck, Oystercatcher, Grey Plover, Knot, Dunlin and Redshank as well as holding large numbers of roosting Golden Plover and Lapwing.

More detailed counts were also carried out within transects parallel to the pipeline route on three sites: on the intertidal flats adjacent to the landfall site at Westfield, on Snab Sands and on Walney foreshore. Each of these sites differed in their habitat type. In order to assess the effects of laying a pipeline across intertidal flats the proportional changes in bird densities and usage across the transects before and after construction needs to be compared. The data presented here provides a pre-construction baseline.

Within the transects around the pipeline route, the Westfield site was an important feeding area for Knot, Dunlin, Bar-tailed Godwits and Curlew; Snab Sands held large numbers of feeding Knot, Dunlin and Redshank; and the Walney foreshore site was the most important area for feeding Oystercatcher and Turnstone.

The following species were present in either even densities across the site transects or in high enough numbers to potentially show any possible effects of laying the pipeline.

Westfield: Oystercatcher, Grey Plover, Knot, Dunlin, Bar-tailed Godwit and Curlew.

Snab Sands: Shelduck, Oystercatcher, Knot, Dunlin, Curlew and Redshank.

Walney foreshore: Oystercatcher, Turnstone and Curlew.

As Oystercatcher and Curlew were both present at all three study sites, it may also be feasible to assess possible differences in the effects of laying the pipeline on different habitats.

2. INTRODUCTION

This report is a summary of two winters (1991/92 and 1992/93) ornithological fieldwork relating to the laying of a new pipeline by British Gas as part of the development of the North Morecambe gas field in the Irish Sea. The pipeline will cross intertidal areas as it traverses Walney Island and then South Walney and Piel Channel Flats SSSI crossing Snab Sands, the Walney Channel and the foreshore between Concle Bank and Ridding Head Scar at Westfield. The intertidal flats around south Walney Island form part of the Morecambe Bay complex, which is the second most important site in Britain for its wintering waders and wildfowl. The Natural History Museum was contracted by British Gas to carry out a full ecological survey of the area in the vicinity of the pipeline. One of the objectives of this ecological survey was to provide baseline data to enable assessment of the ecological impacts of laying the pipeline. As part of this objective the British Trust for Ornithology was contracted to carry out a baseline survey of the feeding and roosting behaviour of waders and wildfowl.

Ornithological fieldwork was carried out during the 1991/92 winter, and in spring and autumn 1993. The results from this survey and the Natural History Museum vegetation and invertebrate surveys are presented in a joint report (George *et al.* 1992) The ornithological survey was carried out on three sites using transects parallel to the pipeline route. These transects required marking out with stakes. However, as a result of the delay in setting up the site and the poor weather which followed less usable data was collected during the 1991/92 winter than was anticipated. This was particularly so for the site on Walney foreshore which had to be relocated after an alteration in the pipeline route in mid-March. Insufficient data could be obtained on this site during the remainder of March to be included in the report. It was therefore decided that further winter fieldwork was required, to be submitted in this supplementary report.

3. METHODS

Detailed accounts of the methods of data collection and analysis are described in George *et al.* 1992 which should be read prior to this supplement. The same methods were used for this report unless otherwise stated.

3.1 Data Collection

All day counts

Counts were carried out throughout the tidal cycle within the same transect lines set up the previous winter. The only alteration was on site 1 at Westfield (Figure 3.1.1). The lower mudflats at Westfield had originally been counted separately in case further invertebrate samples were taken on the lower shore and correlative bird counts were required. As this did not occur it was decided that it was superfluous to have two divisions on the lower shore and in the 1992/93 these were counted as one count area.

Further counts throughout the tidal cycle were proposed and carried during the 1992/93 winter, between December and February, although the majority were completed in January. These were as follows:

Site 1 Westfield

All day counts covering three full tidal cycles in the 1992/93 winter.

Site 2 Snab

Counts during the 1991/92 winter showed that few birds remained on this site over the low tide period. It was therefore proposed that three further counts restricted to the high tide period should be carried out in the 1992/93 winter.

Site 3 Walney foreshore

As this site held the least data from the 1991/92 winter, all day counts covering four complete tidal cycles were proposed and carried out.

Low Tide Counts

Three low tide counts were proposed and carried out during the 1992/93 winter. Count areas remained the same as previous surveys but count areas I, J and K were not included in this survey (Figure 3.1.2). These areas are mostly composed of saltmarsh with deep channels obscured from an observers view. Previous counts have only therefore give an indication of birds feeding and roosting on the visible upper part of the marsh. Numbers of species such as Redshank and Curlew which often feed along channels may well be underestimated in this area. It was not thought therefore that the time spent in counting these areas was justified by the accuracy of counts.

3.2 Data Analysis

A full account of the methods of data analysis is presented in the previous report (George *et al.* 1992).

All day counts

Data from 1991/92 and 1992/93 winters were combined into one data set and the format e.g. of count areas on Westfield made uniform. It should be remembered that, as in the first report, density refers to the average number of bird hours/tidal cycle/hectare and is therefore an indication of density and usage.

Low tide counts

Again, data from both winters were combined into one data set. Although only three counts are presented here, whenever time and tide state allowed extra counts were carried out to increase accuracy. As these did not represent a complete low tide count covering all areas, additional counts of individual count areas were averaged with the nearest 'official' low tide count of that count area.

4. SPECIES ACCOUNTS FOR THE 1991/92 AND 1992/93 WINTERS.

A summary of the low tide counts is given in Tables 4.1 and 4.2. As it was not possible to carry out the low tide counts on the same dates in both winters it is not possible to directly compare the 1991/92 winter with the 1992/93 winter. However, numbers can be seen to be broadly similar and although variation between winters may have some influence on any differences in the data presented here, these differences can mainly be attributed to the increased data set reducing variability.

4.1 Shelduck

Figure 4.1.1 shows a very similar pattern to that found in the 1991/92 winter. The highest density of Shelduck were present on Roosecote Sands, part of the Westfield site, and a lower but even density of birds spread along the saltmarsh on the Snab site. Shelduck were not observed on the Walney foreshore site.

Numbers and patterns over the tidal cycle also remained very similar, with peaks of around 300 on Westfield and 150 on Snab (Figure 4.1.2). The increased data set has noticeably reduced the variability between counts at Westfield and therefore the error bars, as well as producing a more gradual change in numbers over the tidal cycle. Shelduck continued to move onto the site for the first four or five hours after high tide, peaking at around 300 birds, a high percentage were feeding during this time. The percentage of birds feeding dropped sharply before low tide, possibly as birds became satiated. Shelduck also started to move off the site around this time and with the fall in numbers the relative proportion of birds feeding correspondingly rose.

The distribution pattern at low tide remained very similar (Figure 4.1.3) with the highest numbers of Shelduck present on Roosecote Sands.

4.2 Wigeon

The density and distribution of Wigeon remained very similar. Low densities were observed along the saltmarsh at Snab and the northern end of the Westfield site (Figure 4.2.1). Further data noticeably reduced the variability between counts and produced a clearer pattern over the tidal cycle, especially on the Westfield site (Figure 4.2.2). Numbers on Westfield generally increased to a peak of around 170 just before low tide, with the majority of these birds roosting. Numbers fell from low tide onwards but an increased proportion were feeding on the site. The number and pattern at Snab remained the same. No Wigeon were recorded on the Walney foreshore site. Low tide counts did not noticeably differ with further data (Figure 4.2.3).

4.3 Pintail

As before, Pintail were only recorded using the Snab site but in lower numbers, with a peak of around 40 birds feeding and roosting on the site over the high tide period (Figure 4.3.1).

4.4 Oystercatcher

The 1992/93 fieldwork showed that high densities of feeding Oystercatcher used the Walney foreshore site, particularly on the northern half (Figure 4.4.1). Low densities of Oystercatcher were also observed feeding along the saltmarsh at Snab over the high tide period in 1992/93 which had not been recorded in 1991/92. Slightly higher densities were recorded on the northern transects of the Westfield site.

Figure 4.4.2 shows that the increased data set reduced the variability between counts previously shown on the Westfield site. Numbers peaked just before low tide at around 600 birds, slightly higher than that recorded in the 1991/92 winter alone. Further counts over high tide at Snab revealed that on some high tides around 100 Oystercatcher remained feeding on the site.

The number of Oystercatcher on the Walney foreshore site ranged from around 400 to 650 over the tidal cycle. Numbers were high in the two or three hours following high tide, with an increasing percentage of birds feeding, and then fell slightly to circa 400-500 over the low tide period as birds dispersed along the shore. The number of birds increased again on the rising tide as Oystercatcher gathered to roost, mainly on transects 6 and 7. For brief periods small numbers gathered on transect 3, but this was close to the cliff end and birds were easily disturbed. Around 200 birds left the site in the two hours before high tide. Most of these were from the southern transects which became covered at this time and birds moved to join the roost just south of the study site below the car park. This roost was also often disturbed at high tide and birds moved further south along the coast when this occurred.

The pattern of low tide distribution remained broadly similar with the highest numbers of birds recorded on Walney foreshore and Roosecote Sands, although the number on Walney foreshore was much greater with the increased data set (Figure 4.4.3).

4.5 Ringed Plover

As before, small numbers of feeding Ringed Plover (up to 10 birds on average) were recorded in low densities on the Westfield site. They were more widely distributed on the low tide than previously recorded but again in very low numbers (Figure 4.5.1).

4.6 Golden Plover

As in the 1991/92 winter Golden Plover were only recorded on the Westfield site in 1992/93 (Figure 4.6.1). During the 1992/93 winter few Golden Plover were observed feeding and the densities of feeding birds remained low. Roosting birds were often recorded on the upper shore of the extra count area to the south. The largest flock was 195 birds. As shown by Figure 4.6.2 an average around 30 birds were present over much of the tidal cycle, with up to 60 birds present just after low tide. Birds then started to leave the site as the rising tide covered their favoured roost site, in the rocky areas and saltmarsh on the upper shore. Although a high percentage were observed feeding on arrival on the site, just after high tide, the majority of birds only roosted on the site. As shown in Tables 4.1 and 4.2 only roosting Golden Plover were recorded on the low tide counts. These were observed on the Westfield site as already mentioned and in the lower saltmarsh areas of Roosecote Sands, particularly count area Q (Figure 3.1.2).

4.7 Grey Plover

Low densities of Grey Plovers were recorded on virtually all of the transects on all three sites, although only present in very low densities on the Snab site (Figure 4.7.1). Similar densities were found in the 1991/92 winter alone but less widely spread. Although numbers still fluctuated over the tidal cycle on the Westfield site they were much less variable with the increased sample size (Figure 4.7.2). The numbers remained low on the Snab site. Numbers of Grey Plover on the Walney foreshore site peaked at around 30 birds over low tide and slowly decreased on the rising tide. A high proportion of these were recorded feeding. There was only small differences in the low tide distribution of feeding Grey Plover. A second winter's data slightly increased the average number of birds recorded on Roosecote Sands and Walney foreshore (Figure 4.7.3).

4.8 Lapwing

Around 60 birds were observed roosting on the upper shore of the Westfield site towards high tide, often near to the Golden Plover. On the southern end of the Snab site numbers built up over high tide to a peak of around 70 birds just after high tide. As the numbers increased on this site so did the percentage of birds feeding. As with the Golden Plover the majority of Lapwing recorded at low tide were roosting on the saltmarsh around Roosecote Sands.

4.9 Knot

Figure 4.9.1 shows that although there have been slight shifts in the importance of individual transects, the pattern of densities on the Westfield site is similar to before, with very high densities of Knot on several transects. The increased sample size has reduced the variability between counts and produced a clearer pattern over the tidal cycle (Figure 4.9.2). Numbers were generally stable around 1700 on the falling tide, dropping slightly at low tide (possibly due to birds being out of sight on the spring tides) and then rising to an average peak of around 2800 on mid-flood tide. Up to this point a high percentage of Knot were feeding but as the rising tide covered the feeding areas, birds quickly left the site and the percentage feeding also fell.

Further winter work also revealed higher densities of Knot present on the saltmarsh at Snab. These were the result of large flocks of around 3500 Knot feeding on the edge of the saltmarsh around high tide. For this very mobile species, which was occasionally observed in large numbers around low tide in the 1991/92 winter, further work over the full tidal cycle on the Snab site would have been useful.

Around 200 Knot were sometimes feeding on the falling tide, in moderate densities, on the northern half of the Walney foreshore site.

As can be seen from Figure 4.9.3 the most important feeding area for Knot remained on the landfall site at Westfield. The larger sample size also increased the number of

Knot recorded on Roosecote Sands and to a lesser extent the landfall site on Walney foreshore.

4.10 Dunlin

Dunlin showed a very similar pattern on Westfield to that found in 1991/92 alone with high densities found on the lower sections of the northern half of the site and Roosecote Sands (Figure 4.10.1). The increased data set showed a reduced variability over the tidal cycle and a lower average peak of around 5000 just before low tide (Figure 4.10.2).

Although the density of Dunlin on the Snab site remained high it was reduced with two winters data, with up 2000 birds feeding on the saltmarsh edge with the Knot flock around high tide.

Dunlin were only recorded in low numbers on the northern transects of the Walney foreshore site during the all day counts.

There was some change in the pattern of the low tide counts with an increase in the average number of Dunlin feeding on the Westfield landfall site and on Roosecote Sands and a decrease on the Walney foreshore and Snab landfall sites (Figure 4.10.3).

4.11 Bar-tailed Godwits

Low densities of Bar-tailed Godwits were recorded across most of the lower transect areas on the Westfield site (Figure 4.11.1). A second years data also showed low densities on some of the upper transect areas and on Roosecote Sands. The upper transect areas were used when birds were pushed up the shore by the rising tide. Figure 4.11.2 shows a reduced variability between the counts and a lower average peak of around 160 birds on mid-ebb tide after which numbers dropped to around 50. On one occasion around 50 birds were recorded briefly roosting on the Snab site.

As before, Bar-tailed Godwits were recorded within the Westfield study area on the low tide counts, but in the 1992/93 winter they were also observed feeding on the mudflats south of Sheep Island (Figure 4.11.3).

4.12 Curlew

Curlew presented a very similar pattern to that found in the 1991/92 winter in that low densities were present across all the transect areas, although slightly lower densities were recorded on the lower Westfield transects (Figure 4.12.1). This was reflected by the lower average number of Curlew on this site, peaking at around 350 birds before low tide (Figure 4.12.2). The numbers present and percentage of these recorded as feeding were more stable than recorded in the 1991/92 winter alone.

Although the numbers on the Snab site averaged slightly lower than before, around 50 to 70 birds, they remained fairly constant through the tidal cycle.

Between 20 and 35 Curlew were present on the Walney foreshore site through much of the tidal cycle and a high proportion of these were feeding.

As can be seen from the low tide counts, Curlew remained catholic in their use of the count areas, with highest numbers again present within the Westfield landfall site (Figure 4.12.3).

4.13 Redshank

Figure 4.13.1 shows that although small changes in the distribution and density patterns accompanied the larger sample size, the densities of feeding Redshank remained low on the Westfield and Snab study sites. Numbers at Westfield fluctuated between around 20 to 70 birds over the tidal cycle (Figure 4.13.2). This pattern was different to that found in 1991/92 alone, when very few birds were recorded over low tide and numbers reached over 100 at high tide. The high tide counts at Snab in the 1992/93 winter reduced the high error bars previously found and showed that an average of 150 Redshank used the site over the high tide period for feeding and roosting.

Low densities of feeding Redshank were recorded on several transects on the Walney foreshore site and small numbers (10-25 birds) were present over most of the tidal cycle, leaving at high tide.

As can be seen from Figure 4.13.3 the largest numbers of feeding Redshank were again recorded on the Roosecote Sands area at low tide, away from the pipeline route. However, as mentioned above the Snab landfall site is an important site for Redshank during the high tide period.

4.14 Turnstone

Figures 4.14.1 and 4.14.2 show that there were still low densities of Turnstone feeding on some of the upper shore transects at Westfield, with up to 20 birds present towards high tide.

However, on the Walney foreshore site moderate densities of feeding Turnstone were recorded on several of the transects. The numbers of Turnstone on this site varied at different points of the tidal cycle. Around 80 birds were observed just after high tide and numbers gradually fell towards low tide. This may have been due to Turnstone dispersing along the shore and some moving off the study site but it may also be due to birds being missed as they moved further down the shore level and became increasingly difficult to detect on the uneven rocky shore. Numbers rose again with the rising tide to reach an average peak of around 110 birds on mid-flood tide. As the tide level rose transect 3 (just north of Hillock Whins) was the first to become covered. Turnstone and Oystercatcher which were pushed up the shore tended to get separated into two groups on either side of this. The group to the south were eventually pushed outside the study site by the advancing tide, reducing the number present within the study site. Around 45 birds remained on the site over high tide feeding along the tide edge or strand line.

As can be seen from Figure 4.14.3, the Walney foreshore landfall site was the most important feeding area for Turnstone within the area covered by low tide counts.

5. DISCUSSION

In general a second winter's data did not change the bird distribution patterns described in the first report (George *et al.* 1992). However many of the results from the first winter showed a high degree of variability. This variability was reduced when the data set was increased by the inclusion of a second winter's data.

As can be seen from a summary of the low tide counts (Figure 5.1), Roosecote Sands and the Westfield study site held the highest numbers of birds within the area. Roosecote Sands was of particular importance for feeding Shelduck, Oystercatcher, Grey Plover, Knot, Dunlin and Redshank. Roosecote Sands also held large numbers of roosting Golden Plover and Lapwing at low tide. Within the transects around the pipeline route, the Westfield site was an important feeding area for Knot, Dunlin, Bar-tailed Godwits and Curlew; Snab Sands held large numbers of feeding Knot, Dunlin and Redshank; and the Walney foreshore site was the most important area for feeding Oystercatcher and Turnstone.

As mentioned above the increased sample size of two winters showed a reduction in the variability between counts. This was particularly evident in the patterns of how birds used the site over the tidal cycle. With only the first years data it was difficult to detect similarities between species or sites, apart from an increase in numbers on the Snab site over high tide.

However, a second winter's data shows that several species present on the Westfield site showed a peak in numbers before low tide. This may be due to birds arriving from roost sites as feeding areas within the study site become exposed on the falling tide, and later on dispersing along the shoreline onto intertidal areas outwith the study site. Flocks of Dunlin, Knot and Bar-tailed Godwits feeding on this site were observed being disturbed by a Peregrine on occasions and would either eventually resettle within the study site or on Roosecote Sands. This produced a natural variability in numbers of birds on the site between hours. Oystercatcher, Grey Plover, Knot, Dunlin, Bar-tailed Godwits and Curlew were all present, either in even densities or in high enough numbers to detect possible differences post construction.

During the further counts on the Snab site birds were again recorded arriving on the site over high tide. Large flocks of Dunlin and Knot were observed feeding along the edge of the saltmarsh on neap high tides. Birds present on the edge of, or in, the saltmarsh were difficult to detect and count accurately but the data is thought to be reasonably accurate. As on the Westfield site, flocks of Dunlin and Knot were sometimes disturbed by Peregrine and Merlin hunting over the saltmarsh. The numbers of birds present at high tide also varied depending on the height of the tide. On a spring tide the whole of the saltmarsh area was covered. Exceptionally high tides occurred in early January after a few days of south westerly gales which coincided with spring tides. On these days parts of the road by Snab Sands was also covered at high tide and no areas were exposed for waders. The area was however still used by Shelduck and Wigeon feeding on areas where the water was shallow enough for them to upend and feed on/from vegetation attached to the substrate. Waders were forced to roost on nearby fields and Sheep Island. It was considered that Shelduck, Oystercatcher, Knot, Dunlin, Curlew and Redshank were all present either in even densities or in high enough numbers to possibly detect any substantial effects caused by the construction of the pipeline.

