SOLWAY FIRTH SHOREBIRD SURVEY

1982 - 1984

A Report to the Nature Conservancy Council
and the Royal Society for the Protection
of Birds

by

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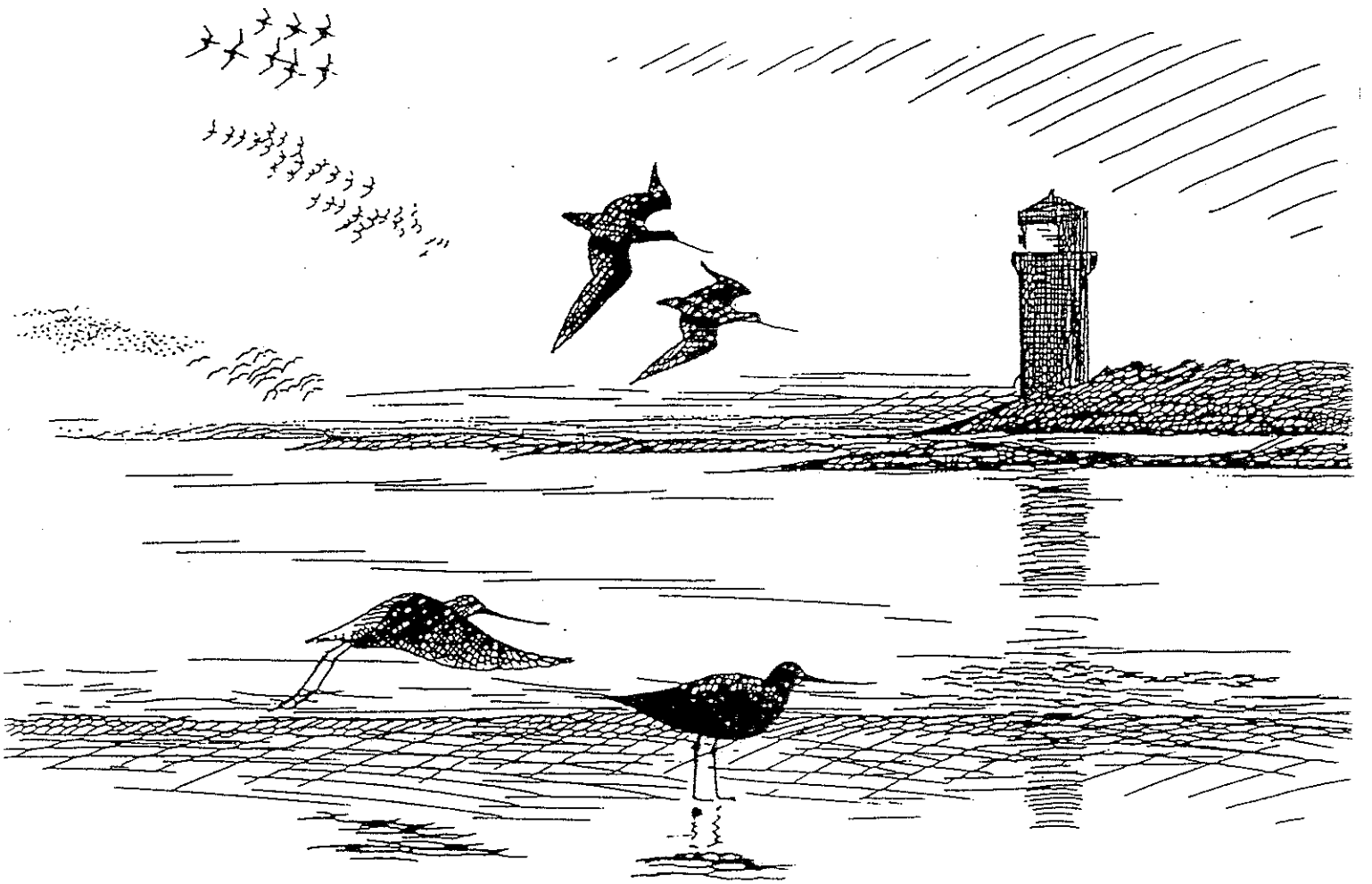
ESTUARIES

SOLWAY WINTER SHOREBIRD SURVEY 1982-84



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ABSTRACT

The ornithological importance of the Solway Firth is examined for wintering waders and wildfowl. Detailed information is presented only for the Inner Solway (outer boundaries are the western edge of Mersehead Sands and Skinburness, on the north and south shores respectively), although a brief assessment of the wader populations on the outer bays is also made. Data on the use of the low water feeding areas were collected during a limited field survey in the period November - February of 1982-83 and 1983-84. In addition, the results of monthly Birds of Estuaries Enquiry counts between 1971 and 1984 are analysed to examine seasonal and long-term patterns of population change for each species.

The Inner Solway is the sixth most important estuary for wintering waders in Britain, supporting an average winter peak of 57,900 birds. Ten species regularly occur in numbers exceeding 1% of the estimated British total (Oystercatcher, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Bar-tailed Godwit, Curlew and Redshank), whilst three occur in internationally significant numbers (Oystercatcher, Knot and Curlew). Long-term population changes of wintering waders are examined in relation to national trends. Four species have changed significantly in abundance since 1971. The Grey Plover has increased, whilst populations of the Turnstone, Redshank and Knot have declined.

The Inner Solway is of national importance to 8 species of wildfowl (Whooper Swan, Pink-footed Goose, Barnacle Goose, Shelduck Wigeon, Pintail, Scaup and Goldeneye), and of international importance to 5 species (Whooper Swan, Pink-footed Goose, Barnacle Goose, Shelduck and Pintail), the most significant being the Barnacle Goose of which the entire Svalbard (Spitsbergen) breeding population winters on the Solway. The intertidal areas are of value to the geese primarily as a safe nocturnal roosting area; most feeding occurs inland. For waders, the most important feeding areas are Mersehead Sands, Blackshaw and Priestside Banks, Cardurnock and the mouth of

Moricambe Bay. Species preferring muddy substrates are most numerous on the inner, sheltered parts of the estuary. For geese, the main roosting sites are Blackshaw and Priestside Banks, Mersehead Sands, Rockcliffe and Moricambe Bay. Dabbling ducks are concentrated in the Caerlaverock area, in the channels of the Esk and Eden, and at the mouth of Moricambe Bay.

The current conservation status of the estuary is described, and all threats to the birds are listed. Some suggestions for future studies are made.

C O N T E N T S

List of Figures

List of Tables Page

1. INTRODUCTION

The Solway Firth is, after Morecambe Bay and the Wash, the largest continuous area of intertidal habitat in Britain (ca. 220 km^2) and is well known as a site of national and international importance for wildfowl and waders (Ratcliffe 1977, Prater 1981). The entire area was designated a Grade 1 site by Ratcliffe (1977) and is also a proposed Ramsar site.

Unlike many other estuaries in Britain, the Solway has not been threatened by major developments – probably because of its geographical location and very wide tidal amplitudes (>10m on high springs). It has therefore been of relatively low priority for conservation-related survey work. This situation has now changed with an increase in tourism, oil prospecting and concern over pollution by radioactive waste. This report presents the results of the first major ornithological survey of the whole estuary, and includes a summary of much of the available historical information.

The survey aimed to assess the importance of the Solway to wintering birds, and the report principally covers the period November to February. Some work was also carried out to examine the use made of the estuary by migrating waders in spring. This will be reported separately, elsewhere. No information was collected for the autumn period which requires further study. The survey covered only the intertidal areas and specifically excluded the use of the saltmarshes or 'merses', except as high tide roosting sites for waders.

Much information has been collected by amateurs on the bird populations of the Solway Firth during the last fifteen years. The North Solway Ringing Group has been ringing waders on the Scottish shore for many years, while counts have been carried out since 1969 by the Birds of Estuaries Enquiry counting teams. The only major ornithological study of the intertidal areas was made by Mearns

(1977) who examined the usage of roosting sites by waders on the Scottish shore over an 8 month survey period. The results were not formally published.

This report aims to bring up to date the current knowledge of the distribution and abundance of birds using the intertidal areas of the Solway Firth. Data are taken from the BoEE counts, a low water survey of birds on feeding areas, and the results of ringing activities.

2. AIMS

The survey had four major aims:

First, to locate the major intertidal feeding areas for waders and wildfowl, and to measure the relative usage of different areas. This was assessed from the results of low water counts.

Second, to organise co-ordinated Birds of Estuaries Enquiry counts on the Solway Firth, in conjuntion with local ornithologists. Such counts provide information on the seasonal patterns of abundance of each species, and on the total populations present.

Third, to examine the movements of waders within the estuary and between other British estuaries. The first aspect was studied by direct observations of movements, and observations of the movements of individually marked birds. Between-estuary movements were analysed from ringing recoveries.

Fourth, to assess the importance of the area as a staging post for migrating waders in spring. This aspect is not treated in this report, but will be presented elsewhere.

3. THE STUDY AREA

The geographical limits of the Solway Firth have variously been defined as the area contained by a line drawn from the Mull of Galloway to Haverigg Point, Cumbria (Perkins and Williams 1963) or by a line joining the Mull of Galloway and St. Bees Head (Perkins 1973).

For wildfowl and waders using the intertidal areas, a number of discrete habitat units can be recognised (Figure 3.1). The first and largest area is the Inner Solway, contained by a line joining the westward tip of Mersehead Sands to Workington, Cumbria. This represents an almost continuous area of intertidal flats totalling about 220 km^2 and is the third largest such area in Britain. In addition, there are a number of bays on the Scottish shore (Rough Firth/Auchencairn Bay, Kirkcudbright Bay, Fleet Bay, Wigtown Bay and Luce Bay) each holding discrete wintering populations of waders and wildfowl. It is unlikely that there are regular movements of birds within a tidal cycle between these units, and for purposes of assessing the conservation importance of the area, they may therefore be treated separately.

The very limited scope of this survey precluded a detailed examination of the whole area, and fieldwork was restricted to part of the Inner Solway, from Silloth to Mersehead Sands inclusive. For the purpose of this report, the term 'Inner Solway' refers to this area only. Data collected for the Birds of Estuaries Enquiry are however examined to give a summary of the wader populations on the other sites.