The Walney foreshore site was the most important area for feeding Oystercatcher and Turnstone. Oystercatcher occurred in very high densities (up to 250 bird hours/ha.) on three transects and in moderate to high densities on the other transects. It was also an important area for around 500 roosting Oystercatcher at high tide. Densities of Turnstone reached 10 to 49 bird hours/ha. on five of the transects. Although these densities may appear low relative to Oystercatcher, it should be remembered that Turnstone also have a relatively lower qualifying level for national importance and the numbers and densities on this site represent quite an important feeding site for this species. Both Oystercatcher and Turnstone were present in high enough numbers and spread over enough transects to detect any possible effects of the pipeline construction.

Curlew was the only species present in relatively even densities spread across all the transects on all the sites. Although it was only recorded in low densities it may be possible to show any differences in the possible effects of the pipeline construction on different habitats.

6. FURTHER RECOMMENDATIONS

1. It is recommended that the birds surveys are repeated after construction of the pipeline in order that possible changes in bird densities can be monitored. This should be done in conjunction with a repeat of other intertidal monitoring programmes. If it is to be done within one winter then a similar number of counts to those done in the 1991/92 and 1992/93 winters combined should be carried out to reduce the variability shown by a small data set.

7. REFERENCES

George,J.D., Tittley,I., Warbrick,S., Evans,N.J., Muir,A.I., Chimonides,P.J. & Spurrier,C. 1992. *North Morecambe Project, baseline ecological survey 1991/92.* A report for British Gas Exploration and Production Limited. The Natural History Museum, London, and the British Trust for Ornithology, Thetford: Vol 1, 116 pages; Vol 2, 104 pages.

8. ACKNOWLEDGEMENTS

I would like to thank Dr. R.H.W. Langston and Dr. N.A. Clark for contract management, Miss S. Foulger for help with report production and Mr. R. Treen for volunteering to help with low tide counts. Thanks also to the British Gas survey team for staking out transects on the study sites.

WINTER COUNTS 1991/92	COUNT 1 16-23 Jan 1992			COUNT 2 25-27 Feb 1992			COUNT 3 28 Mar 1992		
SPECIES	F	R	T	F	R	T	F	R	T
Shelduck	903	104	1007	276	126	402	316	62	378
Wigeon	55	63	118	100	0	100	0	0	0
Mallard	0	0	0	2	47	49	0	4	4
Pintail	0	0	0	0	10	10	2	0	2
Eider	0	1	1	0	0	0	0	0	0
Red-b. Merganser	0	0	0	1	0	1	0	0	0
Oystercatcher	1564	542	2106	587	63	650	136	84	220
Ringed Plover	1	0	1	11	0	11	2	0	2
Golden Plover	0	185	185	0	0	0	0	438	438
Grey Plover	62	0	62	76	0	76	62	0	62
Lapwing	40	102	142	0	380	380	0	78	78
Knot	2295	2000	4295	366	440	806	850	0	850
Dunlin	4803	0	4803	6648	2500	9148	320	0	320
Snipe	0	0	0	0	0	0	14	0	14
Bar-tailed Godwit	1	0	1	131	0	131	10	0	10
Curlew	313	60	373	525	280	805	133	115	248
Redshank	422	3	425	636	8	644	618	1	619
Turnstone	8	0	8	0	0	0	0	0	0

Table 4.1 A summary of the low tide counts during January, February and March 1992 (F = Feeding, R = Roosting and T = Total).

WINTER COUNTS 1992/93	COUNT 1 1-5 Dec 1992			COUNT 2 10-19 Jan 1993			COUNT 3 30 Jan-3 Feb 1993		
SPECIES	F	R	T	F	R	T	F	R	T
Shelduck	539	210	749	633	54	687	527	320	847
Wigeon	0	300	300	10	0	10	4	17	21
Mallard	0	0	0	0	3	3	0	0	0
Pintail	0	0	0	0	0	0	0	0	0
Eider	0	0	0	6	50	56	0	0	0
Red-b. Merganser	0	0	0	0	0	0	0	0	0
Oystercatcher	1288	200	1488	838	298	1136	1708	385	2093
Ringed Plover	9	30	39	20	0	20	37	0	37
Golden Plover	0	580	580	0	0	0	0	397	397
Grey Plover	153	0	153	11	6	17	94	11	105
Lapwing	30	154	184	0	7	7	0	15	15
Knot	500	60	560	5950	0	5950	2157	0	2157
Sanderling	0	0	0	0	0	0	4	0	4
Dunlin	4086	0	4086	5050	0	5050	10546	0	10546
Snipe	0	0	0	0	0	0	0	0	0
Bar-tailed Godwit	0	0	0	4	0	4	185	0	185
Curlew	301	175	476	173	95	268	425	86	511
Redshank	176	0	176	156	0	156	655	0	655
Turnstone	0	0	0	19	0	19	68	0	68

Table 4.2 A summary of the low tide counts during December, January and February 1993 (F = Feeding, R = Roosting and T = Total).

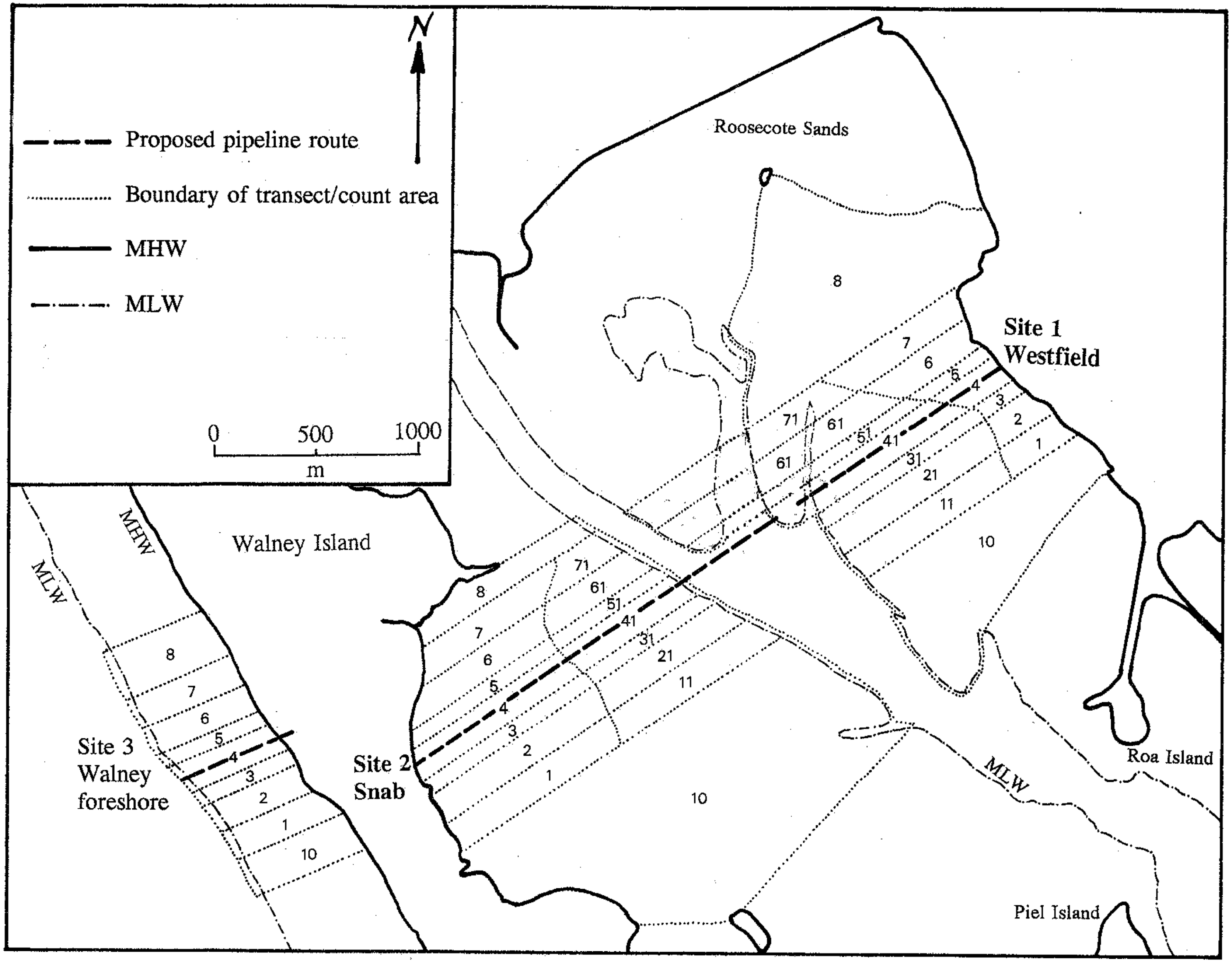

Figure 3.1.1 Site map of pipeline transects.

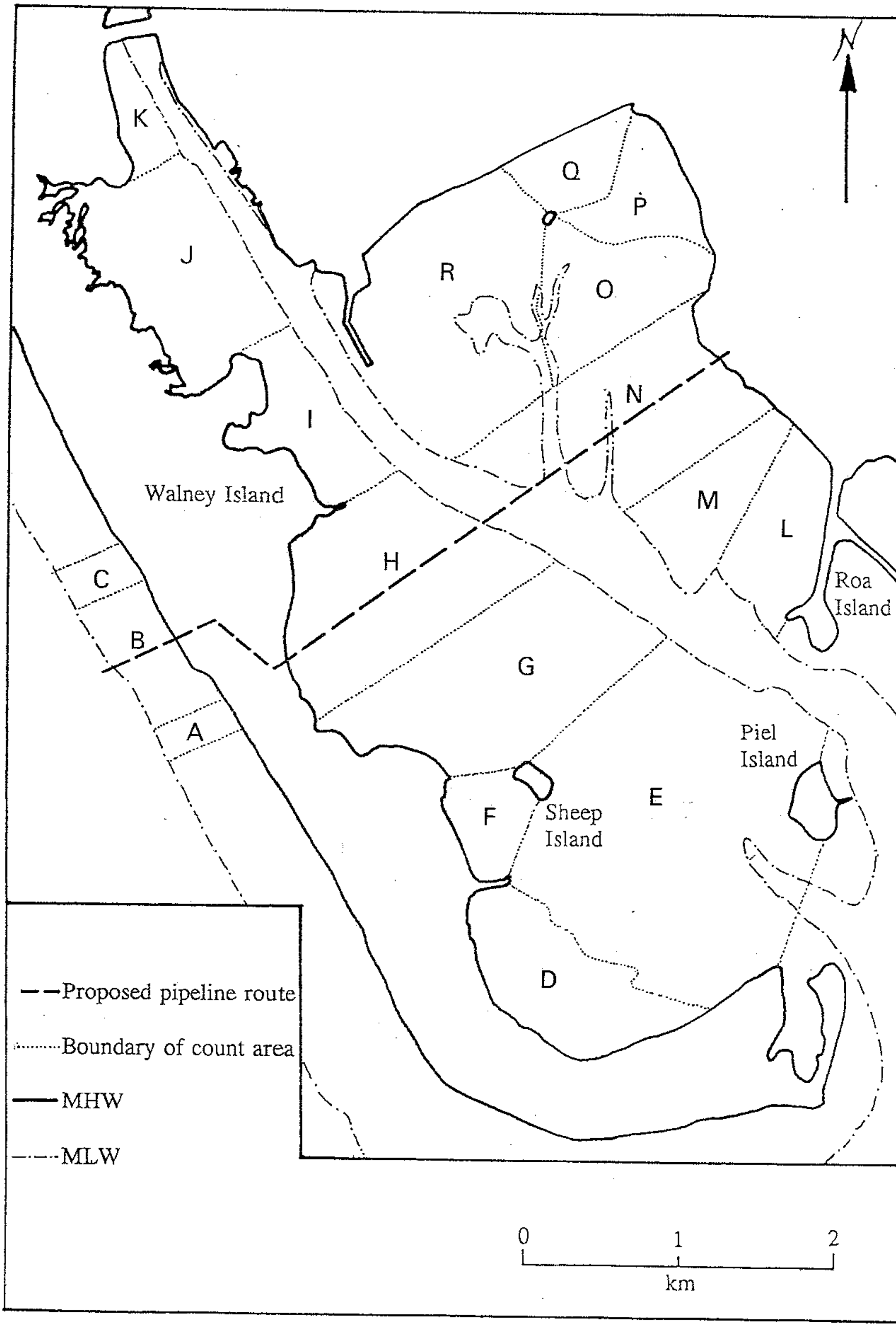

Figure 3.1.2 Site map for the low tide survey.

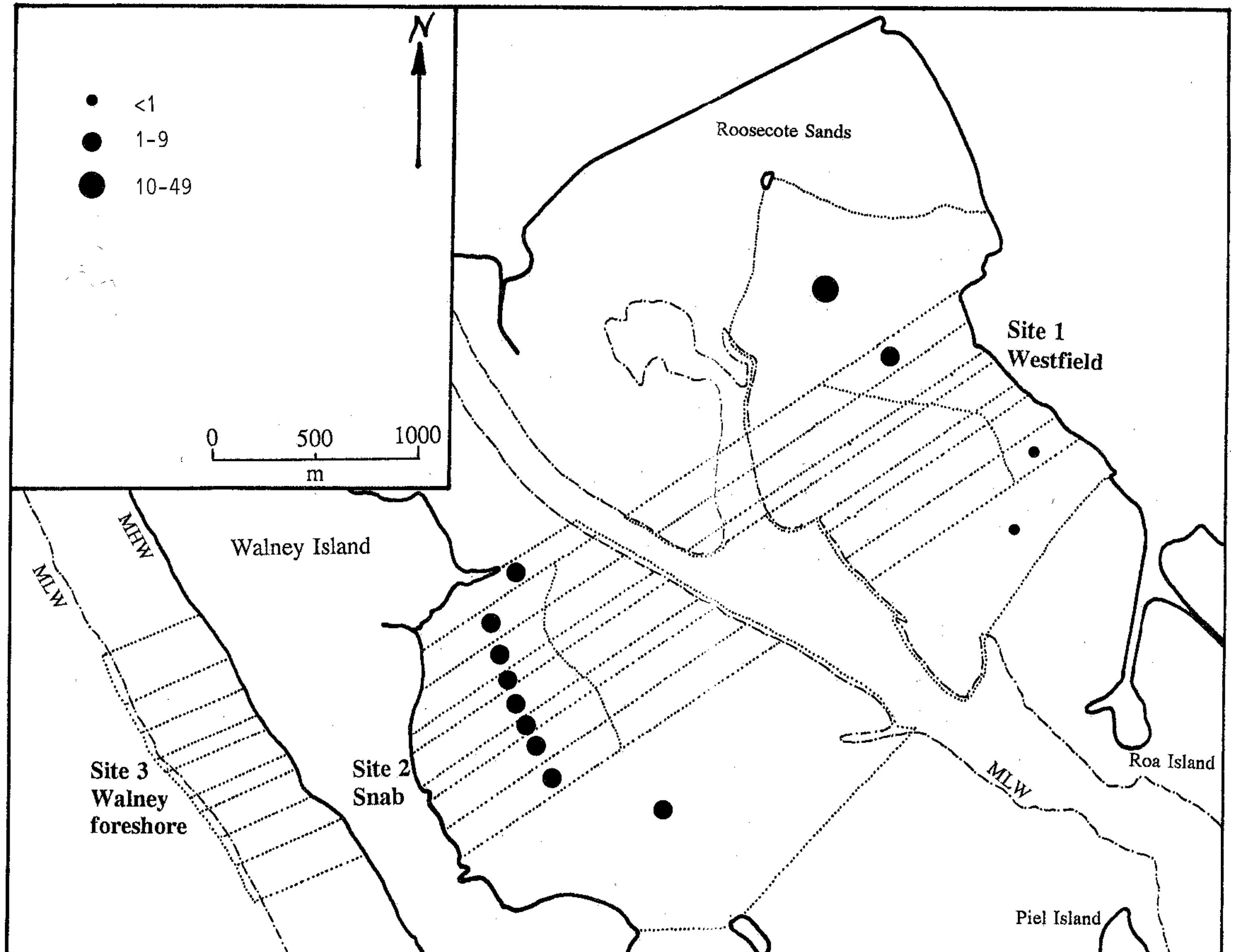

Figure 4.1.1 The average density (bird hours/ha) of Shelduck feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

SHELDUCK, WINTERS 1991/92 & 1992/3

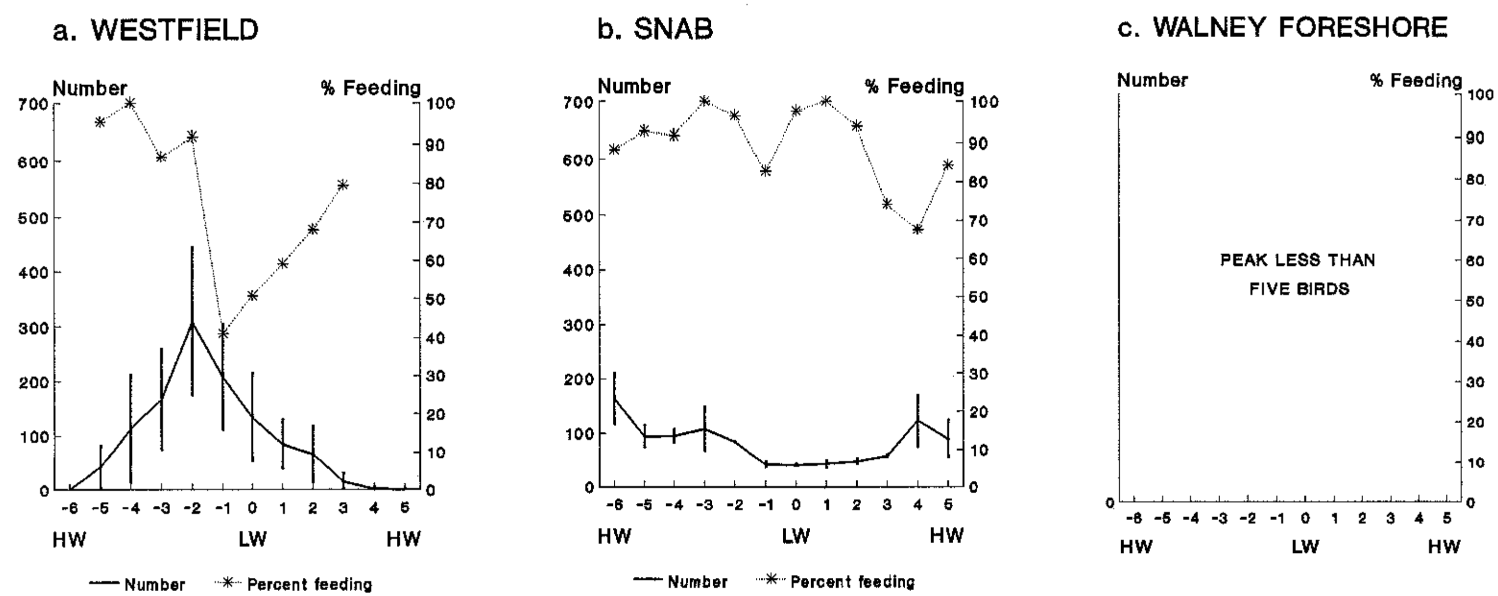

Figure 4.1.2 The average number of Shelduck present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

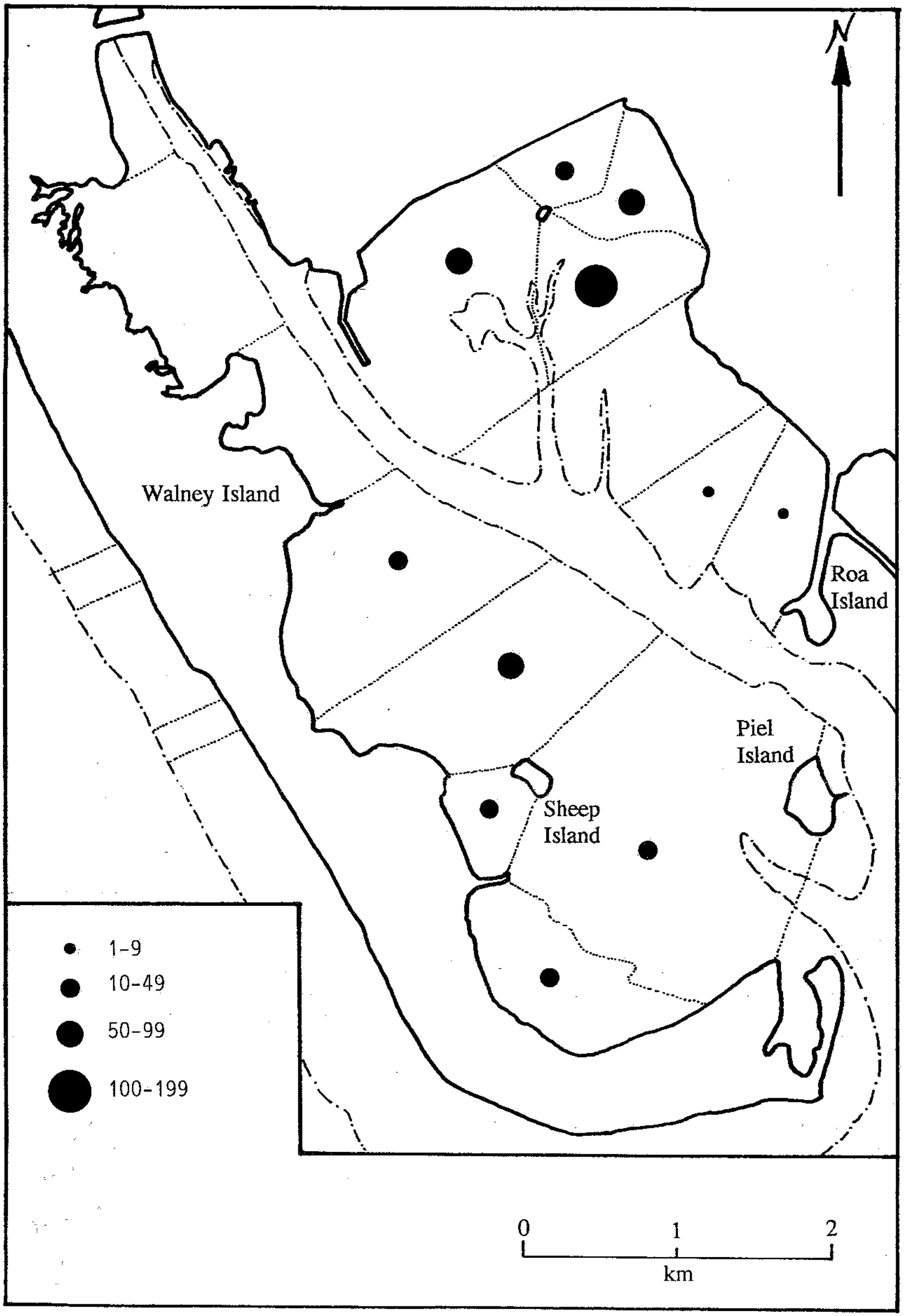

Figure 4.1.3 The average number of Shelduck feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

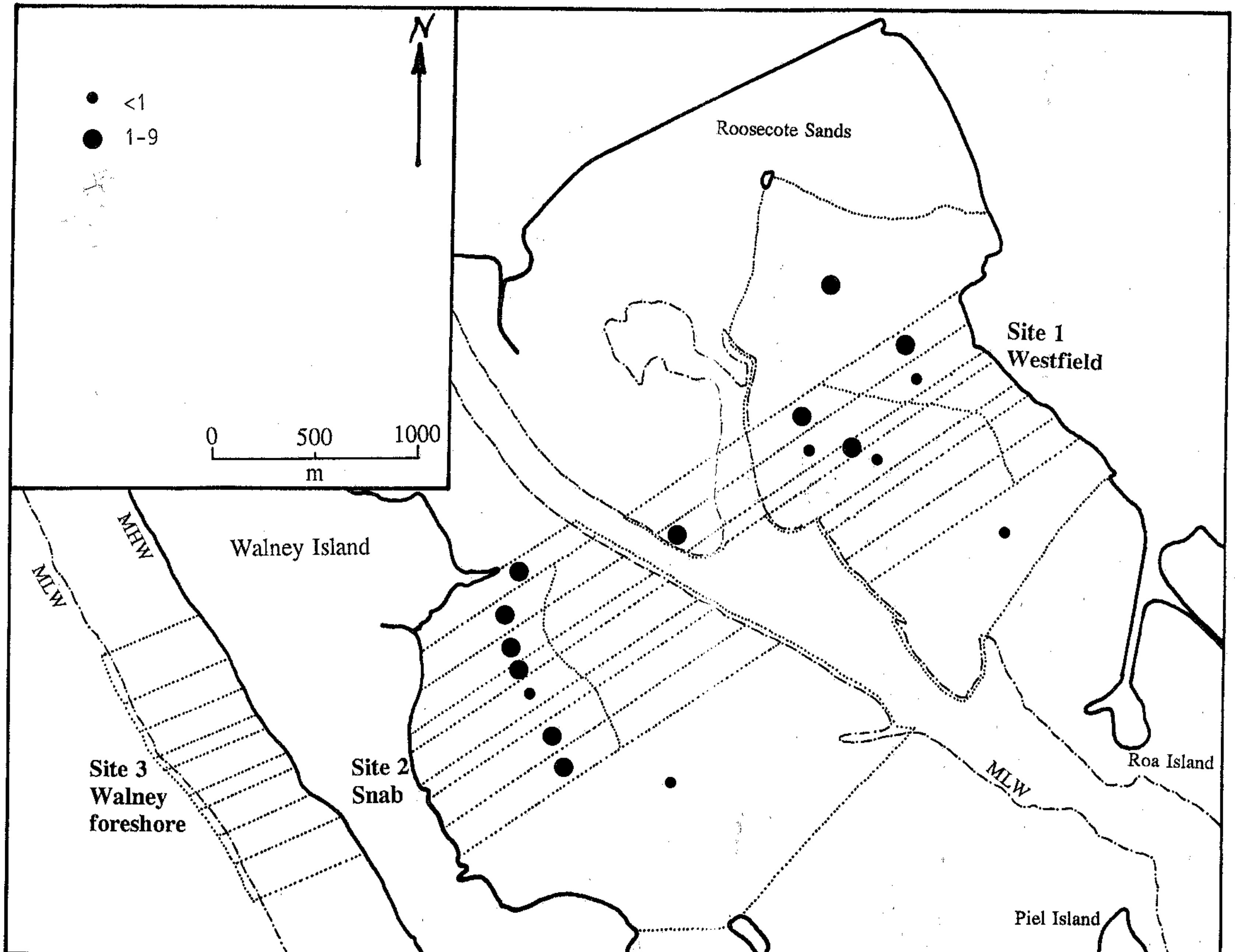

Figure 4.2.1 The average density (bird hours/ha) of Wigeon feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

WIGEON, WINTERS 1991/92 & 1992/3

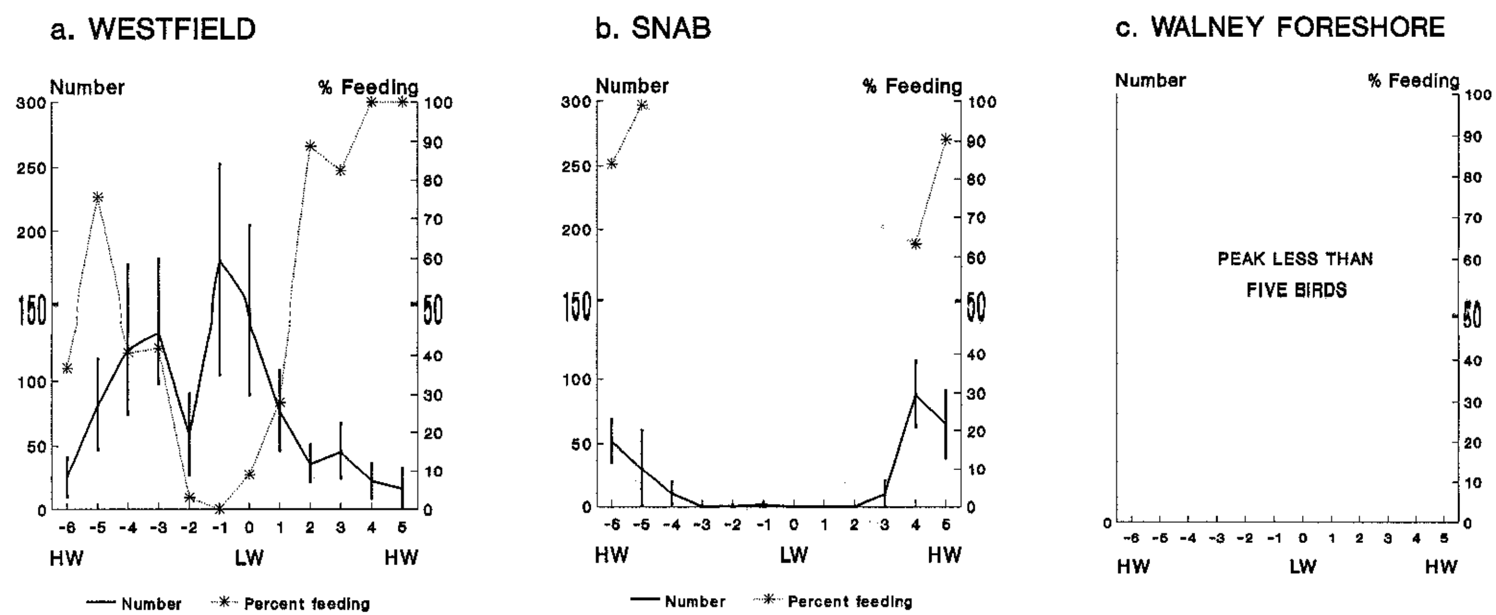

Figure 4.2.2 The average number of Wigeon present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

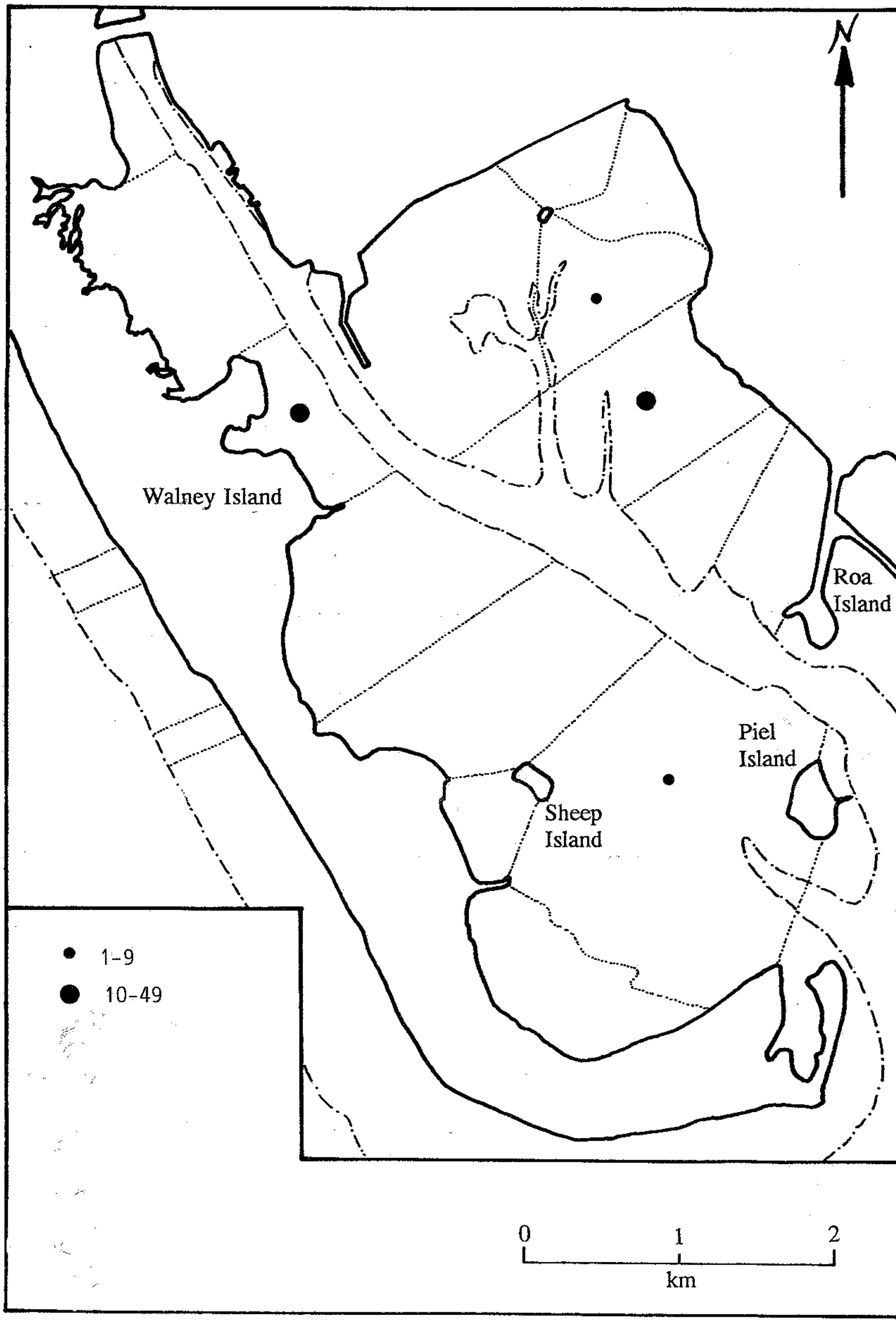

Figure 4.2.3 The average number of Wigeon feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

PINTAIL, WINTERS 1991/92 & 1992/3

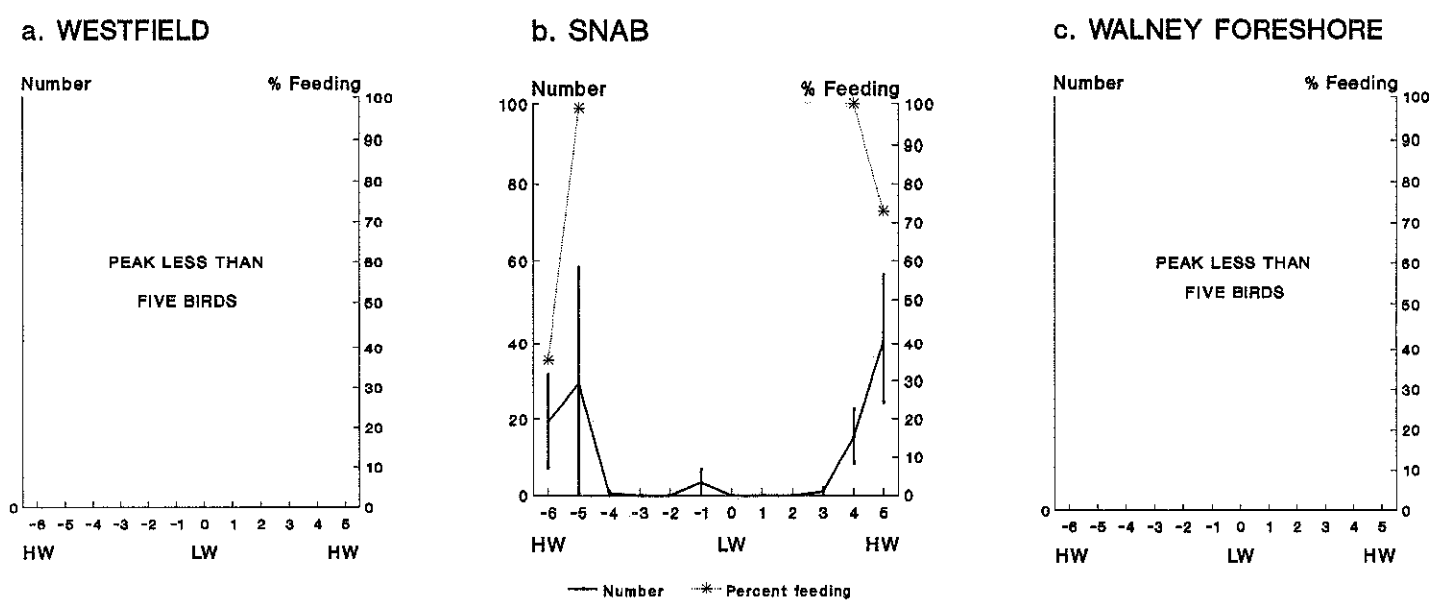

Figure 4.3.1 The average number of Pintal present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

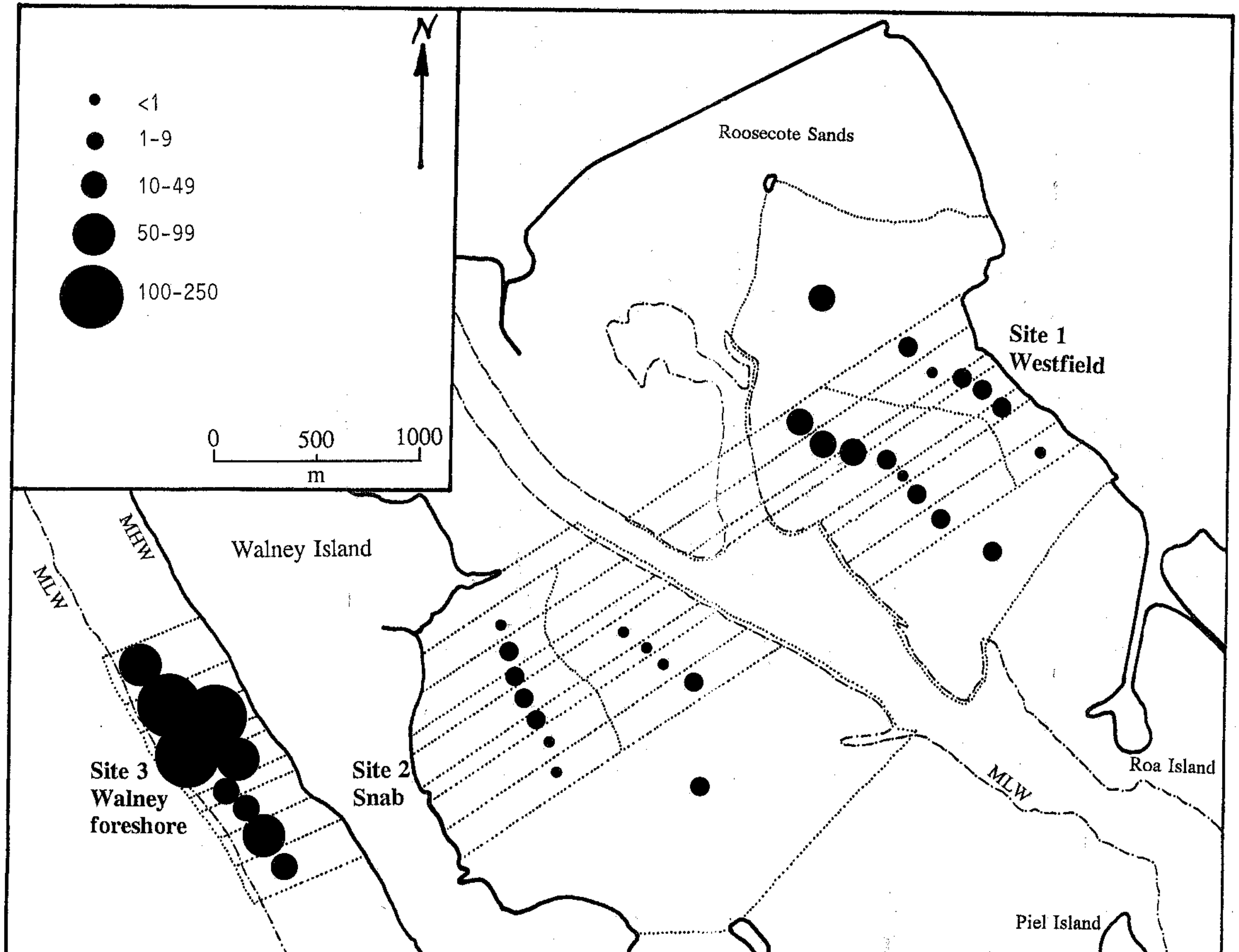

Figure 4.4.1 The average density (bird hours/ha) of Oystercatcher feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