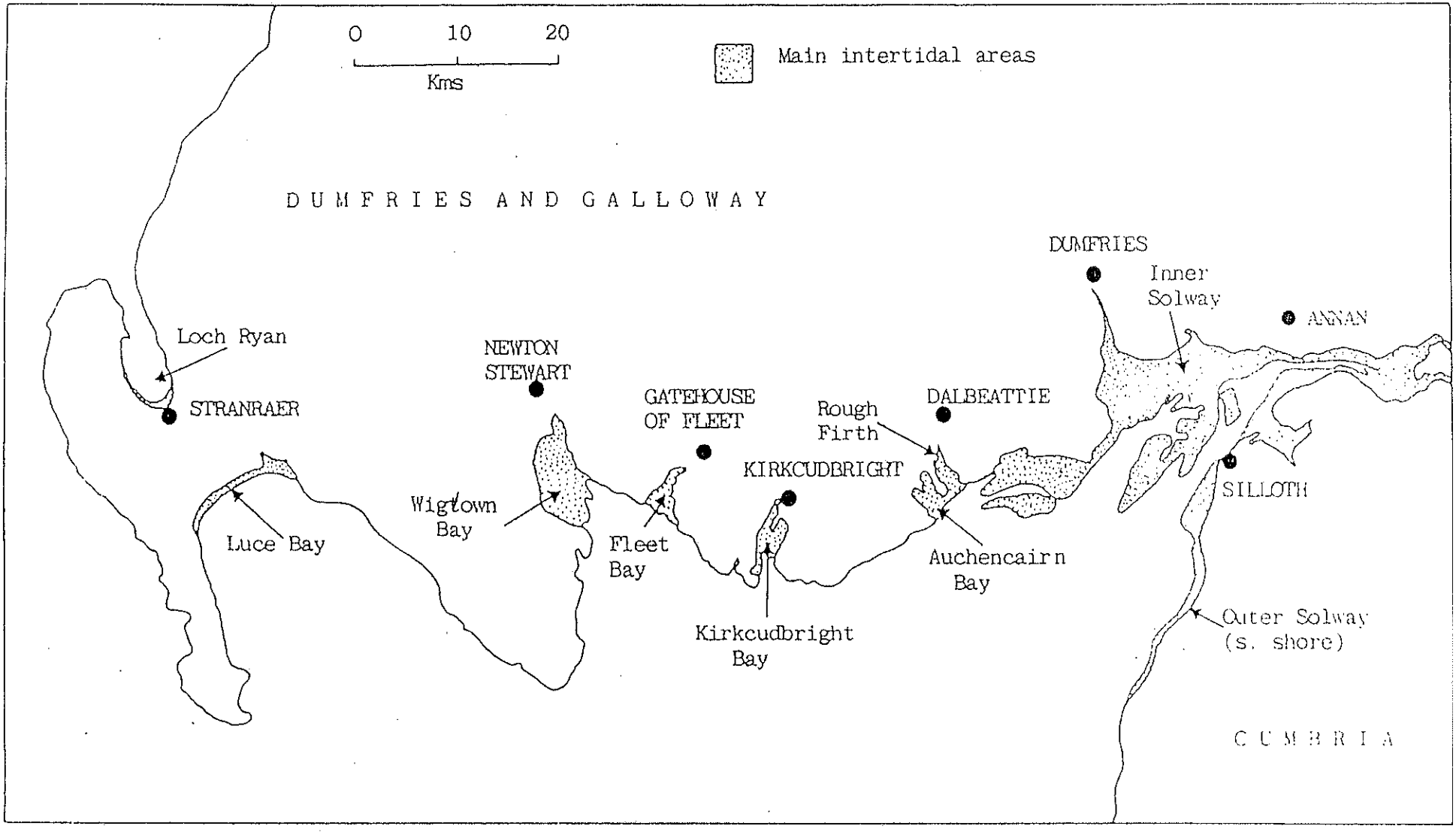


Figure 3.1 The Solway Firth, showing the relationship between the intertidal areas of the Inner Firth, and the outer bays.

4. FIELD METHODS AND LIMITATIONS

4.1. High Water Counts

Information on the numbers of wildfowl and waders present on the Inner Solway has been collected through the Birds of Estuaries Enquiry (BoEE) since 1969. Counts are made on a pre-selected date in the middle of each month chosen to coincide with spring tides, when waders can be counted most satisfactorily. Up to 20 counters participate, making simultaneous counts at each main highwater roost. These counts are summed to give the estuary totals. Examination of the sources of error in large-scale counts of shorebirds has been made by Prater (1979) and by Kersten et al. (1981) and all evidence suggests that such counts under-estimate the total numbers of birds present. Further details of the methods are presented by Prater (1981).

Counts on the Solway have been sporadic, with a gap from 1976 to 1979 when no complete counts were made. Wherever possible, I have restricted analyses for this report to the most recent counts available. These are the three seasons of 1981-82, 1982-83 and 1983-84. Counts were organised separately on the north and south shores (although made simultaneously when carried out), and the following table shows in which months counts have been carried out for the two areas:

	S. Solway			N. Solway		
	1981-2	1982-3	1983-4	1981-2	1982-3	1983-4
July	x	+	x			
August	x	x	+			
September	x	+	x			x
October	x	x	x			x
November	x	x	x		x	x
December	x	x	x	x	x	x
January	+	x	x	x	x	x
February	x	x	x	x	x	x
March	x	x	x		x	x
April	+	x	x			
May	+	x	x			
June	+	x				

Table 4.1 Frequency of BoEE counts on the Inner Solway during the last three counting seasons. An 'x' indicates that complete coverage was achieved, whilst a '+' indicates only partial coverage. A blank indicates that no count was made.

Good coverage has been achieved for the midwinter months (Dec-Feb) in both areas but only the south shore has been counted during the spring and autumn period.

When interpreting the results of the high water roost counts, four limitations have been considered throughout this report:

Rockcliffe Marsh. This important saltmarsh was not included in the counts because of great difficulty and danger of access on high tides, and because of a lack of manpower. The area is of great importance to field-feeding species such as Lapwing and Golden Plover as well as geese, but is of lesser importance as a roosting area of truly estuarine wader species (at least in winter). Some underestimation in total counts will however occur for Oystercatcher (max. 200), Redshank (max. 150) and Dunlin (max. 200).

Field feeding/roosting. The Solway is surrounded by a narrow band of low-lying fields (mainly pasture) which often become flooded in winter. These are used as a major feeding area by Lapwing and Golden Plover, and as a secondary feeding area/high water roost by Curlew, Redshank, Oystercatcher and Dunlin. Wherever possible, the birds using these areas were included in the counts, but some underestimation of totals occurred when flocks using these extensive habitats were missed. This occurred principally in two areas:

(a) Fields surrounding Morecambe Bay (S. shore)
(b) Fields between Annan and Gretna (N. shore)

Turnover. BoEE counts can measure only the bird populations present on one particular day in a month. This may considerably underestimate the number of individual birds which have used the estuary in that month. During periods of peak migration/cold weather movements, the entire population may be 'turning over' very rapidly (eg Moser and Carrier 1984). Thus at these times the importance of the site will be underestimated by the BoEE counts.

Movements. High water roosts tend to form at sites where the birds are relatively safe from predators and disturbance. For this reason, some birds may fly considerable distances from their low water feeding areas to roost. It is not therefore possible to assess the importance of different parts of the estuary for feeding, by examining the roosting distribution of the birds (Barret and Barret 1984). I have therefore used the results of low water counts and observations of the movements of birds to interpret the high water counts.

Thus, high water roost counts give the best estimate of the total number of waders present on the estuary but they are always expected to underestimate the true importance of the area. The distribution of birds on the roosts does not necessarily reflect the importance of different sections for feeding.

4.2 Low Water Counts

A major aim of the survey was to identify the most important intertidal feeding areas of waders and wildfowl. This requires that the birds are counted over the low water period, at which time some 220 km^2 of sediment may be exposed. Similar studies elsewhere have generally used larger, full-time teams (Halliday 1978, Goss-Custard 1977, Tasker and Milsom 1979). With the limited manpower available for this survey (1 man, part-time), it was not possible to map the relative densities of birds over the whole area. Instead, the study area was divided into 8 sections, the boundaries being defined to enclose logical units between which bird movements were small. Each section was visited once each month (Nov-Feb inclusive) in 1982-83 and 1983-84, to locate and count feeding waders. Thus, there were 8 counts for each section. Complete information was collected in the first winter but severe and prolonged gales resulted in minor gaps in coverage in the second winter. For the purpose of analysis, I supplemented these missing data with counts made at high water for the relevant section, using knowledge of the movements of birds to avoid inconsistencies.

Each low water count of the Inner Solway took from 8-14 days to achieve, depending on weather, day length and tidal conditions. To minimise the chance of double counts resulting from the local movements of birds, adjacent sections were counted consecutively. Counts were carried out during the period 4 hours either side of low water. Some sections could

be counted most easily from a raised vantage point on the shore, whilst other sections required that the entire length of the intertidal area be walked. Strictly 'low water' counts were not feasilble on the two largest sections (1 and 3), and they were assessed instead, by counting the birds on the rising tide, watching carefully for movements of birds into or out of the area. The counts were aided greatly by the absence of many creeks on the Solway (cf Goss-Custard 1977) in which the birds could easily have been hidden.