OYSTERCATCHER, WINTERS 1991/92 & 1992/3

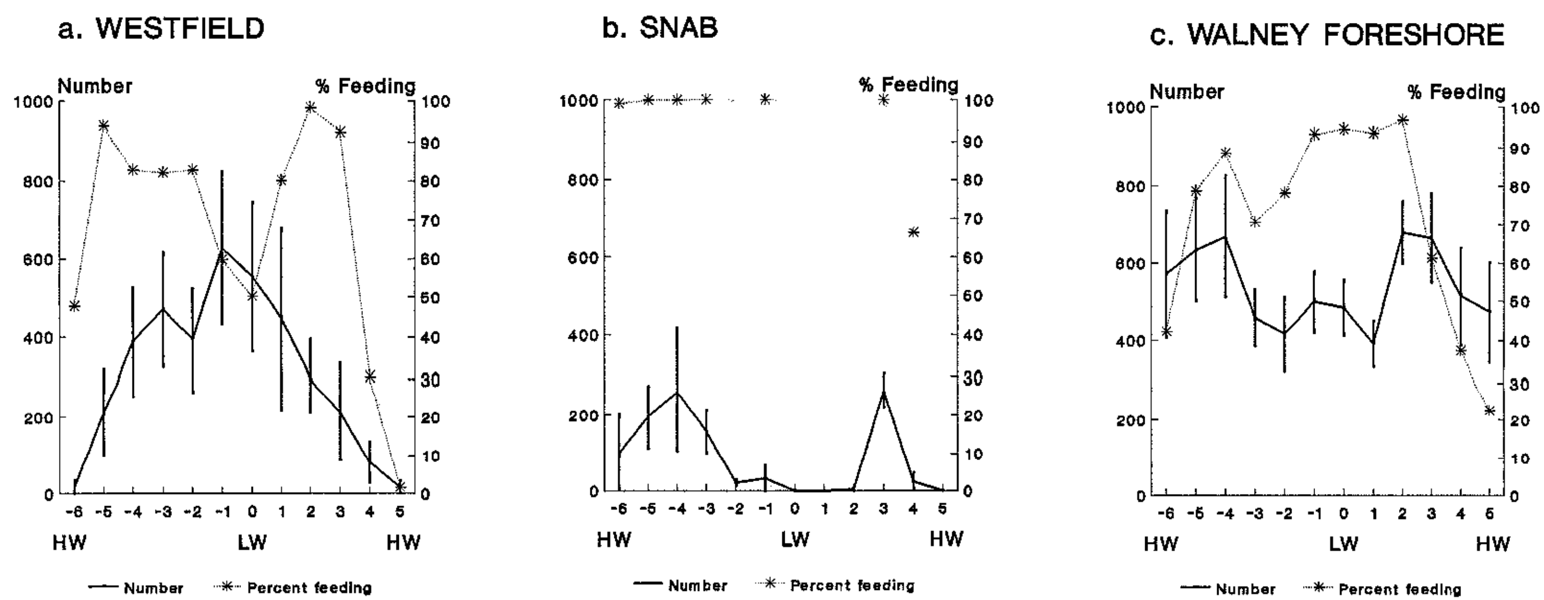

Figure 4.4.2 The average number of Oystercatcher present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

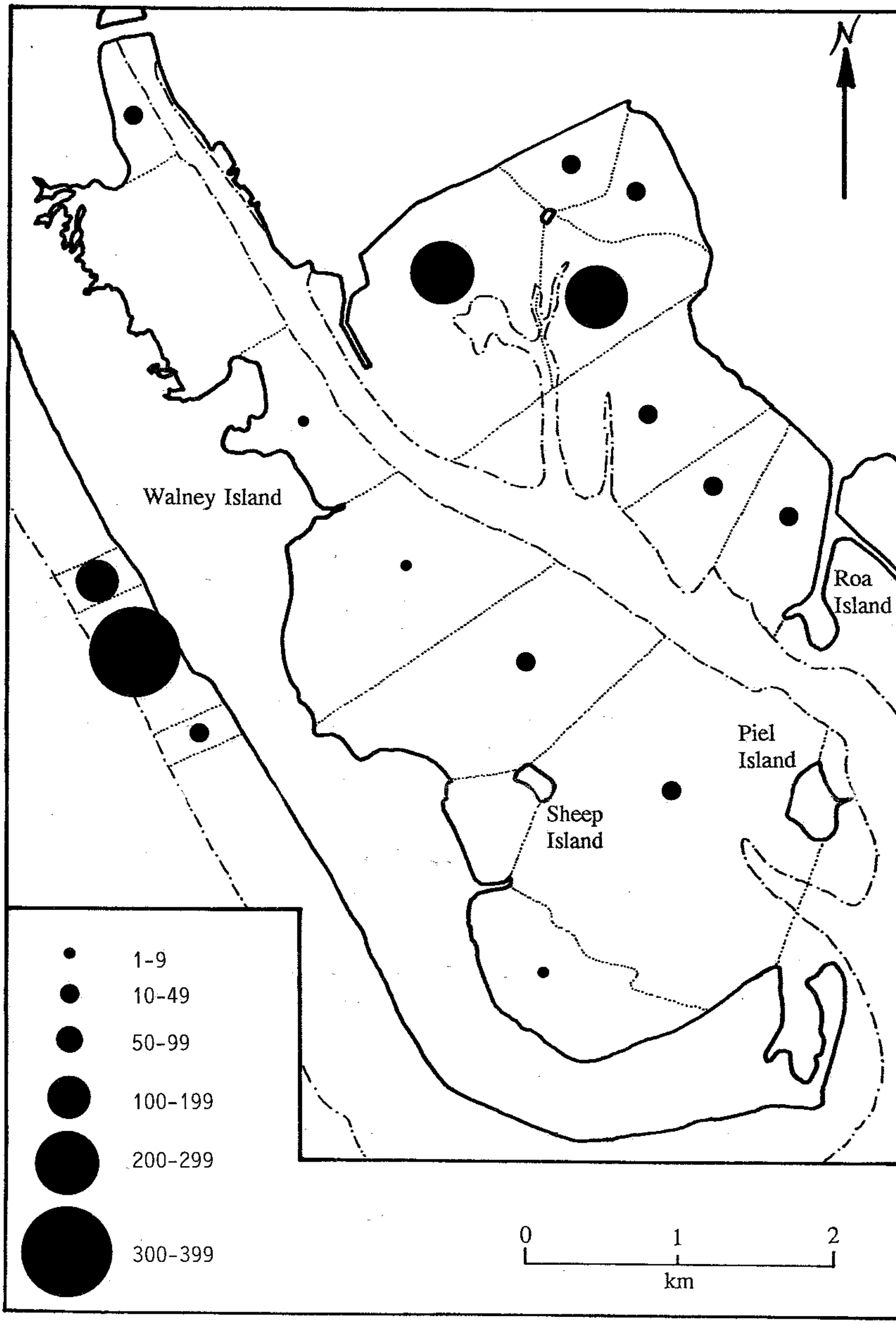

Figure 4.4.3 The average number of Oystercatcher feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

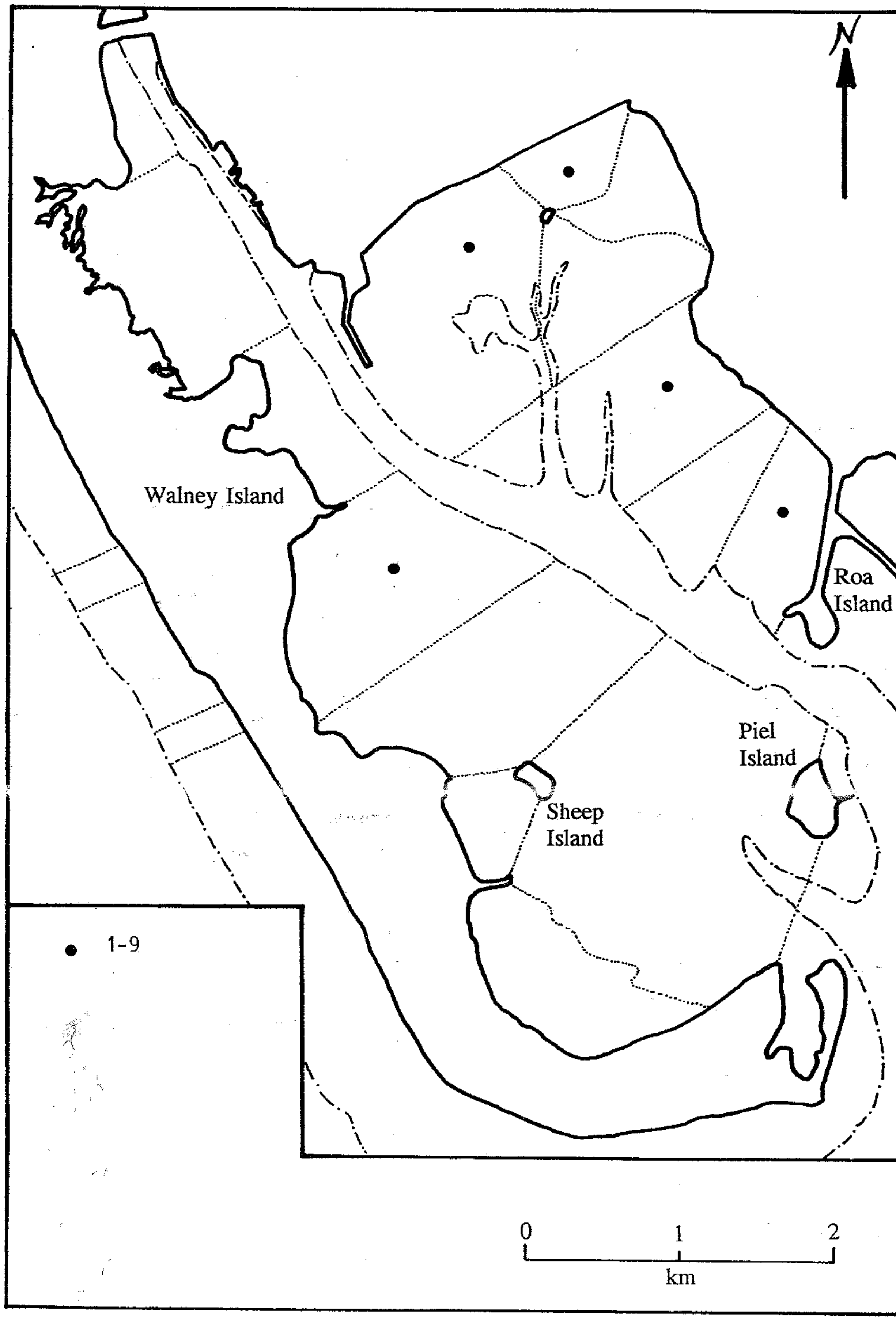

Figure 4.5.1 The average number of Ringed Plover feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

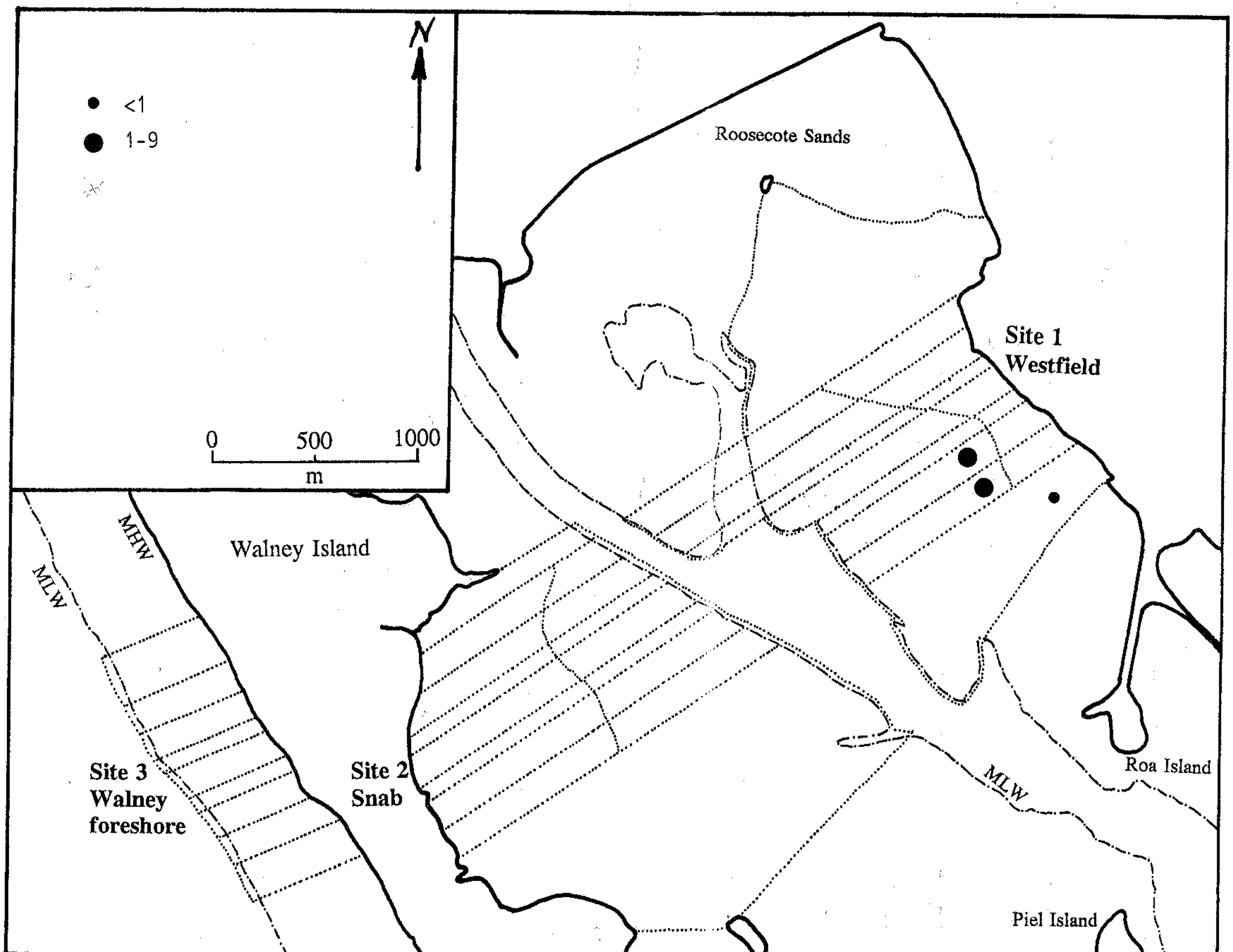

Figure 4.6.1 The average density (bird hours/ha) of Golden Plover feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

GOLDEN PLOVER, WINTERS 1991/92 & 1992/3

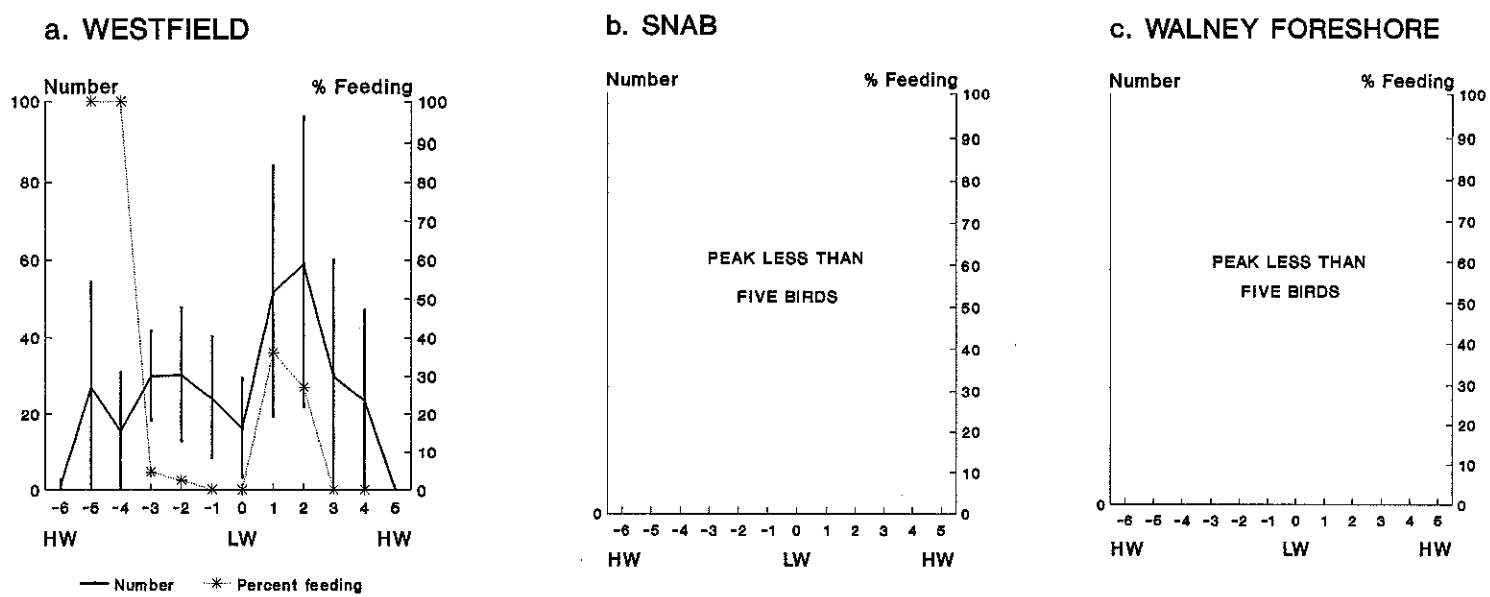

Figure 4.6.2 The average number of Golden Plover present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

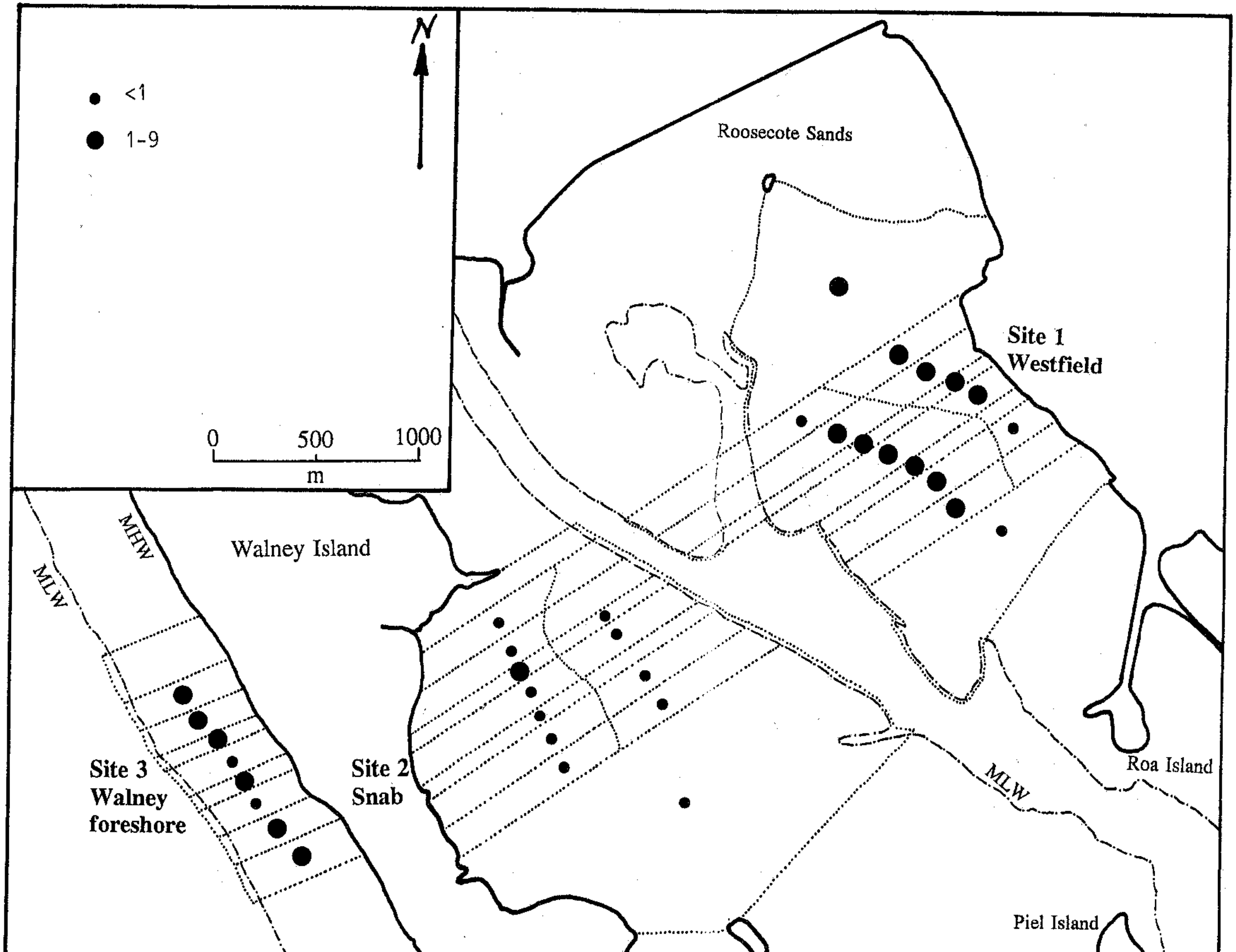

Figure 4.7.1 The average density (bird hours/ha) of Grey Plover feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

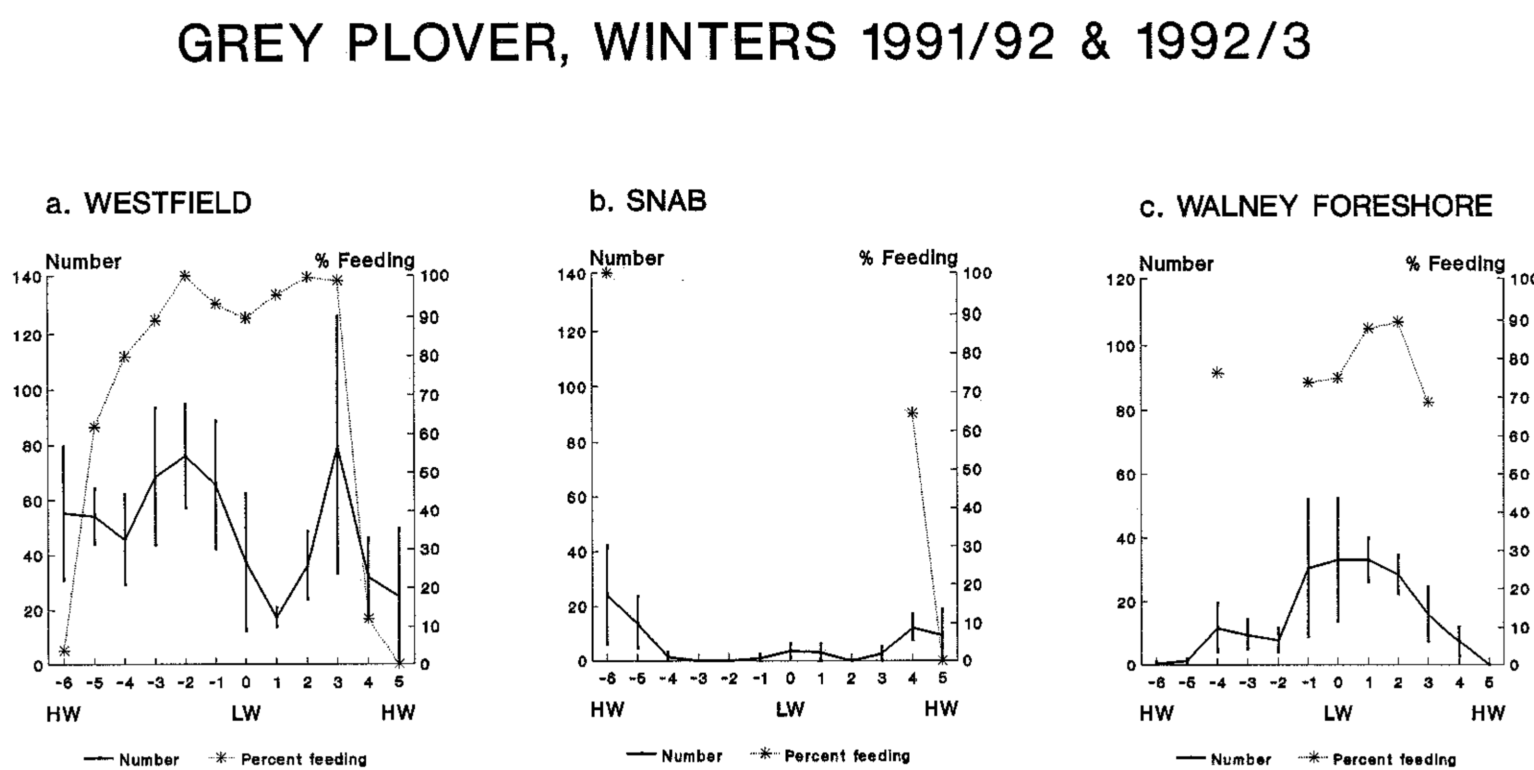

Figure 4.7.2 The average number of Grey Plover present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

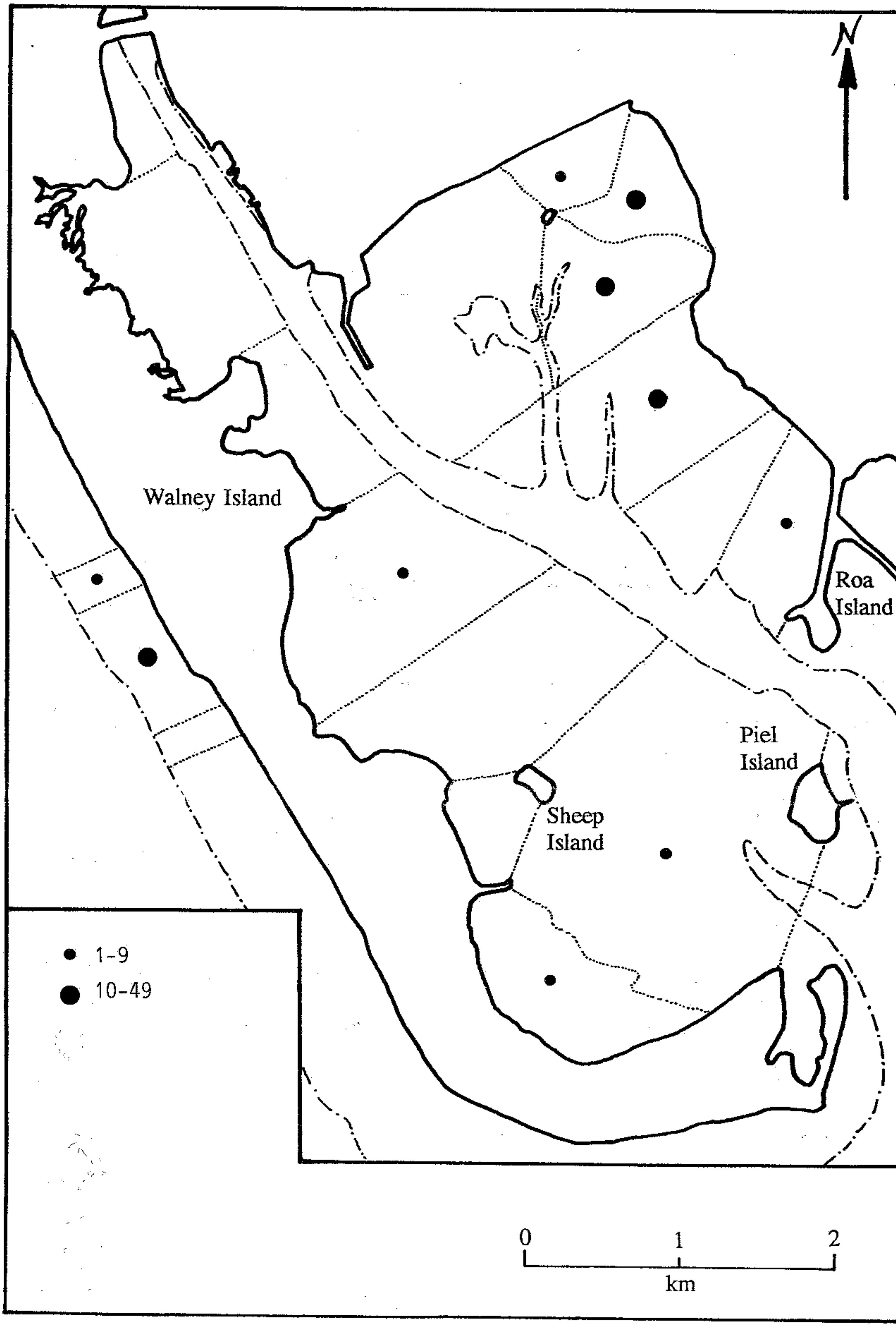

Figure 4.7.3 The average number of Grey Plover feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

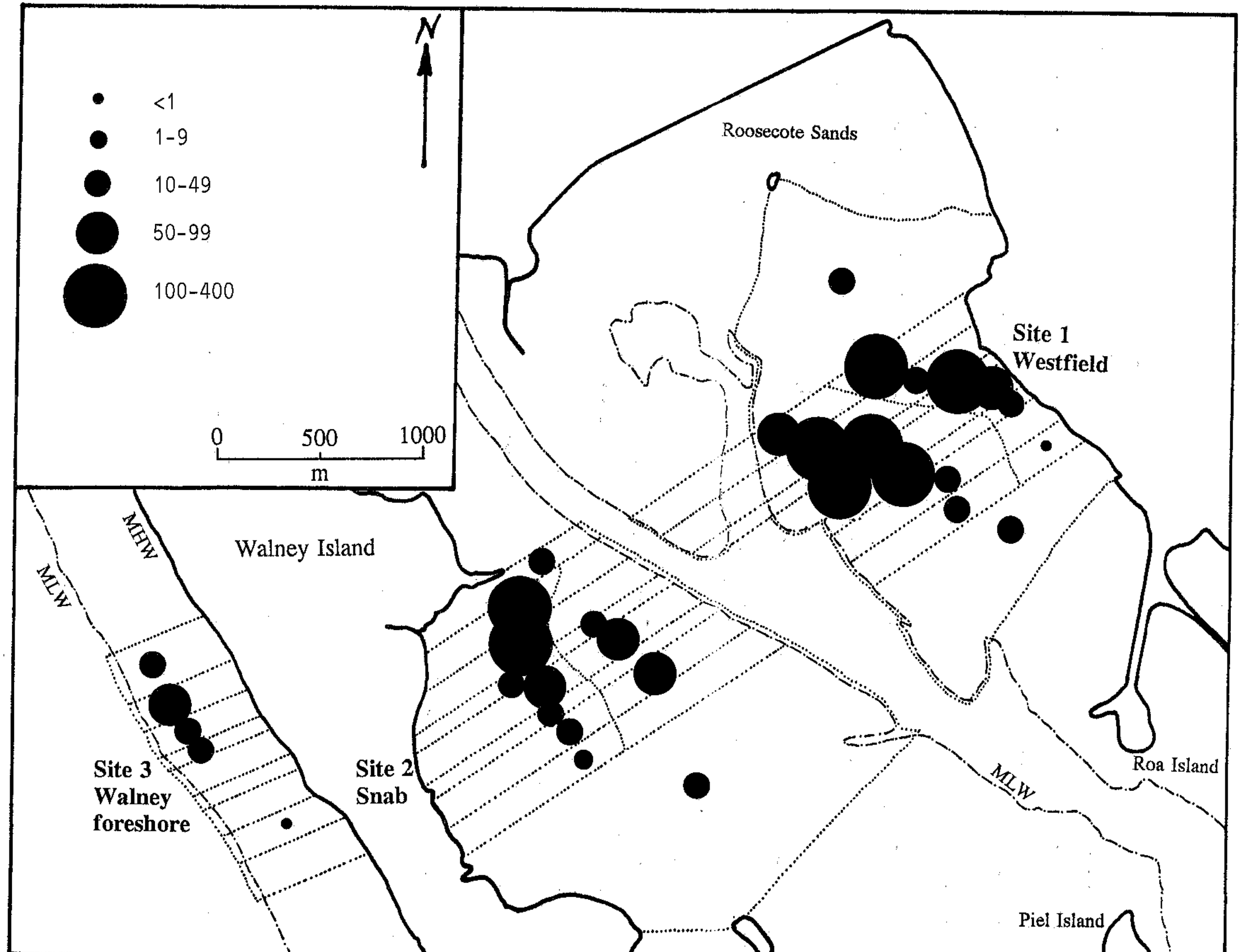

Figure 4.9.1 The average density (bird hours/ha) of Knot feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

KNOT, WINTERS 1991/92 & 1992/3

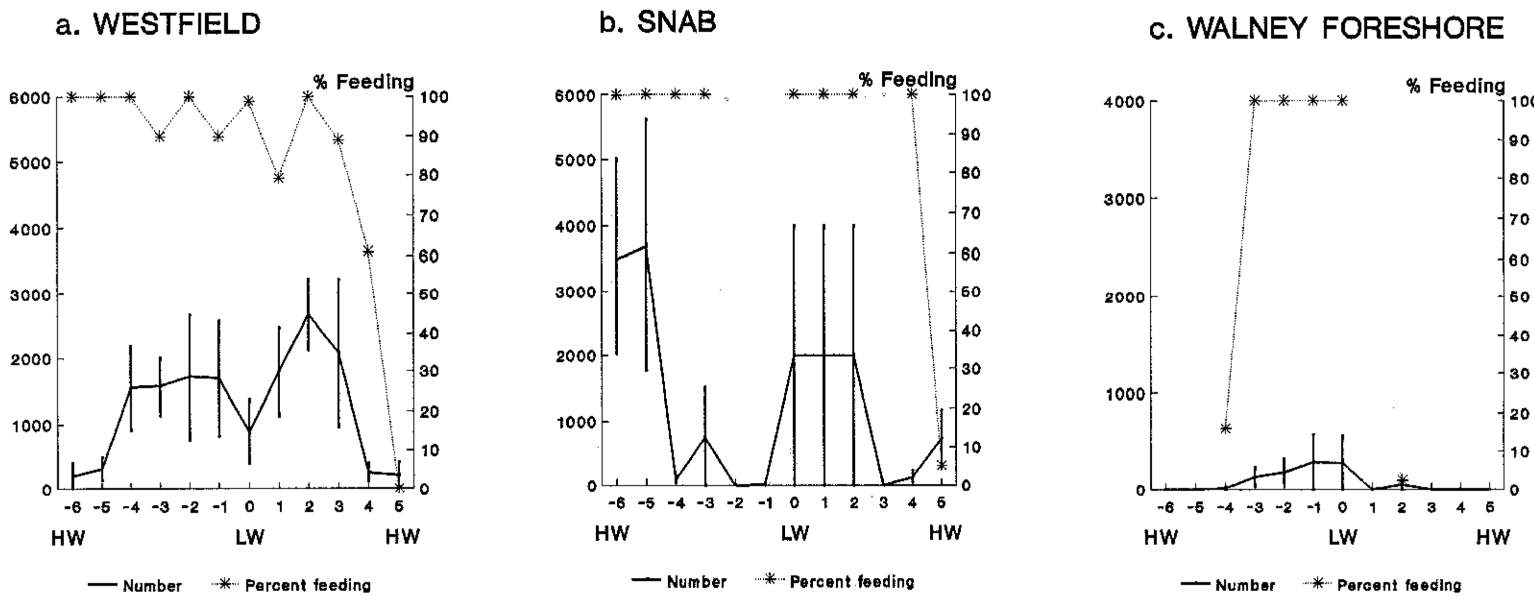

Figure 4.9.2 The average number of Knot present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

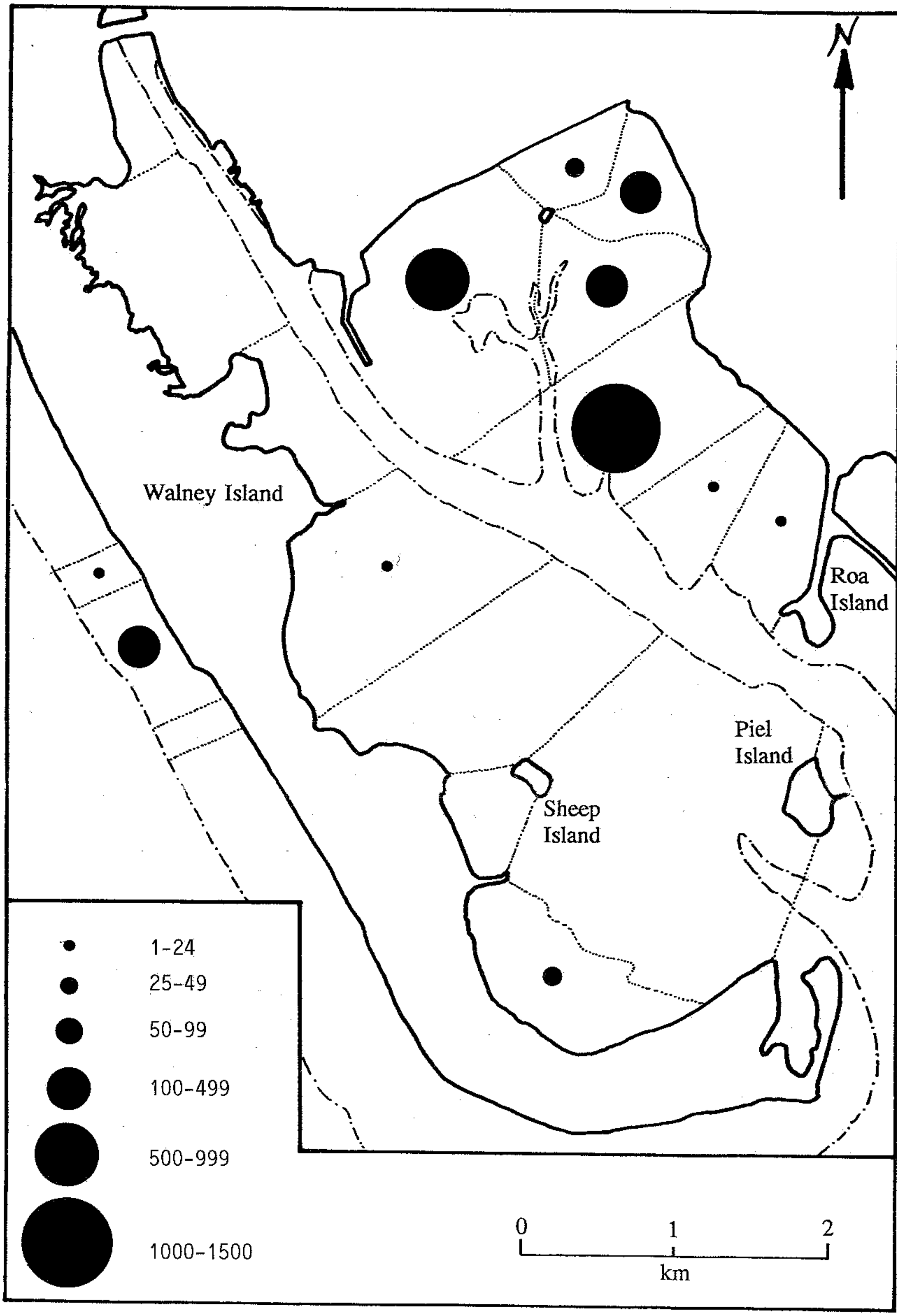

Figure 4.9.3 The average number of Knot feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