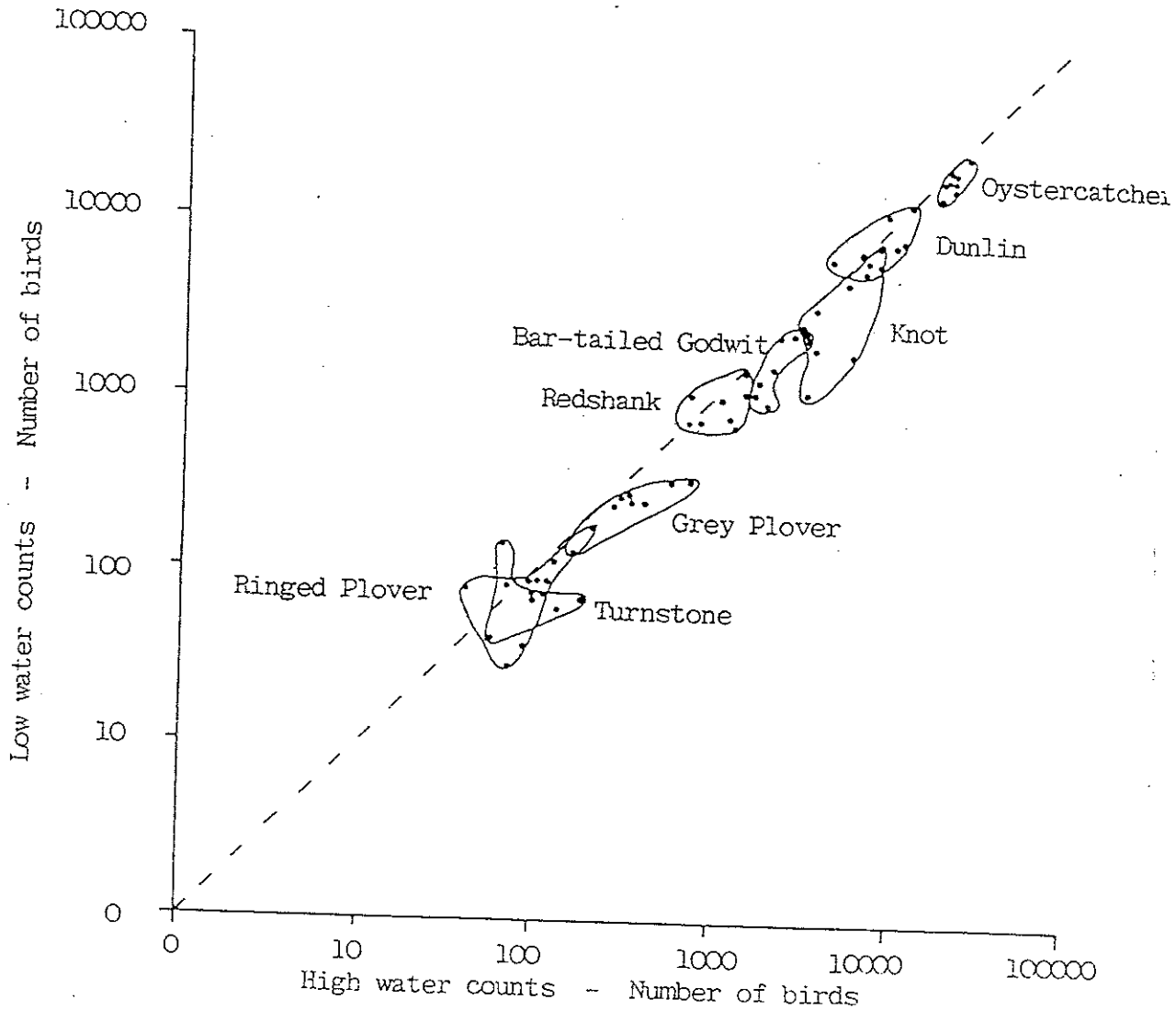
All observations were made using a 20-45X Mirador telescope, supplemented by 10 X 40B binoculars. Data were recorded directly onto a tape recorder, to be transcribed onto summary sheets later the same day. This facilitated scanning large flocks of birds without requiring the use of a notebook.

4.3 Comparison of Low Water and High Water Counts

The importance of the intertidal feeding areas was assessed from low water counts. High water roost counts are generally considered to give the most reliable results (Prater 1981) since at low water, the birds are spread over vast areas.

It is important to ensure that the low water counts are representative of the actual usage of the feeding areas. A test of the data would be to compare totals for low and high water counts in individual sections for each count. This was not however possible since some birds moved between sections for feeding and roosting. I have thus compared the estuary totals for each of the eight low water counts with the totals from the corresponding BoEE counts (Figure 4.1). The results show a reasonable agreement although, as expected, the low water counts tend to produce consistently lower totals than roost counts. The most likely sources of difference are that some birds may have been missed at low water because they were out of sight or that some birds moved into the study area from

FIGURE 4.1. Comparison between low water counts and high water counts of waders on the Solway Firth. Each dot represents the results of counts in a single month. There are 8 dots per species (November - February inclusive in 1982-3 and 1983-4).



south of Silloth, at HW, thus inflating the HW totals (particularly Oystercatcher and Knot).

Thus, a comparison of low water and high water counts gave results of similar orders of magnitude, although the former always tended to give rather lower values. Low water counts give a 'best estimate' of the relative usage of the intertidal areas, although this underestimated the absolute importance of each section. The greatest errors were for species with a clumped distribution, such as Knot, Grey Plover, Ringed Plover and Turnstone where failure to detect a flock on the feeding areas greatly affected overall totals.

5. RESULTS : SECTION APPRAISALS

This section of the report examines the relative utilisation of the intertidal feeding areas of the Inner Solway, by waders and wildfowl. The study area was divided into 8 major ornithological units (Figure 5.1). These were selected because they were discrete, convenient units for counting since movements of birds between them were few.

The text for each section is divided into five parts, with an accompanying map and table.

Description of the physical characteristics of the intertidal areas, shoreline and hinterland.

Ornithological importance. A table accompanies each section, giving details of the numbers of birds feeding, and assessing the relative importance of the section for each species in relation to the rest of the Solway. Only waders and Shelduck are examined quantitatively since geese and dabbling ducks which use the intertidal habitats largely for roosting, were not studied intensively.

All data are combined for the eight low water counts made on each section (see p. 15 for details of field-methods). The following measures of importance were calculated for each species on each section:

- Maximum count of the eight counts available
- Minimum count of the eight counts available
- Median count of the eight counts available
  This measure was used rather than the mean because of the large numbers of zero counts for some species. A median count of 100 birds indicates that on half the visits to the area, one would expect to count at least 100 birds.

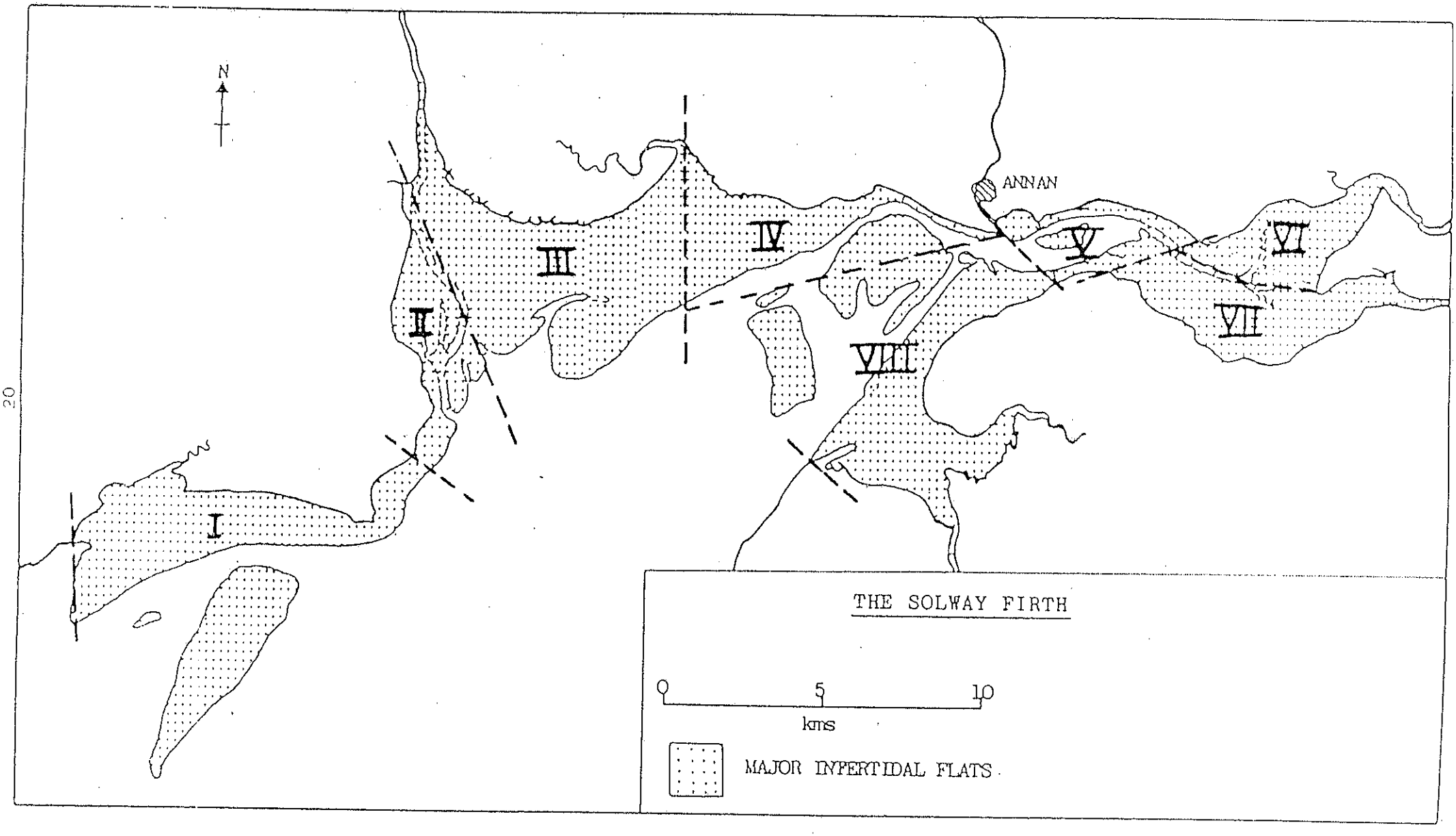


Figure 5.1 Map of study area showing the 8 ornithological units

- Percentage of Solway population[1] Calculated as $\frac{1}{6}\sum \frac{Si}{Ti}$ where Si is the count for the section in count 'i', and Ti is the total for all sections in count 'i'. The individual percentage values were arcsin transformed for the calculation, and reverse transformed to give the mean and 95% confidence limits.

- Section rank[1] Each section was ranked against the other sections according to the percentage of the Solway population held of each species. An overall rank was calculated by summing the rank-scores for individual species.

Roosts. The main spring tide roosting sites of waders are described for each section. Neap tide roosts are not described in detail because these are highly variable in position, and are not likely to be limited in availability. More detailed information on the use of roosting sites on the Scottish shore is given by Mearns (1977).

Distribution and movements. Each section text is accompanied by a map of the section. This shows features of the intertidal areas, the main areas used by feeding birds, and the location of the principal roosts. In order to minimise the complexity of these maps, I have used the following codes to denote the main areas used by each species:

OC	Oystercatcher	BA	Bar-tailed Godwit
RP	Ringed Plover	RK	Redshank
GV	Grey Plover	KN	Knot
TT	Turnstone	DN	Dunlin
CU	Curlew	SH	Shelduck

★ denotes the principal roosts, and the code-number refers to the roost description in the appropriate text.

Potential threats. Those relating to estuary birds only, are described.

1 A summary table of these values is given in Appendix 3, for quick reference.

5.1 SECTION 1. Southwick Burn to Powhillimount

Grif Refs. NX888534 - NX990564

5.1.1 Description (Figure 5.2)

Although ornithologically a distinct unit, this section falls into three separate habitat units:

The extensive flats of Mersehead Sands provide the second largest homogenous unit of intertidal habitats on the inner Solway. If the vast offshore bank of Barnhourie is included, the most distant point on LW Springs lies some 9km from the shore. The substrates are almost entirely hard sands, with one or two muddier patches in Sandyhills Bay, around Southwick Water, and just to the west of Southerness Point. There are three major freshwater outlets, at Fairgirth Lane, Southwick Water and at the western end of Preston Merse. From Sandyhills to Caulkerbush, the shore is backed by steep wooded slopes rising to 150 feet. To the east lies the long, low plain of Preston Merse, dissected by the meander of Southwick Water at the eastern end. The farmland of Preston Merse is separated from the intertidal areas by a long strip of dunes, in places reaching 30 feet high.

The Southerness rock outcrops which fringe Southerness Point form a unique habitat on the Inner Solway, extending some 250 metres from the shore at LW. The rocks are interspersed with sandy patches and stony scars, some with Mytilus beds. The area backing the rocks is undergoing rapid tourist development, with a large holiday camp, new bungalows and a golf course being the main features.

Gillfoot Bay lies to the east of, and is sheltered by, Southerness Point. The sediments are of firm/soft sand, interspersed by small rock outcrops towards the low water mark. The area is backed, in part, by the Southerness Holiday Camp, but also to the east by grazing land.

5.1.2 Ornithological Importance

Waders and Shelduck (Table 5.1)

This is the third most important of the eight ornithological units recognised on the Inner Solway, holding the highest proportions of the Solway populations of Turnstones (44%) and Bar-tailed Godwits (69%). It is also the only section in which Purple Sandpiper occurs. The occurrence of this species and of Turnstone in relatively large numbers is related to the extensive rock-outcrops at Southerness Point, which are unique to this section of the Inner Solway. Excepting these two, the species composition of waders in this section is heavily weighted to those species which characterise the sandier parts of estuaries, particularly Bar-tailed Godwits, Grey Plovers and Ringed Plovers. The section is less important for species which prefer muddier sediments, such as Redshank, Curlew and Shelduck. The small numbers of these species which do occur, are generally found in the muddier areas.

Wildfowl

An important night-time roost of geese occurs on Mersehead Sands from November to March, with the birds feeding on inland fields during the day. Regular numbers include up to about 2000 Barnacles, 1000 Pinkfeet nd 250 Greylag. In severe weather, this area may be particularly important for the geese, since it freezes less readily than areas further inland. Thus, in December 1981 and January 1982, up to 6000 Barnacle Geese were recorded at this roost. This section is both of national and international importance for Barnacles and Pinkfeet. It is not of national significance for dabbling ducks, although a roost of up to 200 Mallard, Wigeon and Pintail frequently occurs at the mouth of Southwick Water. The flock of Common Scoter which was regular at Southerness has now entirely disappeared.

Other species

Large numbers of seabirds can be observed from Southerness at high water, particularly during westerly gales. Of note are regular observations of grebes and divers. The area is particularly important for Red-throated Divers in April and early May. A concentration of 47 individuals was recorded here in May 1983.

Table 5.1. The Ornithological significance of section 1 of the Inner Solway to wintering populations of waders and Shelduck. Results are presented for the two winters of 1982-83 and 1983-84, combined. Data from low water counts.

	Median Count	Max. Count	Min. Count	Section Rank	Mean % of Solway total	95% confidence limits
Oystercatcher	3536	5300	2600	4	19.9	17.3-22.9%
Ringed Plover	15	57	8	3	20.6	15.1-26.8%
Grey Plover	90	140	7	3	27.6	15.9-41.2%
Turnstone	27	63	11	1	43.6	26.5-61.4%
Curlew	47	220	0	6	4.2	1.1- 9.0%
Bar-tailed Godwit	1476	2210	490	1	68.9	55.9-80.5%
Redshank	31	67	16	7	3.6	2.4- 5.2%
Knot	285	680	170	3	11.3	7.4-15.7%
Dunlin	715	4200	350	3	11.5	6.4-17.7%
Shelduck	68	190	0	5	9.5	2.3-20.6%

NB

Single underlining indicates a population of national significance in this section.

Double underlining indicates a population of international significance in this section.

5.1.3 Roosts

There are five main roosts in this section. General observations of flock movements, supported by sightings of colour-marked waders indicated that there were frequent movements of birds between roosts. The scale of these

movements was influenced by tide-height, disturbance and weather. In general, the level of disturbance decreased sharply, with increasing distance from Southerness.

Roost 1.1. Lot's Wife

Grid Ref. NX906554–NX915558

Roost position highly variable. On neap tides, the roost can be well out on the sand towards the mouth of Southwick Water, whilst on high Springs the birds may be forced onto the merse. Adjacent fields were rarely observed to be used for feeding or roosting. The roost is easily viewed and counted from the A710. Human disturbance never observed.

Principal species: Oystercatcher, Curlew, Dunlin and Redshank. Also Mallard, Wigeon, Pintail and Shelduck, offshore.

Roost 1.2. Mersehead Plantation

Grid Ref. NX927553

Subroost normally develops on sand 200 metres below shoreline, before being pushed up against the dunes by the tide. Considerable movements of the smaller waders between this roost and Roost 3. Access on foot from Southerness; observation from behind the dunes. Human disturbance rare.

Principal species: Oystercatcher. Smaller numbers of Dunlin, Curlew, Grey Plover, Knot, Redshank, Bar-tailed Godwit and Ringed Plover also occur.

Roost 1.3. Preston Merse West

Grid Ref. NX945552

On neap tides, the roost formed well out on the sands. On higher tides, a subroost also formed well out, before the birds were pushed up against the dunes. Considerable movement of the smaller waders between this roost and roosts 2 and 4.

Access on foot from Southerness; observations from behind the dunes. Human disturbance rare.

Principal species: Oystercatcher, with smaller numbers of Dunlin and Curlew.

Roost 1.4. Preston Merse East
Grid Ref. NX957548

The main roosting site is a sand-spit, formed where a small stream joins the sea. This can be observed from the shore or from behind the dunes, with access on foot from Southerness. Numbers of birds present very variable - related to amount of disturbance at Southerness and other roosts.

Principal species: Oystercatcher and sometimes Dunlin, Knot, Bar-tailed Godwit. Small numbers of Redshank occasionally.

Roost 1.5. Southerness Rocks.
Grid Ref. NX970542

The main roost site lies directly below the triangulation point, on rocks at the western end of Southerness Point. On some tides, birds also roost in the sandy bay slightly further to the west (particularly Dunlin, Grey Plover and Shelduck), as well as on the shell-beaches of Southerness Point (particularly Turnstone, Purple Sandpiper, Ringed Plover). Use of this roost-site was strongly dependent on the amount of disturbance here and at adjacent roosts. Much movement of birds between here, and Roosts 4 and 6. Access on foot from Southerness; observations best made from triangulation point.

Principal species: Oystercatcher, Turnstone, Purple Sandpiper, Ringed Plover; Dunlin and Grey Plover occasional.

Roost 1.6. Gillfoot Bay

Grid Ref. NX982558

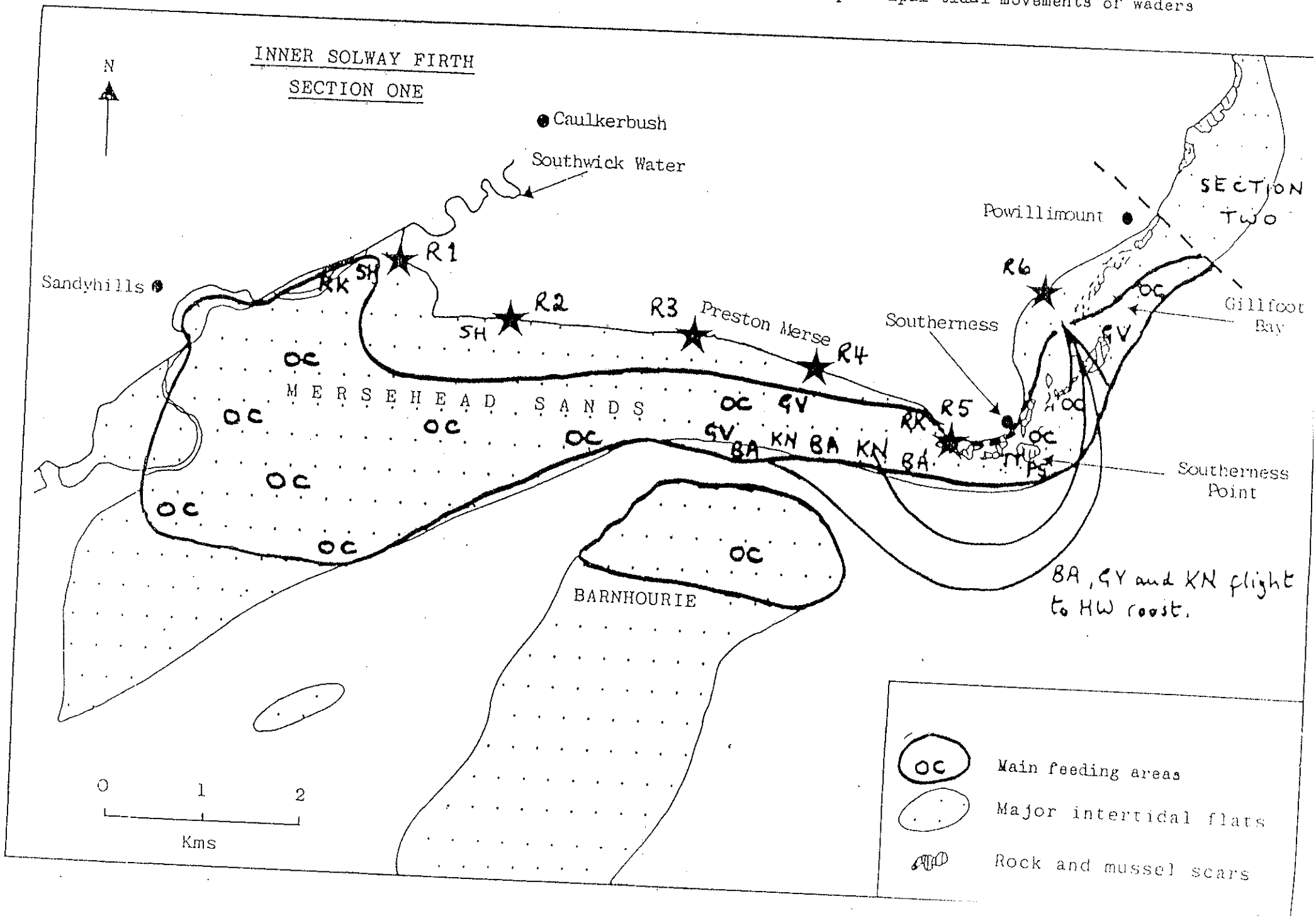
Roost site on small spit of sand/grass which remains exposed on all but the highest spring tides. On neap tides, birds can roost in a thin band all along the shores of Gillfoot Bay, with a concentration of Oystercatchers often on the Powhillimount Scar (NX990563). Protected from disturbance by deep channel of stream at HW. On days with no disturbance, the roost sometimes forms to the west of this channel, on the sandy beach of Gillfoot Bay. Much movement of birds from Roost 5 to here, when Southerness Point is disturbed. Access through the Southerness Holiday Camp; observations best made from the most easterly camp chalets.