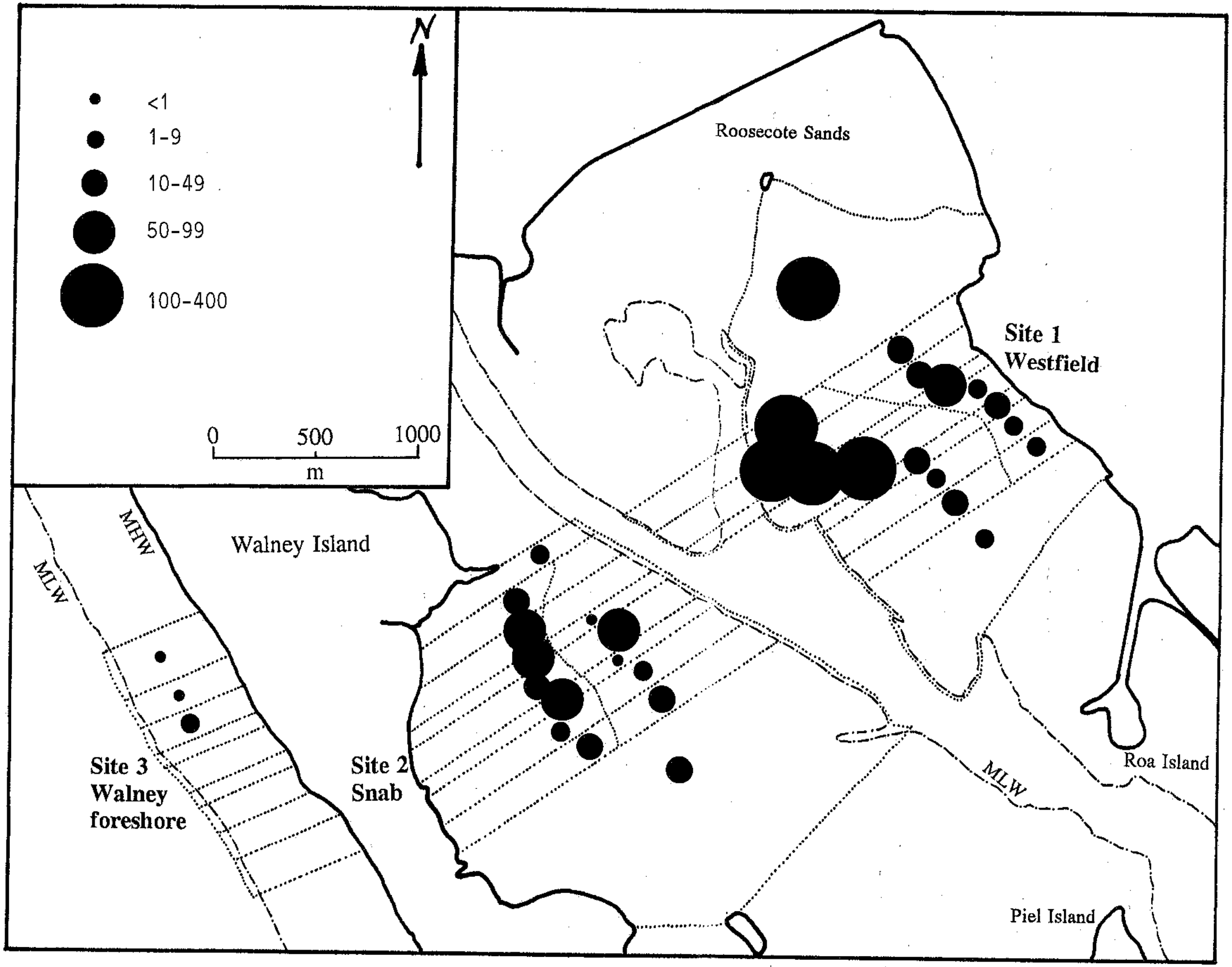

Figure 4.10.1 The average density (bird hours/ha) of Dunlin feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

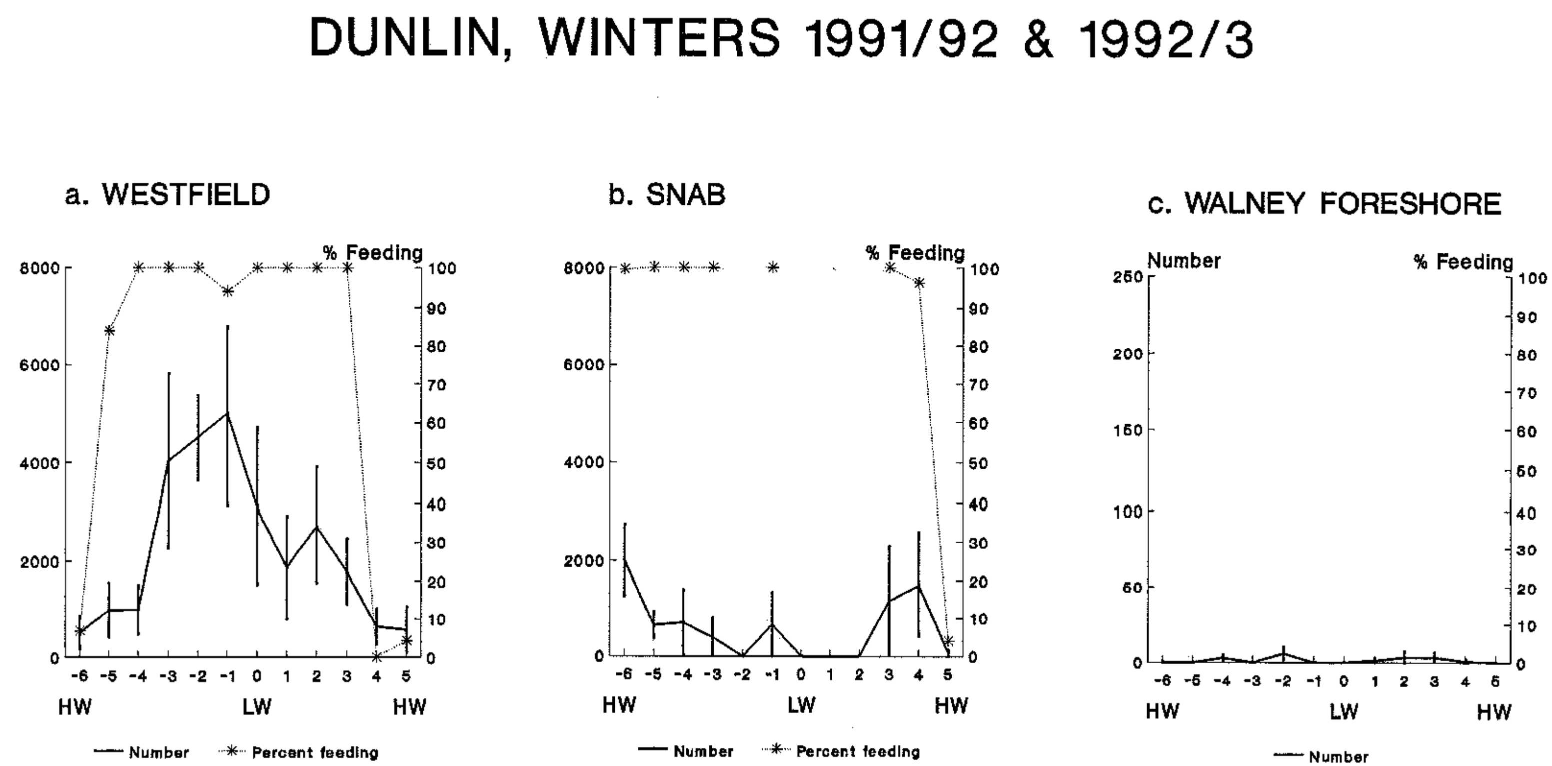

Figure 4.10.2 The average number of Dunlin present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

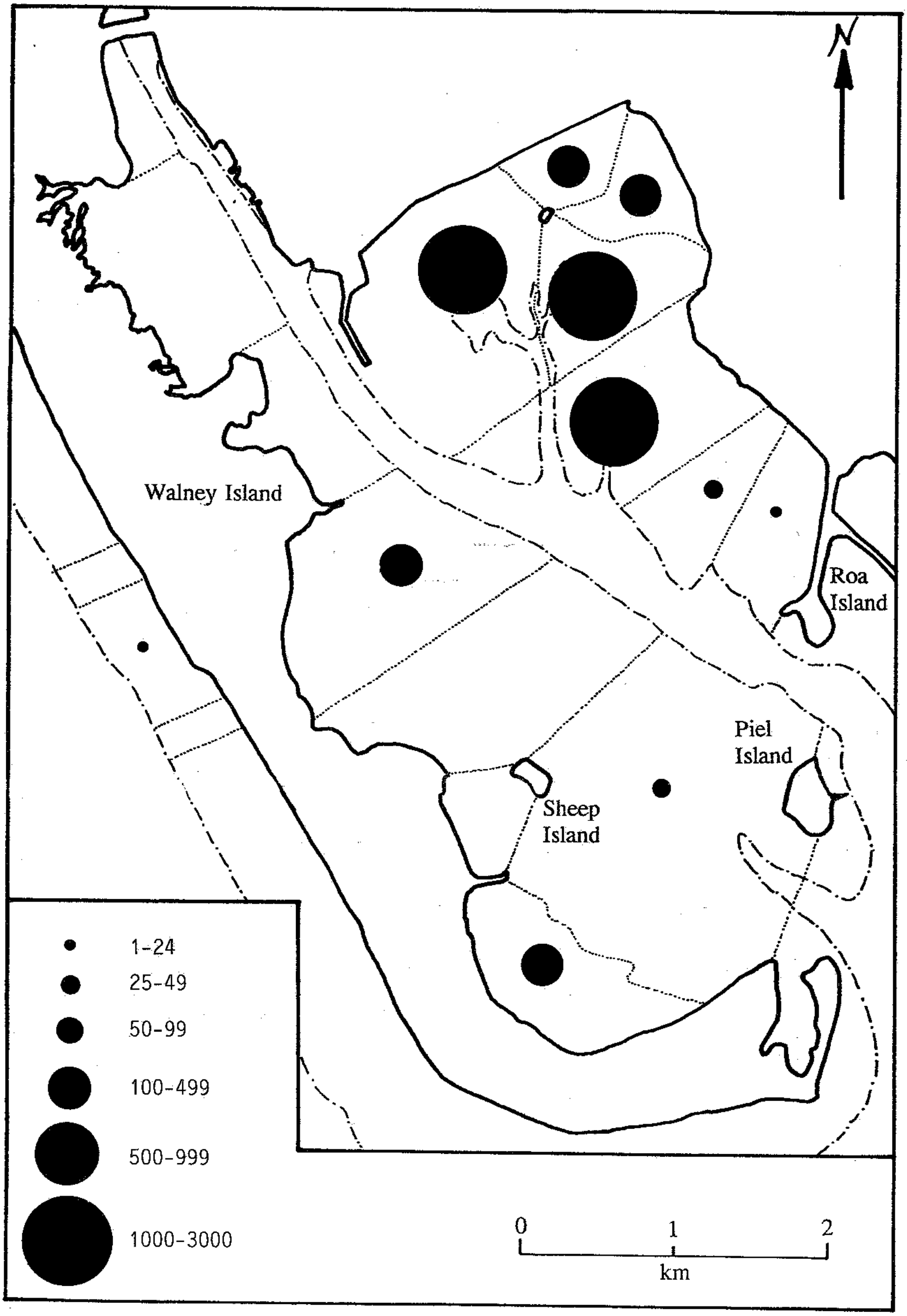

Figure 4.10.3 The average number of Dunlin feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

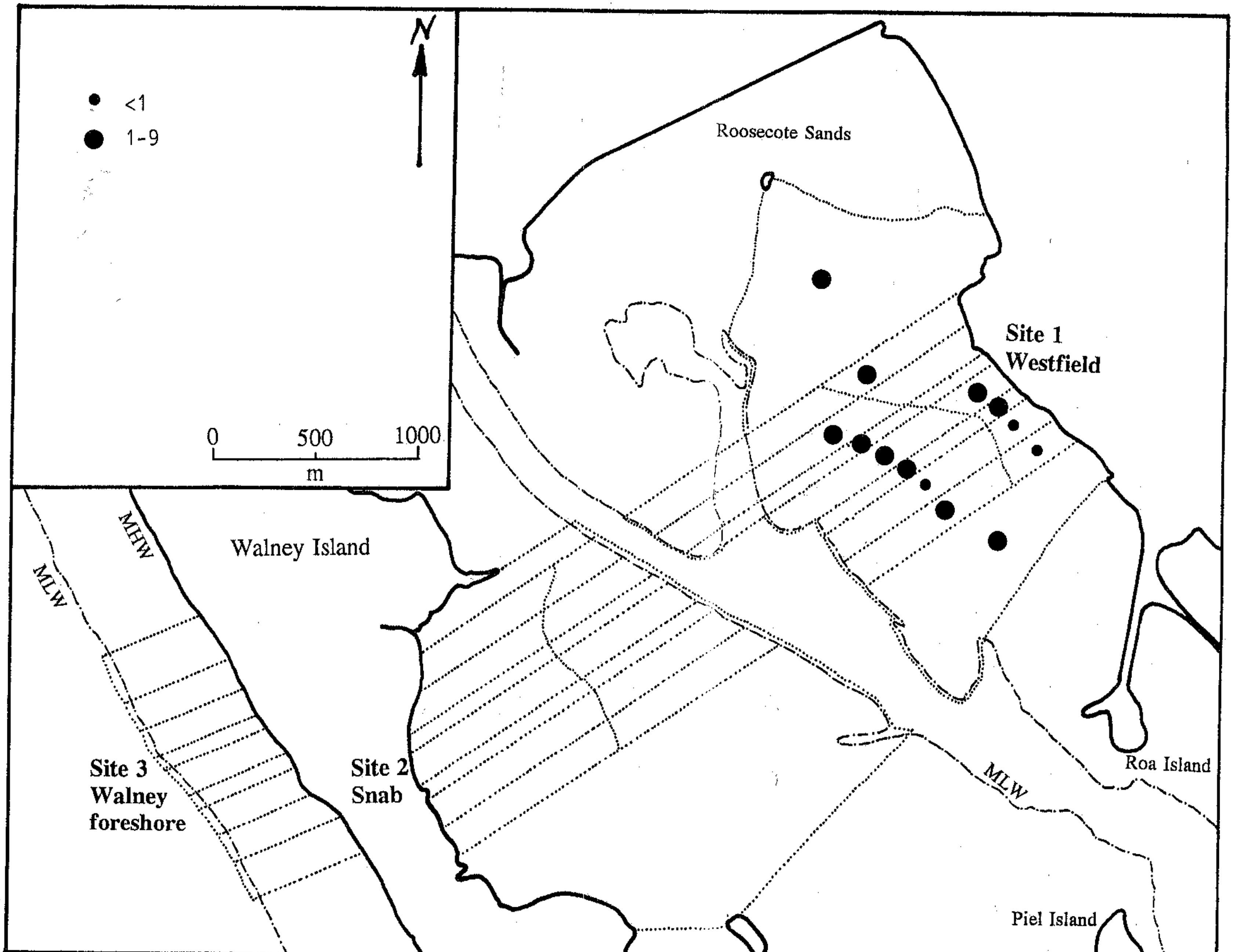

Figure 4.11.1 The average density (bird hours/ha) of Bar-tailed Godwit feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

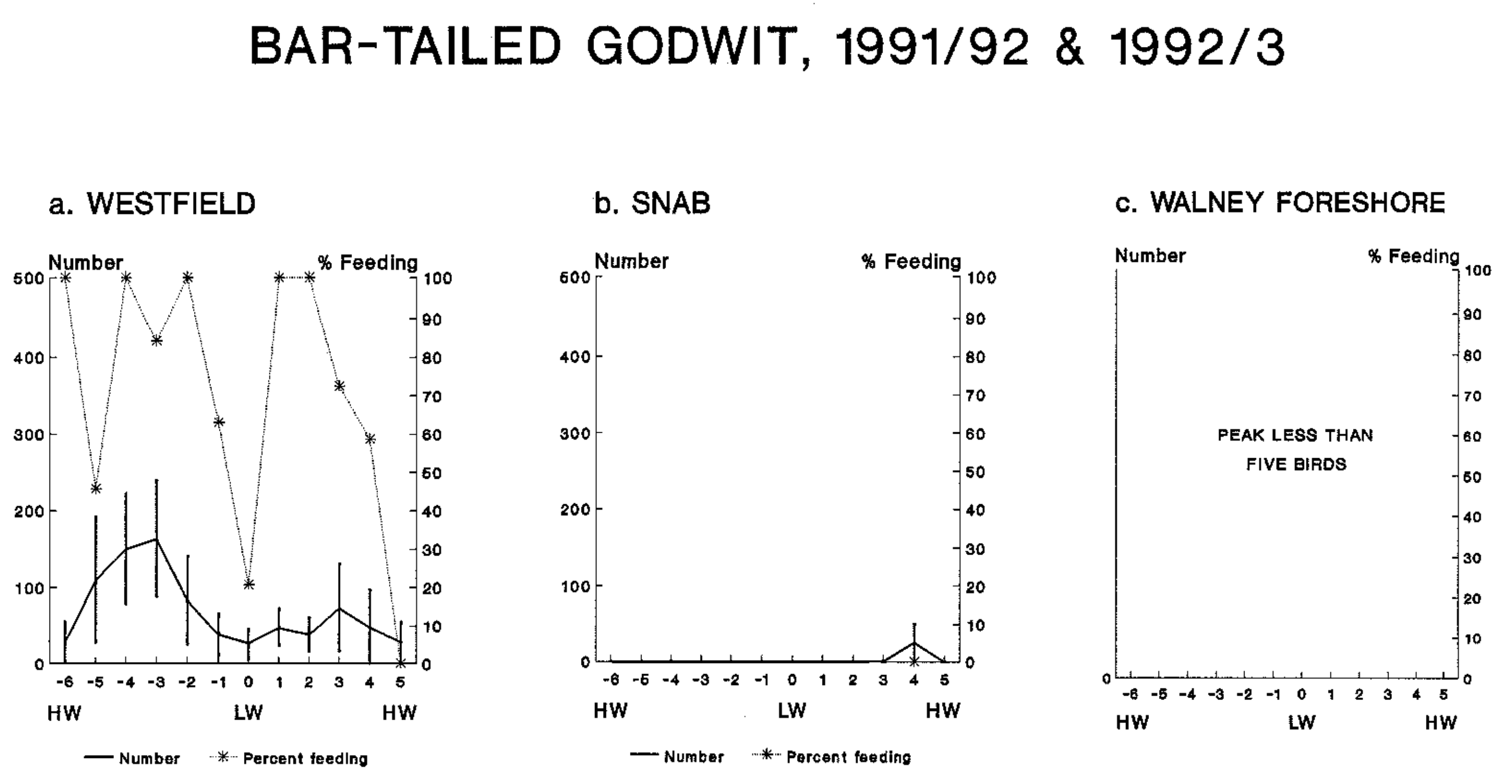

Figure 4.11.2 The average number of Bar-tailed Godwit present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

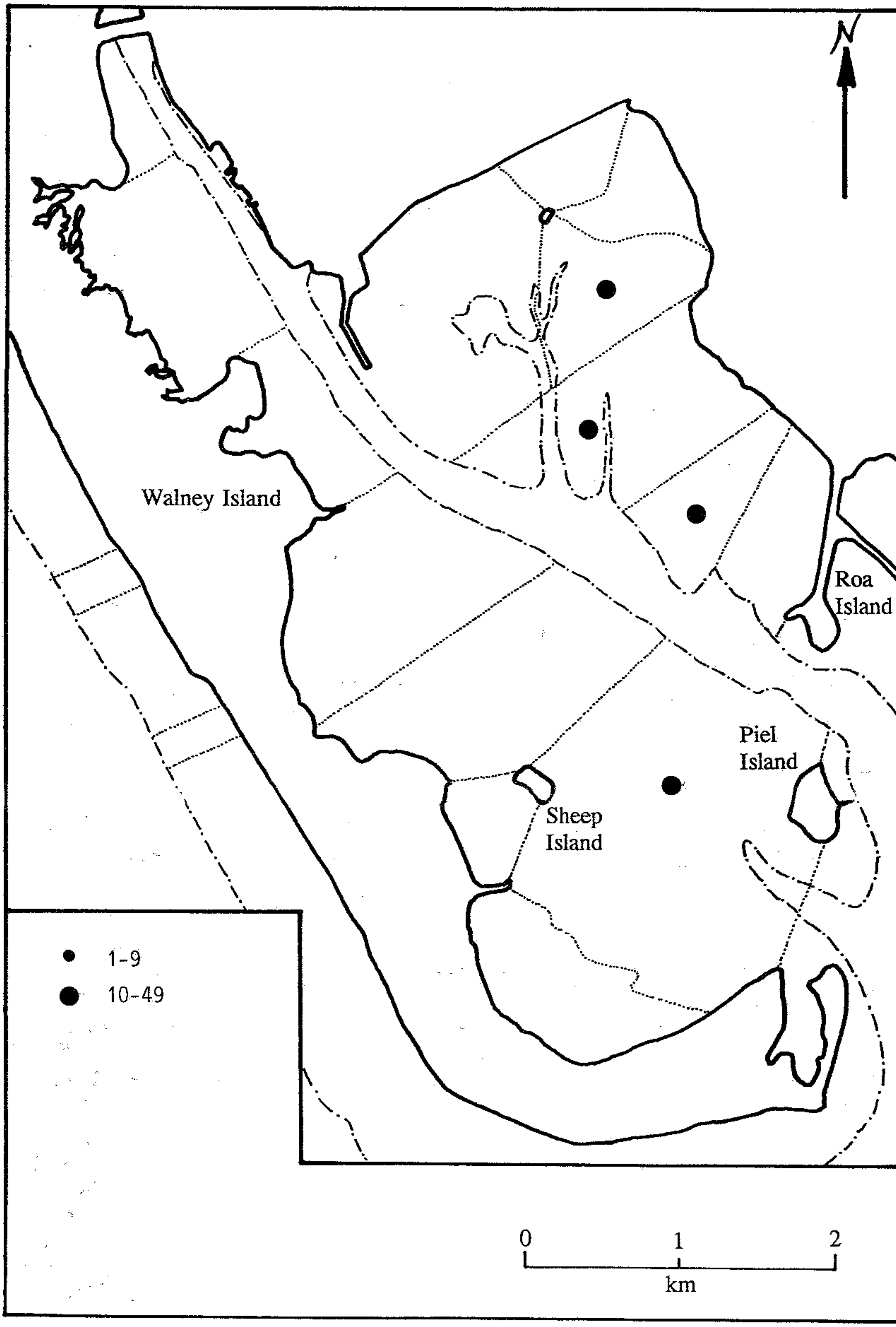

Figure 4.11.3 The average number of Bar-tailed Godwit feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

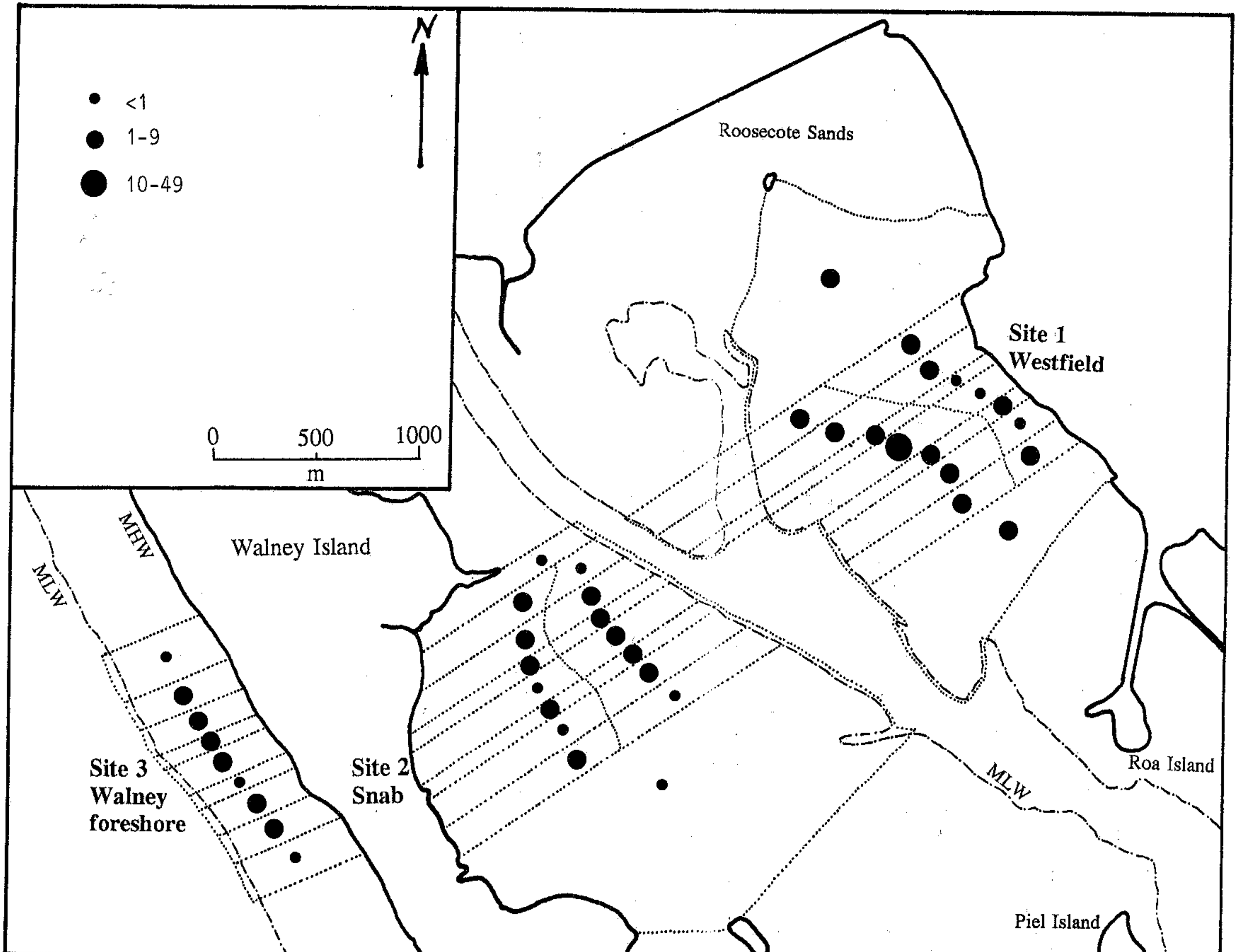

Figure 4.12.1 The average density (bird hours/ha) of Curlew feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

CURLEW, WINTERS 1991/92 & 1992/3

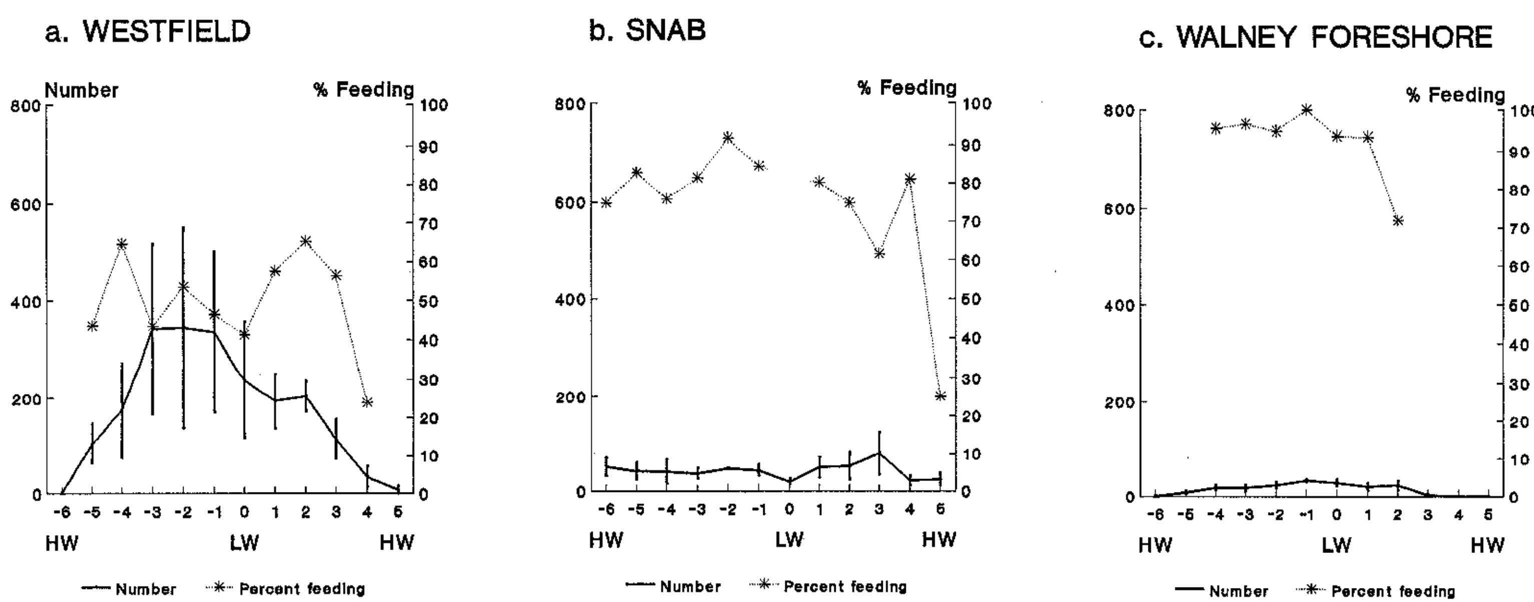

Figure 4.12.2 The average number of Curlew present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

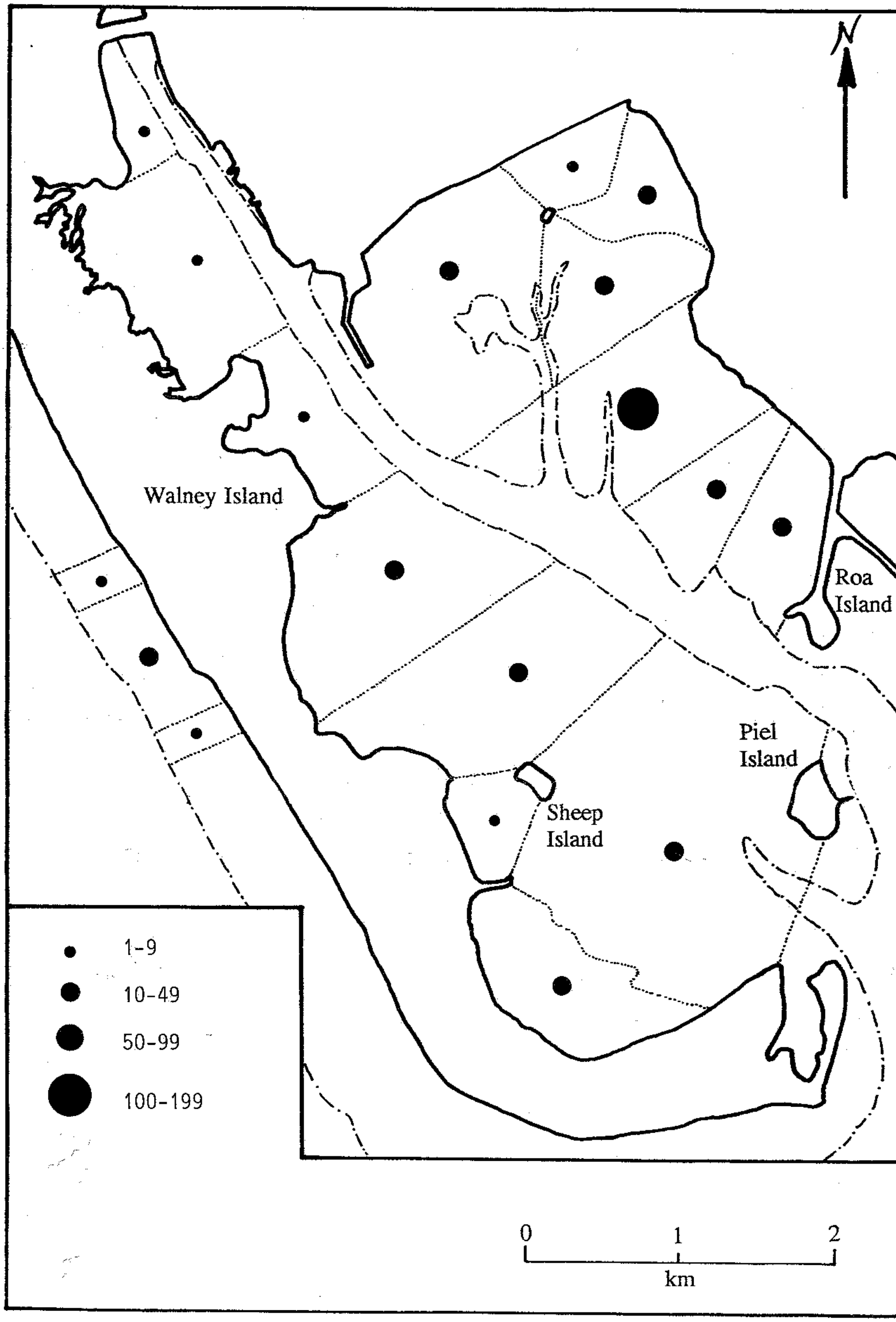

Figure 4.12.3 The average number of Curlew feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

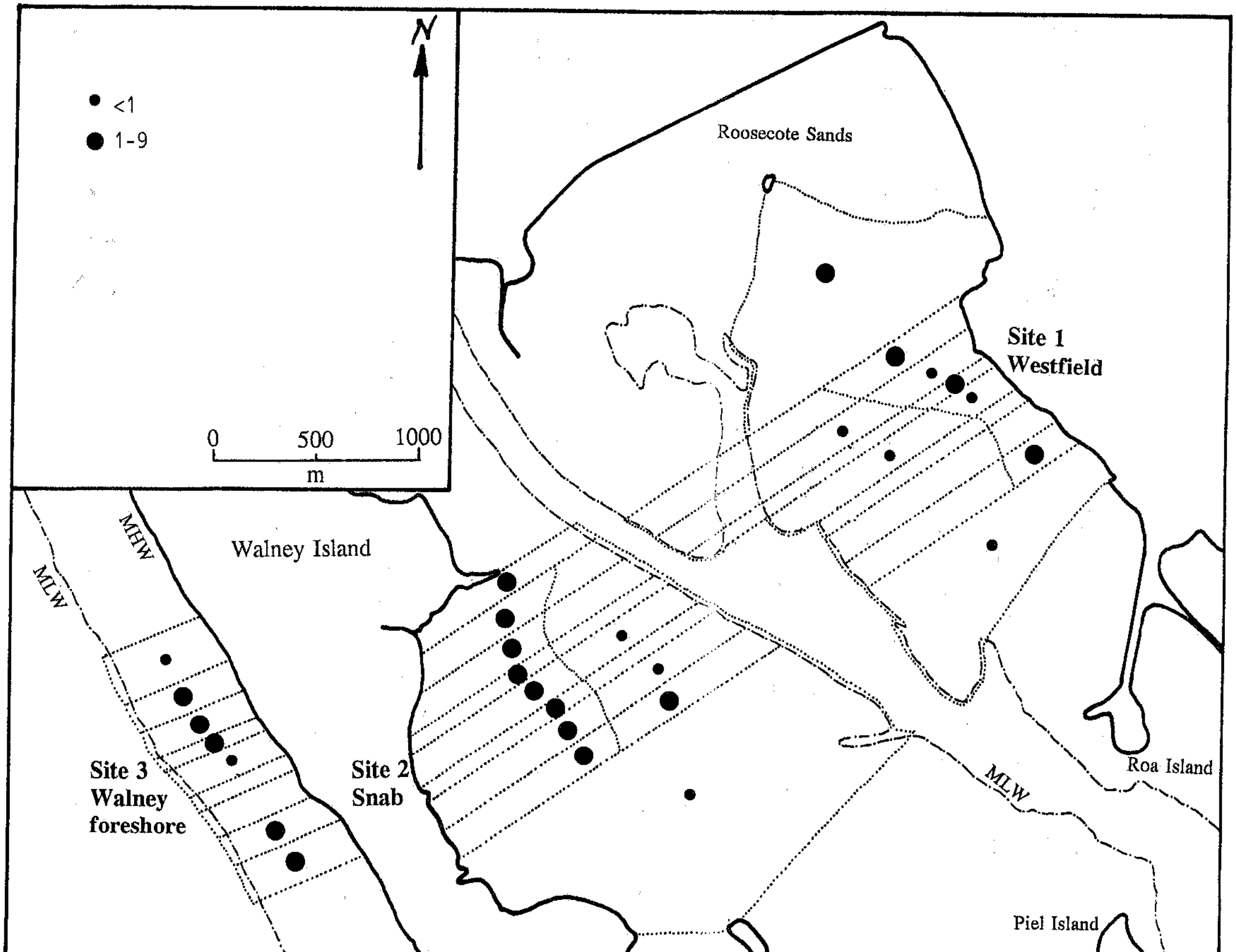

Figure 4.13.1 The average density (bird hours/ha) of Redshank feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

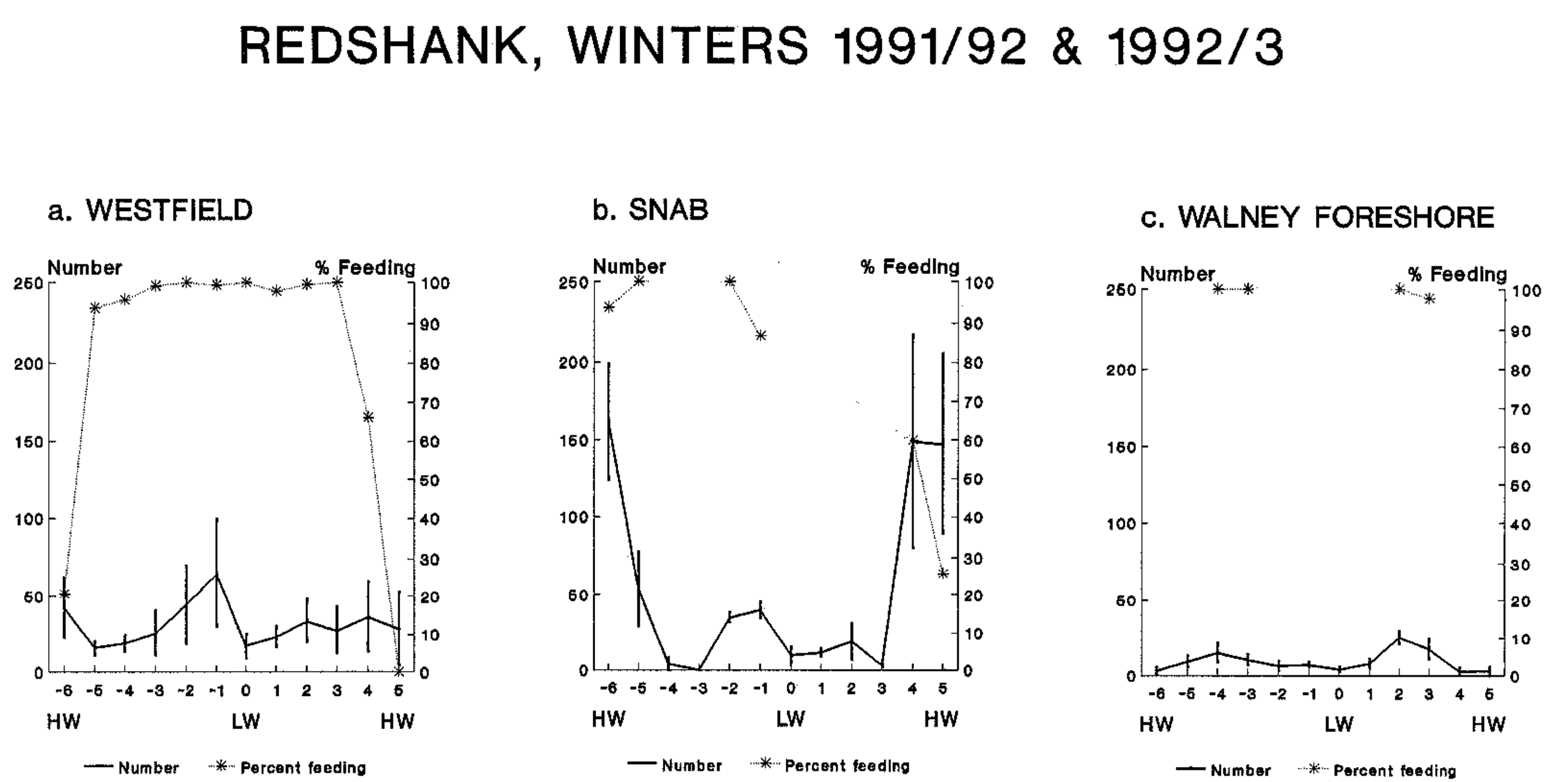

Figure 4.13.2 The average number of Redshank present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