Principal species: Bar-tailed Godwit, Knot, Grey Plover, Oystercatcher, Dunlin. Occasionally smaller numbers of Ringed Plover, Redshank and Turnstone.

5.1.4 Distribution and Movements (Figure 5.2)

The principal feeding areas and general movement patterns of birds within this section are shown in Figure 1.1.1. Only two movements of birds between this section and another were known to occur regularly. The Bar-tailed Godwit flock was highly mobile, as indicated by the large fluctuations in numbers present on any date. Direct observations of movements of the flock from Southerness to Grune Point on the south shore (section 8) were observed on one occasion, and this was supported by sightings of two Southerness-marked individuals in a flock of 620 birds on 7th February 1984. It is likely that similar movements were shown by the Southerness Knot flock, but an inadequate sample was marked for observation. The second movement concerned Oystercatchers and Grey Plovers which sometimes moved between the Gillfoot Bay roost, and the adjacent Borron Point roost in response to extremes of tidal height or disturbance.

Figure 5.2 Map of Section One, showing location of major roosts and principal tidal movements of waders



The normal pattern of local tidal movements was influenced by the level of disturbance at Southerness, causing movements of birds particularly to the Gillfoot Bay roost. During periods of severe westerly gales, this roost is also favoured to those on the exposed shore of Mersehead Sands and Southerness. In general, birds feeding on Mersehead Sands tended to roost at the nearest roost-site to their feeding areas. There were, however, very predictable movements of Bar-tailed Godwit, Knot and Grey Plover which fed mainly at the Eastern end of Mersehead Sands. On every tide, the majority of individuals of these species would leave Mersehead Sands as their feeding area became covered, and flight across Southerness Point to feed in Gillfoot Bay. Here, they were able to feed until forced onto their high water roosting site. These movements were entirely predictable, and occurred in reverse on the falling tide.

5.1.5 Potential Threats

Little is known of the intensity and effects of wildfowling in this important goose-roosting area.

Development of tourism is occurring very rapidly at Southerness. Most pressure occurs in the summer months, but the increasing presence of dog-walkers, motor-cyclists and cars on the beach must be considered a threat. Further encroachment of the Holiday Village to the east will threaten the important Gillfoot Bay roost. This currently offers some sanctuary when the other roosts are disturbed, and may be particularly important during severe weather.

5.2 SECTION 2. Powhillimount to Burnfoot

Grid Refs. NX990565 to NX990637

5.2.1 Description (Figure 5.3)

This is the most sheltered section of the Inner Solway, lying in the lee of the Southerness Peninsula which protects it from the force of the incoming tide, and particularly from the effects of strong westerly gales. The net result of this protection is that fine muddy sediments are deposited in quantities found nowhere else on the estuary. The sediments neatly divide the section into three subunits: The first comprises Carse Bay, which has a fine muddy substrate, dissected by deep creeks, both features being unusual on the Inner Solway. Carse Bay is bounded on the seaward side by the channel of the River Nith, which divides the muddy sediments from the extensive hard sands of Blackshaw Bank (section 3). The dividing line between these two sections is difficult to define, as a result of the mobility of the sediments in the Nith Channel. However, the interface area is little used by feeding birds.

The second subarea comprises the Carsethorn scars, which support some of the highest densities of feeding waders seen on the Solway. The scars run from the upper shore, down to the channel of the Nith, and are approximately 1½ km long. The most extensive Mytilus beds on the Inner Solway occur here. The scars have also trapped large deposits of mud, which also provide important feeding opportunities for some species.

To the east of the scars lie the hard sandflats between Borron Point and Powhillimount. These are very barren, supporting only a small number of feeding Oystercatchers and some Curlew.

The area immediately behind this section comprises arable and pasture land, which may be used by feeding waders over the high water period. There is a small pool at Kirkbean, which is used for washing and roosting. The whole section can be approached and viewed easily from the village of Carsethorn. Disturbance to the area is slight, with low levels of wildfowling in Carse Bay; walkers and bait-diggers on the Carsethorn scars area.

5.2.2 Ornithological Importance (Table 5.2)

Waders and Shelduck

This section ranks fifth most important of the eight recognised sections of the Inner Solway. It is the most important section for Ringed Plovers and the second most important for Redshank, holding 22% and 16% of the Solway populations of the two species respectively. The section is the least important for Curlew and Bar-tailed Godwit. No species were represented in nationally significant numbers.

Wildfowl

This section is not used to any extent by geese. There is a roost of dabbling duck in Carse Bay, which frequently holds the flock of Pintail which occur between here and Caerlaverock. The average winter peak for this flock in the last 5 years is 340 birds, although up to 2400 have been recorded passing through in the Autumn. This section is thus of national and international importance for Pintail. Up to 130 Mallard, plus smaller numbers of Wigeon and Teal also occur, but are not of significance. A flock of Scaup regularly winters off Carsethorn. Peak numbers in the last two winters have been 220 and 120 individuals. The area is thus of national but not international significance for this species.

Table 5.2. The Ornithological significance of Section 2 of the Inner Solway to wintering populations of waders and Shelduck. Results are presented for the winters 1982-83 and 1983-84, combined. Data are from Low water counts.

	Median Count	Max. Count	Min. Count	Section Rank	Mean % of Solway total	95% confidence limits
Oystercatcher	1191	2100	822	5	6.9	5.1- 8.7%
Ringed Plover	23	48	0	1	22.0	9.8-37.6%
Grey Plover	10	29	0	4	3.8	0.4-10.7%
Turnstone	12	26	0	3	18.3	5.9-35.4%
Curlew	21	84	0	8	2.3	0.6- 5.0%
Bar-tailed Godwit	1	3	0	8	-	----
Redshank	166	227	102	2	15.9	11.3-21.0%
Knot	18	415	0	6	0.9	0- 3.6%
Dunlin	435	960	48	7	4.9	2.0- 9.1%
Shelduck	9	52	0	7	2.2	0.3- 5.9%

NB
Single underlining indicates a count of national significance
Double underlining indicates a count of international significance

5.2.3 Roosts

Roost 2.1. Borron Point

Grid Ref. NX996584

The exact location of this roost depends on tidal height. On neap tides, the roost occurs on the long spit which remains exposed below Borron Point. On higher tides (but those lower than 9.0m), the roost occurs at the top of the shore among broken rocks. Most tides above 9.0m, or periods of severe gales push the roost off the shore into the fields directly behind. An alternative roost involving some of the same birds, occasionally forms on the beach to the east of the House-on-the-Shore (NX993572). Access along the shore from Carsethorn, or through the fields at Tallowquairn. This roost can be difficult to count without disturbing the birds.

Occasional disturbance by walkers can push some birds to the Gillfoot Bay roost.

Principal species: Oystercatcher, Grey Plover, Turnstone, often some Knot and Dunlin. Smaller numbers of Redshank, Curlew and Bar-tailed Godwit.

Roost 2.2. Carse Bay
Grid Ref. NX985605 to NX984622

Position of roost very variable. On neap tides, the birds will remain feeding throughout HW in Carse Bay. On higher tides, the birds are pushed off the feeding areas, to roost either on the shingle beach 200-300m north of Carsethorn, or onto the merse edge at the mouth of the Drum Burn. There is little movement of birds between this, and other roosts. Disturbance not observed. Under certain conditions, particularly during gales or when there is a lot of floodwater in the fields, a large proportion of the birds from this roost may feed in the fields between the villages of Carsethorn and Kirkbean. The floodpool at Kirkbean (NX983594) frequently holds small numbers of roosting Oystercatcher, Redshank and Dunlin, and occasionally all the Redshank from this area.

Principal species: Oystercatcher, Redshank, Dunlin, Curlew. Smaller numbers of Grey Plover, Ringed Plover and Turnstone sometimes occur.

5.2.4 Distribution and Movements (Figure 5.3)

The principal species feeding on the Carsethorn Scars were Oystercatchers, with smaller numbers of Grey Plover, Turnstone, Curlew, Redshank, Dunlin and Knot. There was also a regular flock of 10-20 Ringed Plover on the sandier area separating the two halves of the scar. The seaward edge of

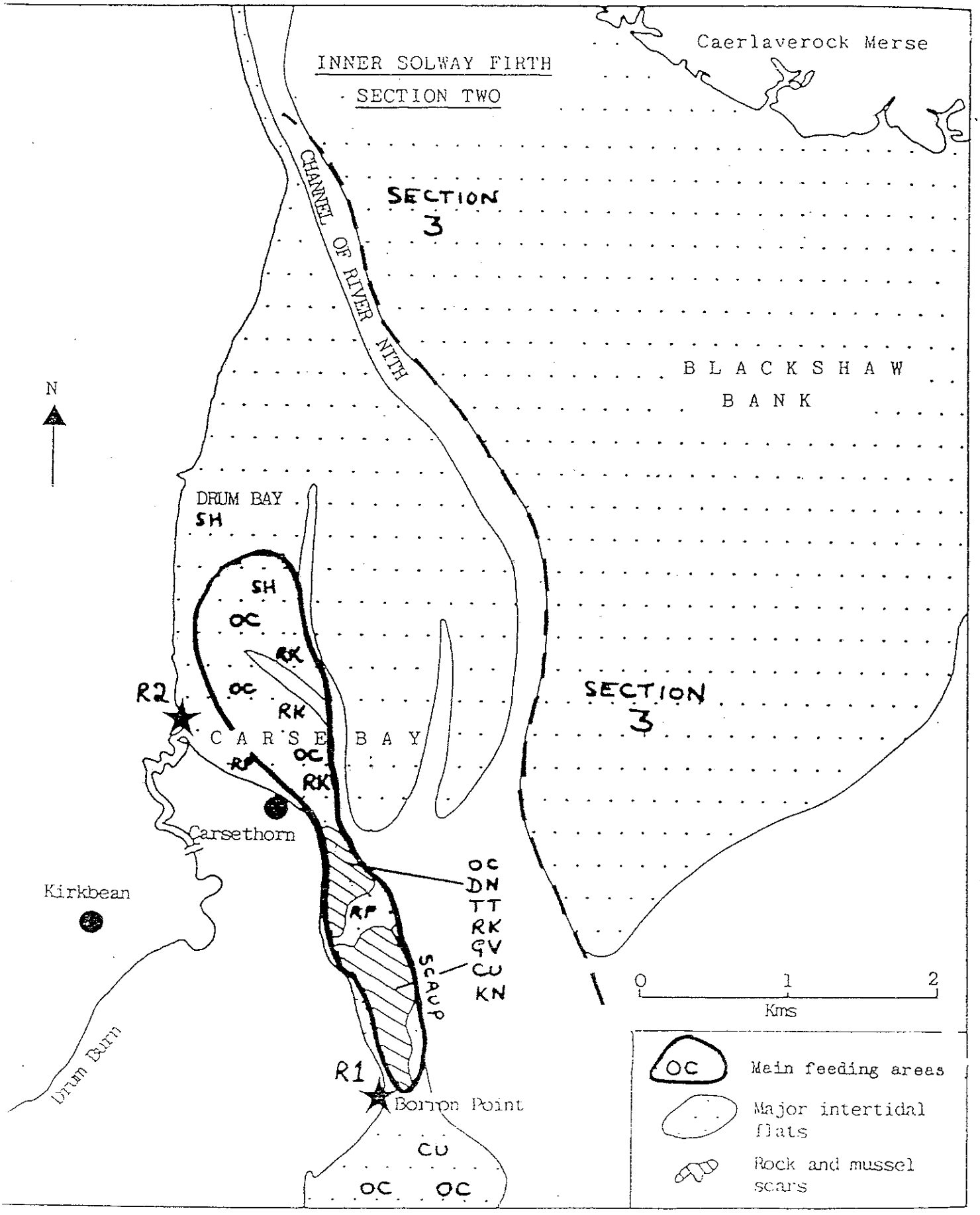


Figure 5.3 Map of Section Two, showing principal feeding areas and roosts

the scar was also an important feeding site for a flock of Scaup. The main species in Carse Bay at low water were Redshank, Dunlin and Oystercatcher. This is also a roosting area for Mallard and Pintail.

The only regular movements in or out of this section on a single tidal cycle were of small numbers of Oystercatchers (normally less than 50 birds), which came from the nearer feeding areas of Blackshaw Bank (section 3) to roost at Borron Point. There was also occasionally a small movement of Oystercatchers and Grey Plovers between Borron Point and the Gillfoot Bay roost, particularly in response to disturbance.

Within the section, there were considerable displacements of birds on a tidal cycle. The Oystercatchers, Grey Plovers and Turnstones moved up on the rising tide directly to the Borron Point roost. In contrast, the Dunlin and Redshank which fed on the Scars, flighted north to use the extra feeding time available before high water, to feed in Carse Bay. At high water, large numbers of these species would, on some occasions feed in the fields between Carse Bay and Kirkbean. The Scaup which fed below the scars always moved into Carse Bay at high water roost.

5.2.5 Potential Threats

Walkers may occasionally disturb the wader roosts in Carse Bay and at Borron Point.

5.3 SECTION 3 Nith Estuary and Blackshaw Bank

Grid refs. NX985655 to NY082670

5.3.1 Description (Figure 5.4)

This is the most extensive area of intertidal flats on the Inner Solway, mainly comprising the vast hard sandbanks of

Blackshaw Bank, which extend more than 5km from the shore at their extreme. Many of the higher parts of these sandbanks remain exposed on all but spring tides, particularly the area below Caerlaverock Merse and around the mouth of Lochar Water. These parts are thus very poor feeding areas for waders. Similarly, many of the outer sandbanks are highly mobile and change configuration frequently following storms or high tides. This is seen at its most extreme with the channel of the river Nith, which may shift position laterally by up to 1km following severe gales. The huge sediment shifts make these areas unsuitable for invertebrates and therefore feeding waders. The vast flocks of Oystercatchers which characterise this section are thus restricted by these physical factors to the central parts of the Bank.

Counting feeding birds on this section at low water is hindered by the vast nature of the sands and the deep gullies which are found, particularly at the seaward edge. However, reasonable counts can be made on clear days, by telescope, with successive checks from the Caerlaverock observation tower, Castle Corner, from the A710 at Drumburn, and from Carsethorn. Alternatively, counts can be made on a rising tide from the Caerlaverock tower, as the birds move up towards the roost on Caerlaverock merse.

The hard sands of Blackshaw extend up the Nith channel only as far as Castle Corner, before the muddier sediments of the river become apparent. This makes the area between Castle Corner and Scar Point a particularly good feeding area. Just to the west of Castle Corner, there is a small stony Scar, and this coupled with the muddy erosion edge of Caerlaverock Merse can be a good feeding area also. Upstream from Scar Point, the channel rapidly narrows and becomes very steep sided and muddy. No waders occur upstream from Glencaple.

This section is very easily counted from the B725 between Glencaple and Castle Corner.

The intertidal areas of Blackshaw Bank are backed by the Caerlaverock Merse, which is up to 500m wide in places. The low-lying flooded fields behind the merse are frequently used by waders. The western bank of the Nith estuary is bounded to the north by the Kirkconnel Merse, and to the south by the steep wooded bank of Airds Point. The eastern bank of the Nith is bounded to the north by the steep Kenneth Bank. The Caerlaverock Merse first appears 1km to the north of Scar Point.

5.3.2 Ornithological Importance

Waders and Shelduck (Table 5.3)

This is the most important section for Oystercatchers, with 22% of the Solway total, and the third most important section for Curlew (12%). Wintering Oystercatcher numbers are regularly of national significance.

Wildfowl

The Caerlaverock NNR, Wildfowl Trust Refuge and associated agricultural land and intertidal flats comprise the most important areas for wildfowl on the Inner Solway.

Swans This is the most important section of the Solway for swans, with up to 150 Whoopers, 70 Bewick's and 50 Mutes regularly each winter. The first two species both occur in nationally important numbers, while the number of Whoopers is also of international significance. To a large extent, the swans remain inland on arable/pasture fields or on the Wildfowl Trust Refuge. There are, however, regular observations of small parties roosting on the foreshore.

Geese In October, the area often holds the entire world population of the Svalbard Barnacle Goose, and is thus of unique international conservation value. In addition, the area is frequently used by 2-3000 (occasionally 5000) Pink-footed geese, and 500-1500 Greylag geese. It is therefore of international importance for both species.

Ducks This is the most important area for wintering dabbling ducks on the Inner Solway, many being attracted to the Wildfowl Trust Refuge. Although most feeding is done inland, the intertidal areas are important as roosting/loafing areas. Pintail are the only species to attain national importance here, with regular counts of 250-500 birds. Occasional counts of up to 2400 birds are of international importance. The average peak counts for the other species over the last 5 years are 370 Mallard, 730 Teal and 950 Wigeon. There are also up to 20 Shoveler each year.

Table 5.3 The Ornithological significance of Section 3 of the Inner Solway to wintering populations of waders and Shelduck. Results are presented for the two winters 1982-83 and 1983-84, combined. Data are from Low water counts.

	Median Count	Max. Count	Min. Count	Section Rank	Mean % of Solway total	95% confidence limits
Oystercatcher	3994	4950	2978	1	21.6	19.1-24.3%
Ringed Plover	+	14	0	8	0.1	0- 1.1%
Grey Plover	+	77	0	7	0.3	0- 1.7%
Turnstone	0	0	0	8	.0	----
Curlew	72	574	0	3	11.6	1.4-29.7%
Bar-tailed Godwit	+	80	0	6	0.5	0- 1.8%
Redshank	34	92	8	8	3.5	2.1- 5.2%
Knot	+	350	0	7	0.4	0- 2.5%
Dunlin	831	2150	130	4	10.1	6.3-14.6%
Shelduck	75	270	3	4	10.5	3.9-19.8%

NB
Single underlining indicates a count of national significance
Double underlining indicates a count of international significance

5.3.3 Roosts

Although small roosts may occur along much of the shore on neap tides, on springs almost all birds in this section roost on the edge of the Caerlaverock Merse, or associated fields.

Roost 3.1 and 3.2 Caerlaverock Reserve
Grid refs. NY038645 and NY056643

On all high tides, a very important wader roost occurs either below, on or at the back of the extensive merse of the Caerlaverock NNR. Roosts occur anywhere along the shore, but two sites are especially favoured, the first being in front of the NNR observation tower, and the second further west at the shooting boundary of the NNR. These roosts are best observed from Castle Corner and from the observation tower.

Principal species: Oystercatcher, Curlew, Dunlin, with smaller numbers of Redshank, Grey Plovers, Bar-tailed Godwits.

This section also includes a very important nocturnal goose-roost, out on Blackshaw Bank. It is the principal roosting site on the Solway for Barnacle Geese, and also a major roost for Pinkfeet and Greylags.

5.3.4 Distribution and Movements (Figure 5.4)

The principal feeding areas for waders are the outer sections of Blackshaw Bank (Oystercatchers and some Dunlin), and the mouth of the Nith estuary from Castle Corner to Kenneth Bank (Oystercatchers, Dunlin, Curlew and Redshank). Some Bar-tailed Godwits are occasionally found along the channel of the Nith off Castle Corner, while small numbers of Cormorants and Goldeneye also feed here.