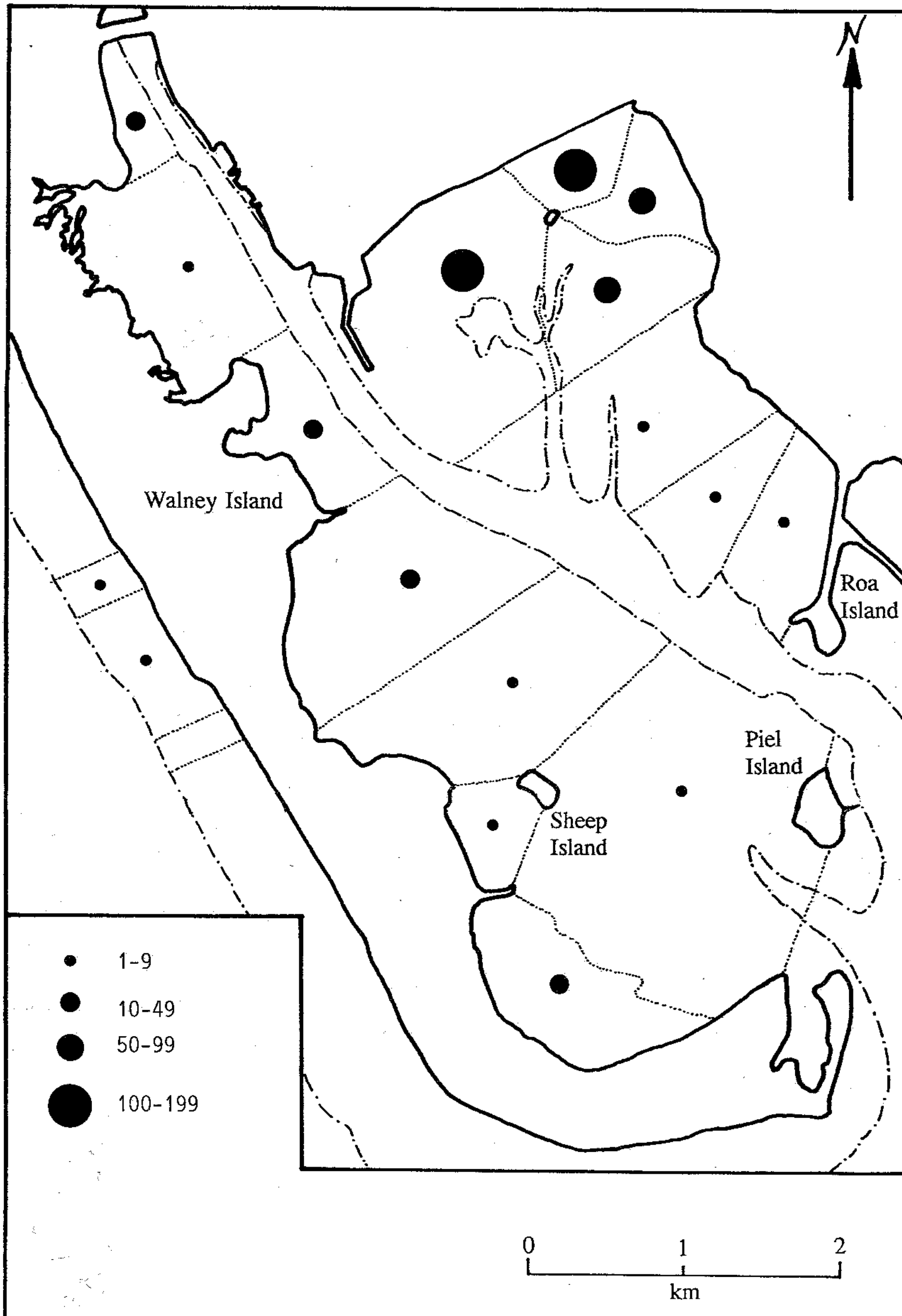

Figure 4.13.3 The average number of Redshank feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

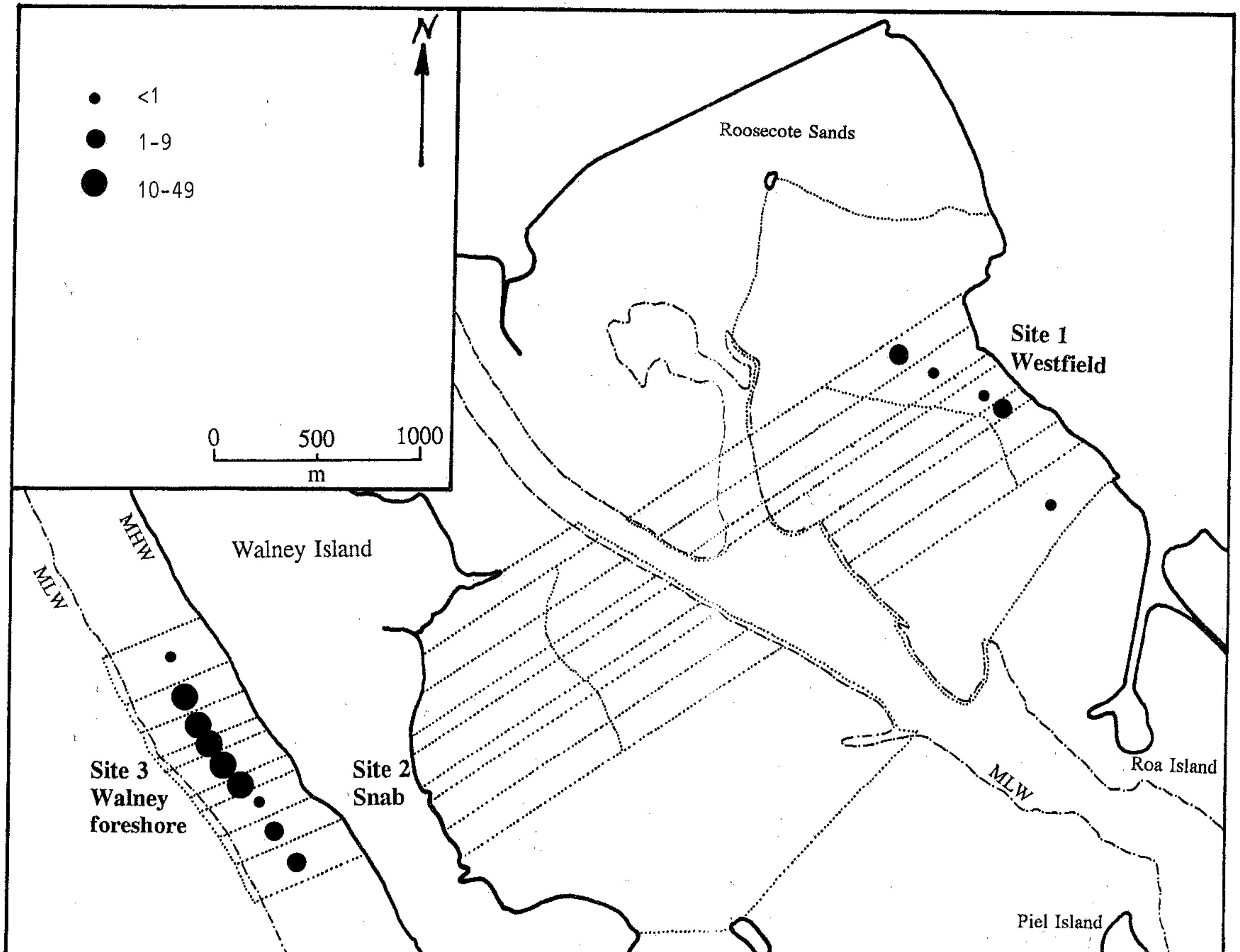

Figure 4.14.1 The average density (bird hours/ha) of Turnstone feeding on each count area, along the pipeline transects during the 1991/92 and 1992/93 winters.

TURNSTONE, WINTERS 1991/92 & 1992/3

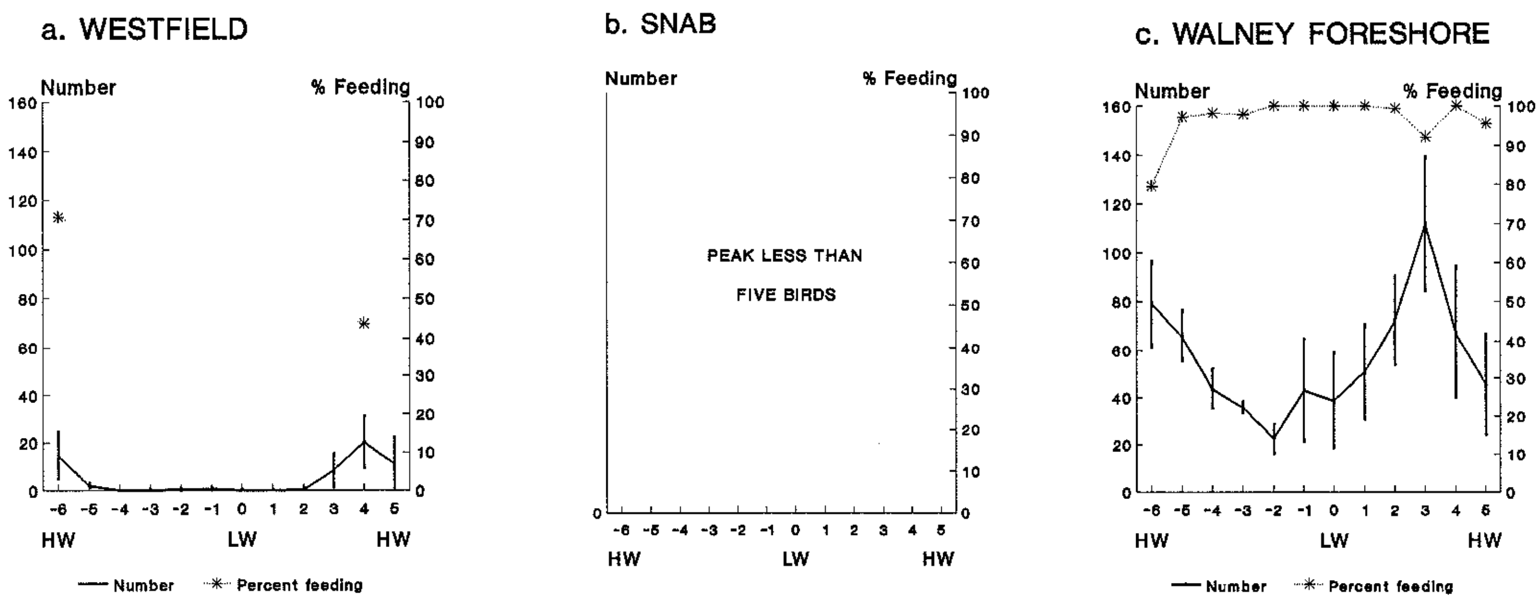

Figure 4.14.2 The average number of Turnstone present and the percentage feeding throughout the tidal cycle during the 1991/92 and 1992/93 winters. The percentage feeding is only plotted when more than 50 birds were counted in total throughout the winter.

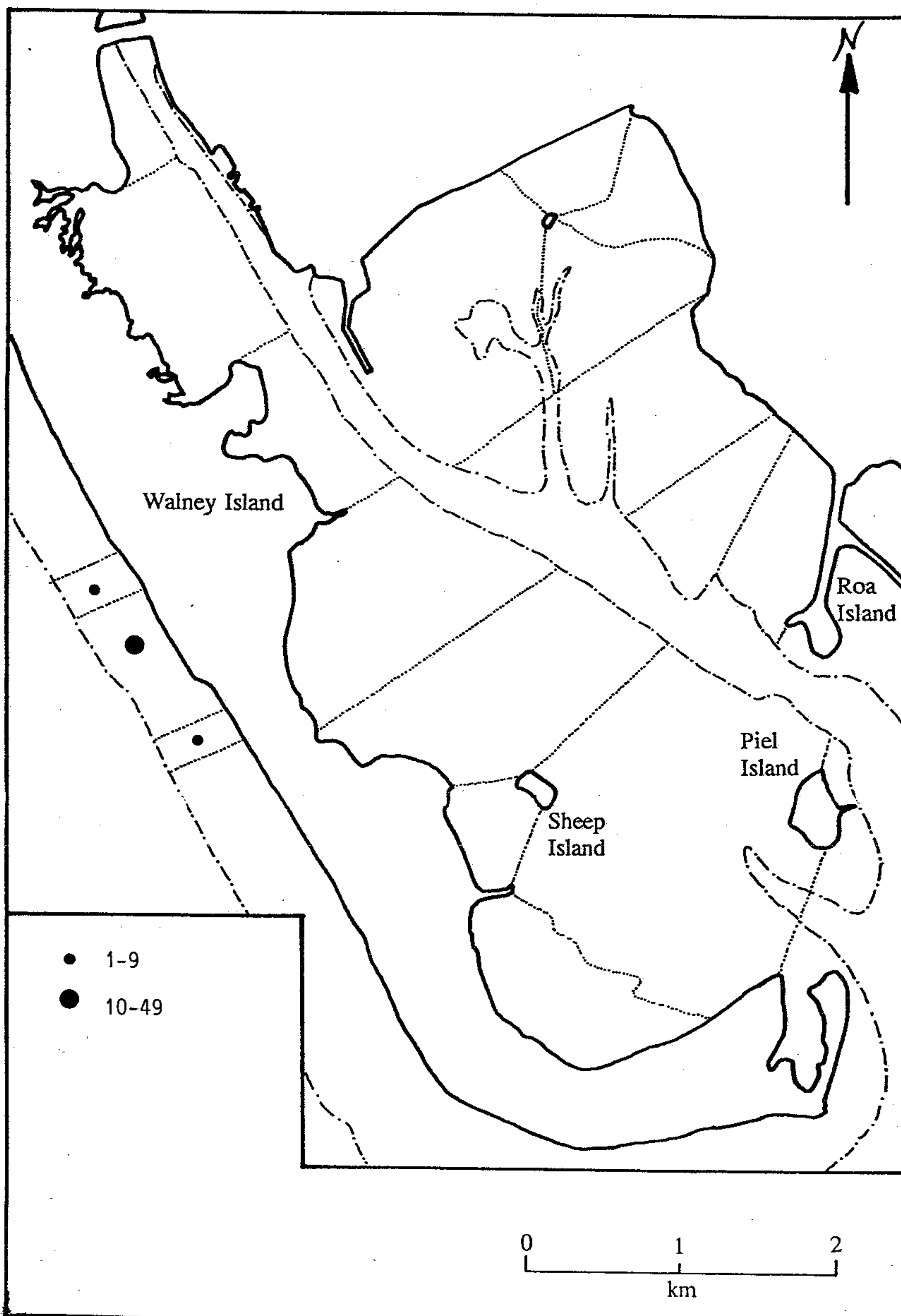

Figure 4.14.3 The average number of Turnstone feeding on each count area at low tide during the 1991/92 and 1992/93 winters.

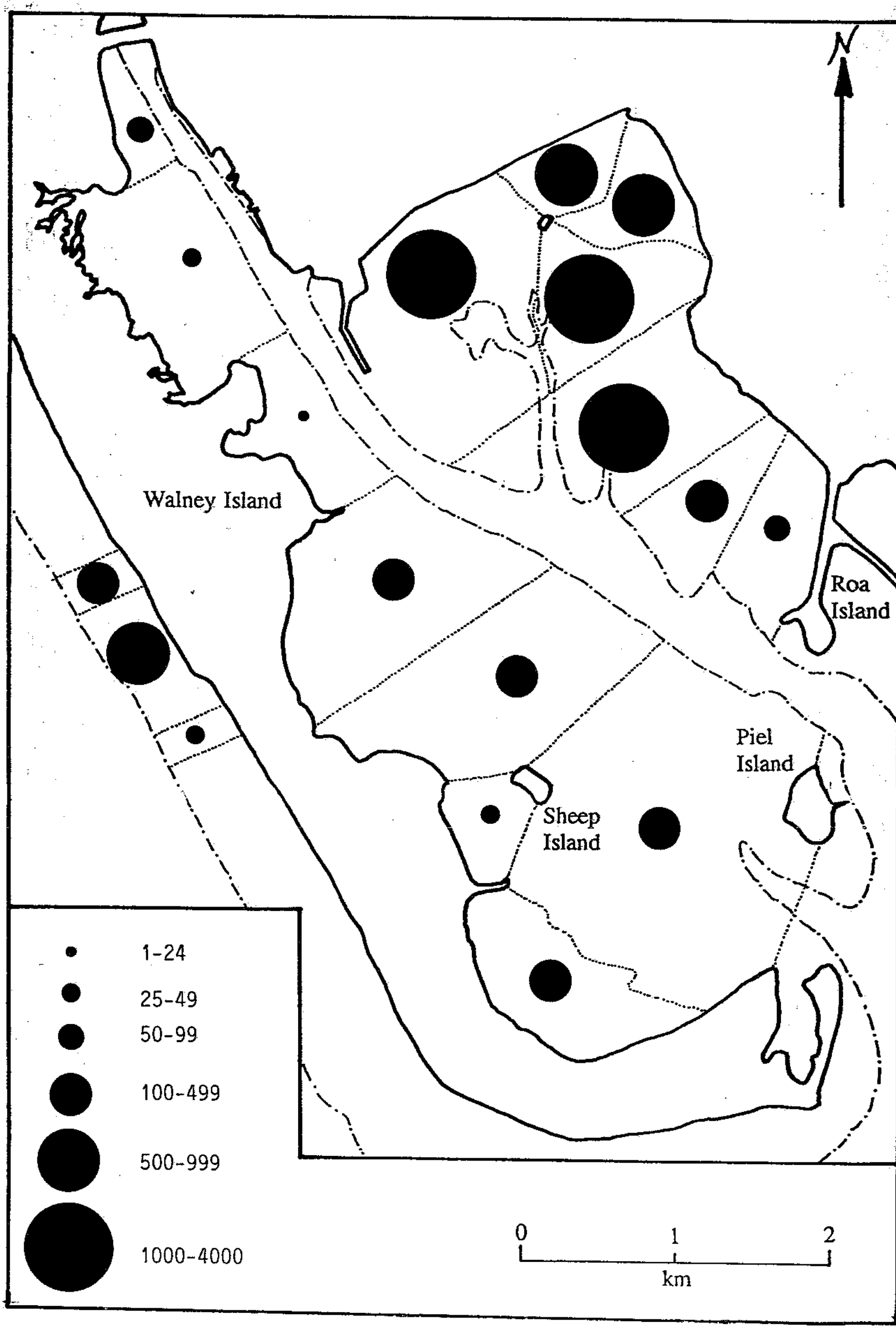

Figure 5.1 The average number of all species feeding on each count area at low tide during the 1991/92 and 1992/93 winters.