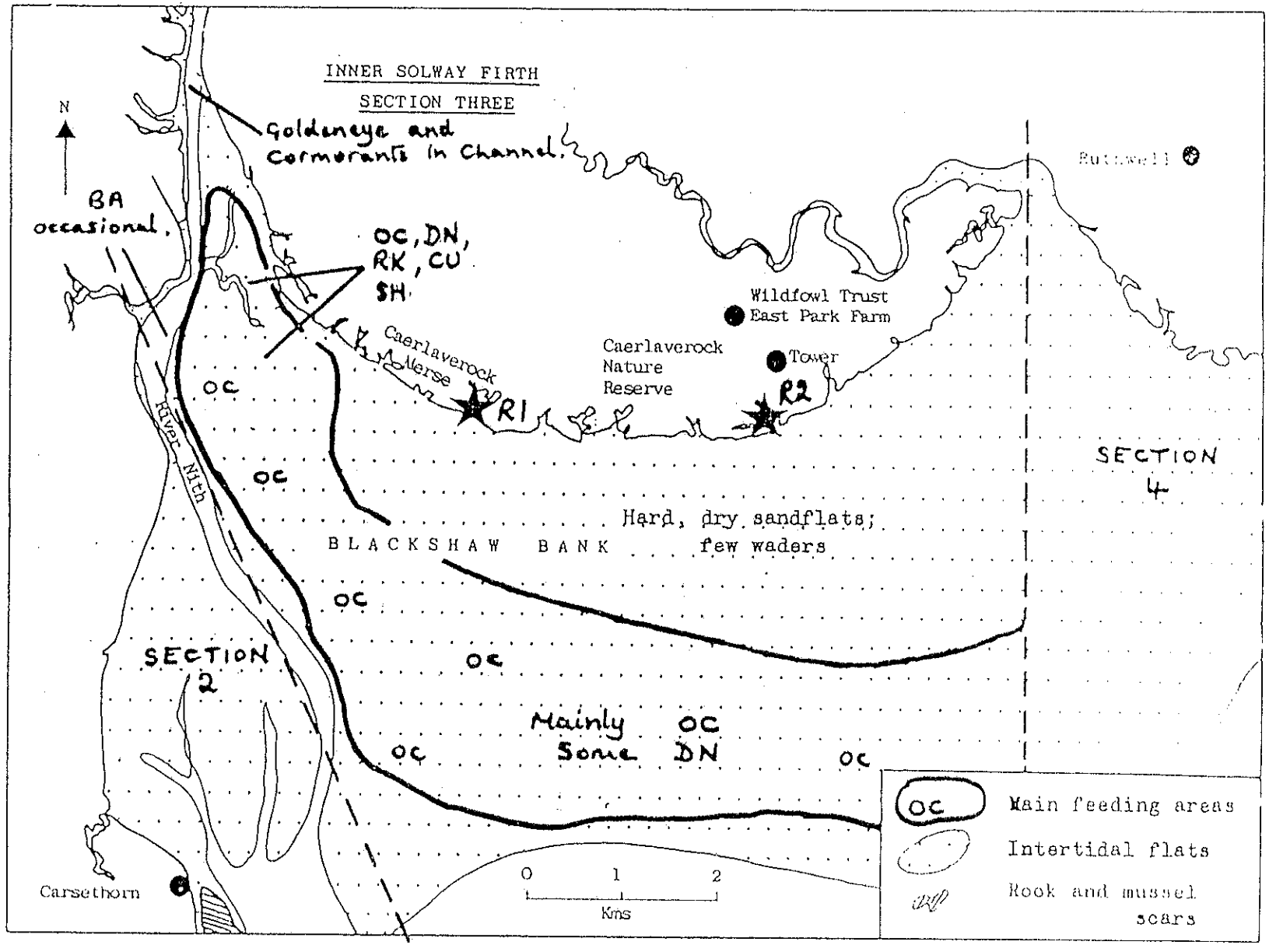


Figure 5.4 Map of Section Three, showing principal feeding areas and roosts

On the rising tide, the major movements are of Oystercatchers being pushed back from Blackshaw Bank onto the Caerlaverock merse, whilst birds from the mouth of the Nith move toward the western Caerlaverock roost. Important subroosts occur on the shore in front of the merse, and along the channel of the Nith (bathing). No birds were colour-marked in this section to examine movements.

5.3.5 Disturbance and Potential Threats

There is an ICI storage tank and outflow pipe at Airds Point. Discharges are monitored regularly by the Solway River Purification Board. Occasional punt-gunning is observed in the channel of the Nith. Parts of the Caerlaverock NNR are used for strictly controlled wildfowling.

5.4 SECTION 4 Lochar Water to Annan Waterfoot

Grid refs. NY084674 to NY192644

5.4.1 Description (Figure 5.5)

This section contains a wide variety of substrate types for feeding waders. At the western extreme is the extensive Priestside bank whose hard, medium-coarse sands form a natural extension to Blackshaw Bank. There are two small scars at Powfoot and Howgarth, also two small raised scars further out (the Rough Scar and Brewing Scar) and another at the top of the shore at Priestside corner. These scars and also the shape of the shore, provide considerable tidal protection for the area upstream, and muddier sediments are characteristic of the area between the Powfoot scar and Newbie. At this point, there begins a high narrow scar, which runs east along the top of the shore to the mouth of the Annan.

Priestside Bank is backed by a narrow but accreting merse which runs from Stanhope to Moss-side. This, in turn, is backed by a broad plain of low-lying pasture fields, which become flooded in winter. To the east of Moss-side, the shore is developed as far as Powfoot, with a large caravan site, golf-course and the village of Powfoot itself. Between Powfoot and the mouth of the river Annan, there is a narrow pebble beach, backed in some parts by pasture, and in other parts by industrial developments. There is an outflow pipe from the Glaxochem factory, at Annan Waterfoot.

5.4.2 Ornithological Importance (Table 5.4)

Waders and Shelduck

Overall, this is the most important section of the Inner Solway for wintering waders and Shelduck. It is the top ranking section for Knot, Dunlin and Ringed Plover, supporting 47%, 24% and 21% of the Solway populations of these species respectively. In addition it is the second most important area for Grey Plovers (30%), Turnstones (20%), Bar-tailed Godwits (8%) and the third most important for Redshank (14%) and Shelduck (14%).

Oystercatchers regularly occur on this section in nationally important numbers, while nationally important numbers of Grey Plover, Bar-tailed Godwit and Knot are recorded, but rather less frequently.

Wildfowl

The main nighttime roost of Pink-footed Geese on the Inner Solway is centred on Priestside Bank. This usually numbers from 2-6000 birds, and may include some Barnacle and Greylag Geese also. It is thus of international importance. In the severe weather of January 1984, the number of Pinkfeet on this roost rose to 20150, or just below 20% of the world population of this species.

Small numbers of dabbling duck are recorded all along the shore - particularly Mallard and Wigeon. Important numbers of Scaup are frequently recorded for the section between Newbie and Powfoot. These birds usually remain far offshore, and are not always included in the monthly counts. The average winter peak for the last 3 winters is 552 birds, making this a nationally important site for this species. Up to 60 Goldeneye are also regularly observed below the Newbie Scar.

Table 5.4 The Ornithological signifcance of Section 4 of the Inner Solway to wintering populations of waders and Wildfowl. Results are presented for the two winters of 1982-83 and 1983-84, combined. Data are from Low water counts.

	Median Count	Max. Count	Min. Count	Section Rank	Mean % of Solway total	95% confidence limits
Oystercatcher	3462	6044	1590	2	20.6	15.4-26.4%
Ringed Plover	14	77	0	1	20.9	6.2-41.5%
Grey Plover	78	131	27	2	29.5	20.3-39.6%
Turnstone	9	38	7	2	19.8	10.5-31.1%
Curlew	69	126	31	5=	6.9	4.6- 9.6%
Bar-tailed Godwit	178	840	0	2	7.9	1.9-17.5%
Redshank	124	304	25	3	14.3	6.5-24.3%
Knot	1848	6000	90	1	46.9	25.0-69.5%
Dunlin	1877	5000	485	1	23.7	15.0-33.4%
Shelduck	76	214	0	3	14.3	6.1-25.2%

NB
Single underlining indicates a count of national importance.
Double underlining indicates a count of international importance.

5.4.3 Roosts

On neap tides, large areas of sands remain exposed on the upper shore of Priestside Bank, in Queensberry Bay and

Powfoot Bay. Important roosts may form in all of these areas. On Spring tides, only two roosts are used.

Roost 4.1 Priestside

Grid ref. NY104655

The position of the roost is highly variable. On neap tides, birds may roost in parties scattered all along the shore from Lochar to Annan Waterfoot, although there are usually concentrations in Powfoot Bay and Queensberry Bay. On ordinary springs, all birds leave the shore in front of Powfoot and Queensberry Bay to form a very large roost on the merse between East and West Howcreek. On very high springs when this merse floods, the entire roost moves even further west to Lochar/Stanhope (NY083670). Access and observation are either on foot from Powfoot, or from East Howcreek Farm.

Principal species: Oystercatcher, Dunlin, Knot, Curlew, Bar-tailed Godwit, Grey Plover.

Roost 4.2 Annan Waterfoot

Grid ref. NY185642

This roost is used largely by birds which have fed on the scar below the shingle beach. It is most important on neap-tides, whilst on springs most birds move from here to either Priestside, the south shore, or section 5. Access from Newbie, along the beach.

Principal species: Oystercatcher, Turnstone, Dunlin, Ringed Plover.

5.4.4 Distribution and Movements (Figure 5.5)

This section supports relatively high densities of estuary birds throughout, offering a variety of substrate types for the different species. Oystercatchers, Dunlin, Knot and Grey Plover occur on both the sandflats and the scars, whilst the Turnstone and Ringed Plovers are largely confined to the scars. Bar-tailed Godwits feed in the muddier areas mainly between the western end of the Newbie scar and Queensberry Bay.

Direct observations of tidal movements showed that many of the birds from the Newbie Scar roosted on the Newbie beach, paticularly on the lower tides. On the higher tides, these birds either flew west to roost at Priestside, or crossed the estuary to roost in section 8, at the eastern end of Cardurnock Flatts. These movements mainly involved Oystercatchers, and some Grey Plover. Some Redshank also roosted on the merse to the east of Annan Waterfoot. On spring tides, all birds feeding to the west of Newbie flew to the Priestside roost.

5.4.5 Potential threats

The Priestside foreshore is the main area for wildfowling on the Inner Solway. No information was collected on the intensity of this pressure, but careful monitoring of the effects on this important goose roost would appear very important.

Tourist development around Powfoot is unlikely to have serious effects, since the major pressure occurs during the summer, when most birds are absent. Similarly, the salmon stake-netting activities at Powfoot and Newbie are unlikely to pose threats to birds.

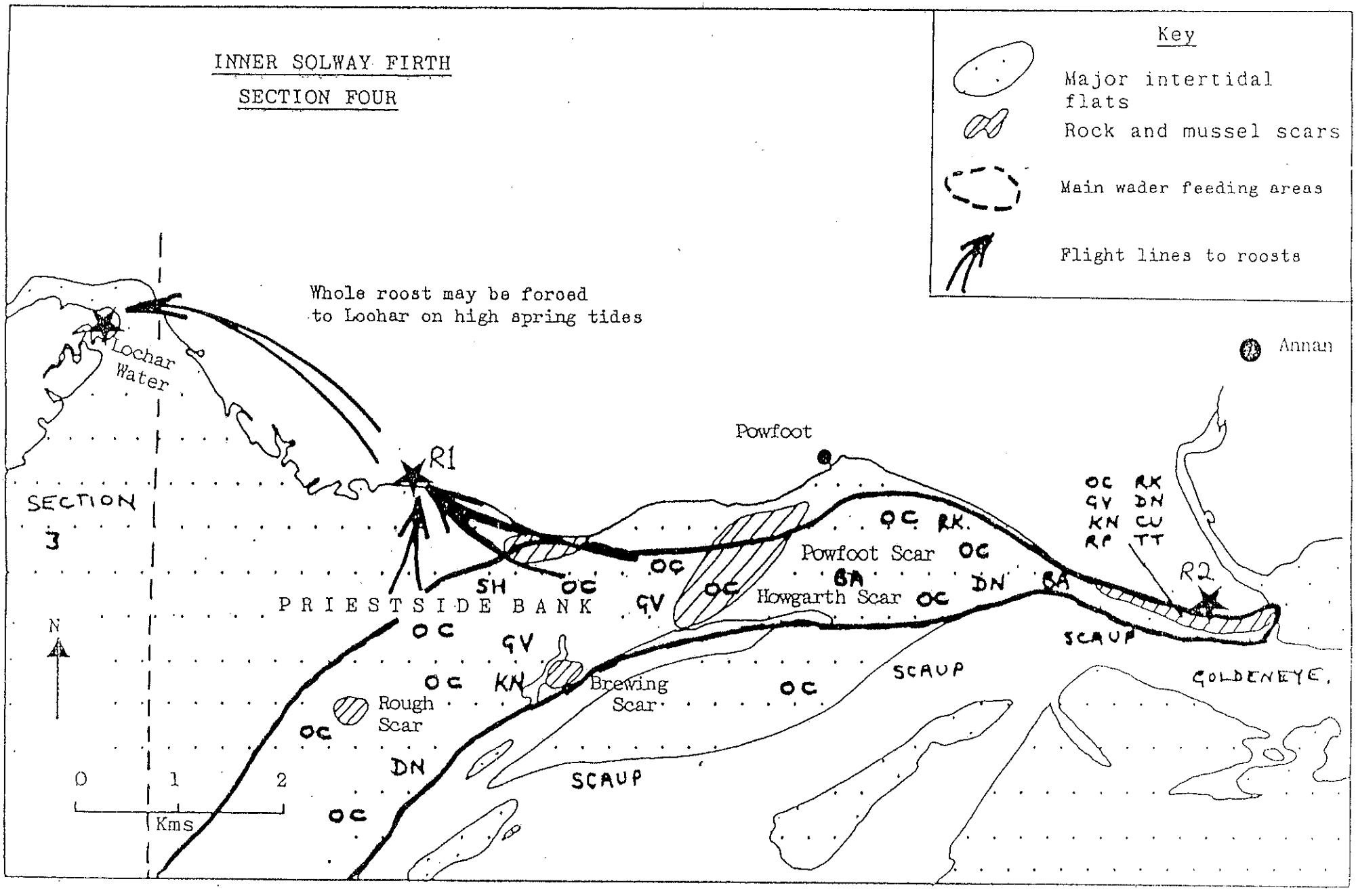


Figure 5.5 Map of Section Four, showing principal feeding areas and roosts

There is a chemical outflow pipe from the Glaxo plant at Annan Waterfoot. Effluents are monitored by the Solway Water Purification Board.

5.5 SECTION 5 Mouth of River Annan to Torduff Point (N shore) and Herdhill to Bowness-on-Solway (S shore)

Grid refs. NY192646 to NY265638 N shore
and NY213626 to NY232627 S shore

5.5.1 Description (Figure 5.6)

Ornithologically, it was unavoidable to treat the north and south shores of the Inner Solway separately throughout. In this section, the estuary is extremely narrow, and at low tide the channel of the river Eden may be only 30m wide. The birds using the area move freely between the two sides, and thus the low water counts from the north and south shores have been combined.

This is the most typically riverine section of the Inner Solway, the shores being only 2km apart and forming a narrow neck between the outer sections, and sections 6 and 7, which constitute the head of the Firth. Firm to soft muddy-sands predominate, although there is a more sandy area immediately to the east of the mouth of the Annan. There are important stony scars on the upper shore between Seafield and Dornock Cottage, below Bowness-on-Solway, and below the Herdhill viaduct. Also there are extensive stony scars on the lower shore (Whan Scar, Gowkesk Rig), which have been scoured by the river Eden. These are exposed on Spring tides only, but are important feeding areas for waders. The section has no creeks and can be easily viewed and counted from numerous points along both shores.

Table 5.5 The Ornithological significance of Section 5 of the Inner Solway to wintering populations of waders and Wildfowl. Results are presented for the two winters of 1982-83 and 1983-84, combined. Data are from Low water counts.

	Median Count	Max. Count	Min. Count	Section Rank	Mean % of Solway total	95% confidence limits
Oystercatcher	856	1129	401	6	4.5	3.5- 5.6%
Ringed Plover	7	25	0	4	10.1	1.0-26.8%
Grey Plover	12	19	0	5	2.6	0.6- 5.9%
Turnstone	1	16	0	6	2.9	0.2- 8.7%
Curlew	168	339	7	4	10.3	3.7-19.6%
Bar-tailed Godwit	56	125	0	4	2.2	0.7- 5.5%
Redshank	158	398	40	1	18.9	12.7-25.9%
Knot	75	736	0	4	3.2	0.3- 8.8%
Dunlin	687	1436	127	5	9.7	5.1-15.3%
Shelduck	9	39	0	8	1.5	0.2- 4.3%

NB
Single underlining denotes a count of national importance
Double underlining denotes a count of international importance

5.5.3 Roosts

The narrow shores which characterise this 'neck' of the Inner Solway are quite unsuitable for roosting waders, and large numbers were only found at high water on the lowest neap-tides. This was however an important feeding area for waders, and the nature of the shoreline resulted in the majority of the birds leaving the section to roost, either on inland fields, or in adjacent sections.

Roost 5.1 Whinnyrig

Grid ref. NY195648

This was the only regularly used spring-tide roost in section 5, and was located on the small merse lying between the mouth of the Annan and the viaduct. Access and viewing

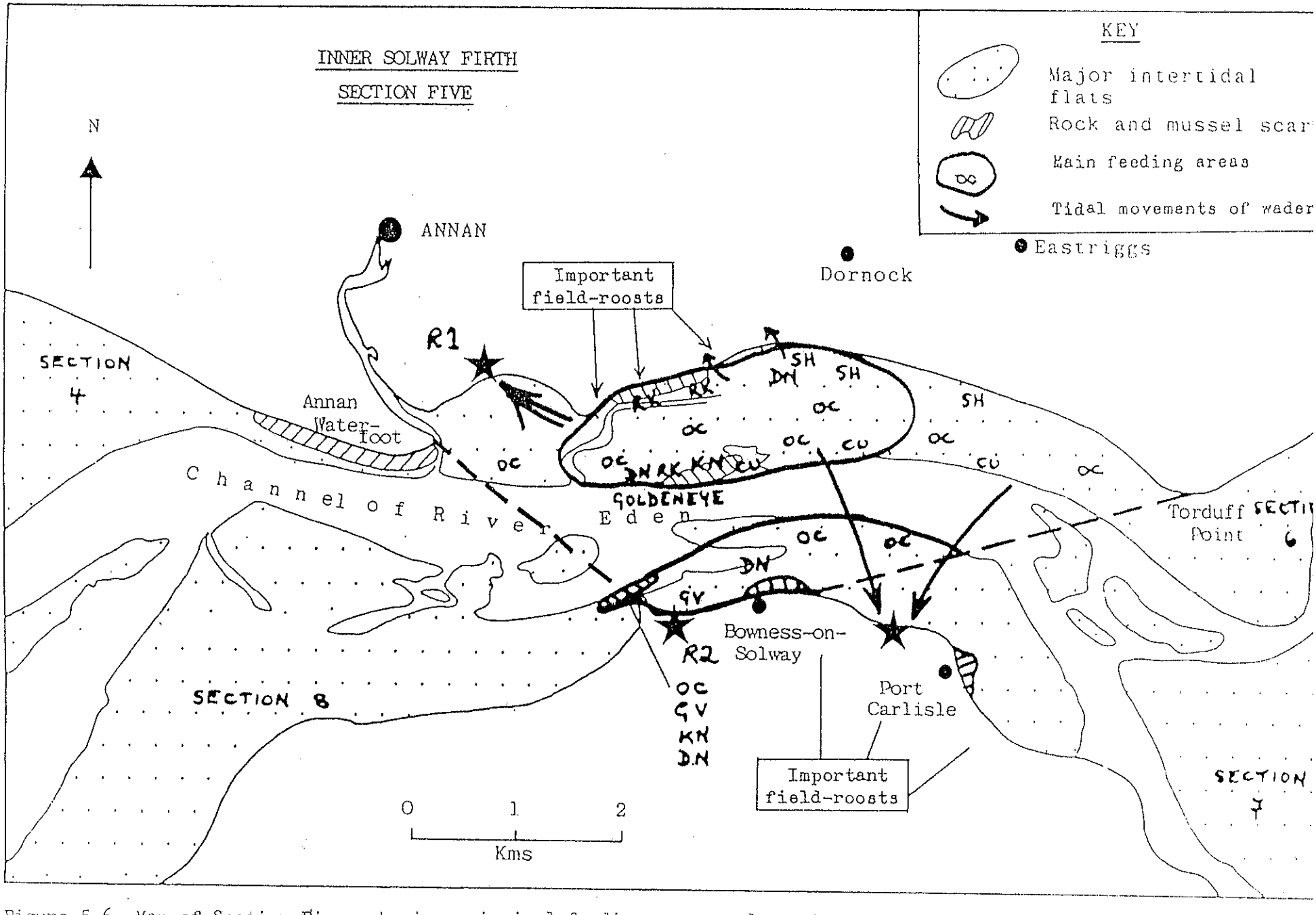


Figure 5.6 Map of Section Five, showing principal feeding areas and roosts

5.6.2 Ornithological Importance (Table 5.6)

Waders and Shelduck

The very innermost section of the Inner Solway is relatively not very important for feeding waders, with sections 6 being overall the least important of the Firth. This section was the second most important for wintering Shelduck (14%). No species occurred in nationally significant numbers.

Table 5.6 The Ornithological significance of Section 6 of the Inner Solway to wintering (Nov to Feb) populations of waders and Wildfowl. Data are presented for the two winters of 1982-83 and 1983-84, combined.

	Median Count	Max. Count	Min. Count	Section Rank	Mean % of Solway total	95% confidence limits
Oystercatcher	405	620	189	7	2.3	1.8- 2.8%
Ringed Plover	2	5	0	6	1.6	0.2- 4.1%
Grey Plover	1	10	0	6	0.6	0- 1.8%
Turnstone	3	15	0	4	3.2	0.3- 9.1%
Curlew	26	90	6	7	2.6	1.5- 4.0%
Bar-tailed Godwit	2	146	0	7	0.4	0- 1.6%
Redshank	148	196	36	4	13.4	9.3-18.0%
Knot	+	36	0	8	0.1	0- 0.7%
Dunlin	305	460	46	8	3.1	1.7- 5.0%
Shelduck	89	132	0	2	14.4	5.9-28.2%

NB
Single underlining denotes count of national importance
Double underlining denotes count of international importance

Wildfowl

Rockcliffe Marsh is used as a major feeding area by Barnacle Geese, and in the latter half of each winter 90% of the flock may be there. The birds roost on the sandbanks to the north, west and south of the saltmarsh. These areas, plus the channel of the river Eden are aso important roosts for

2-4000 Pinkfooted Geese in the latter half of each winter. The area is of international importance for both species.

The channels of the Esk and Eden in sections 7 and 8 form a major roosting area for Mallard and Wigeon, although few counts are available. Maximum counts during the survey gave the following totals:

	Mallard	Wigeon		Mallard	Wigeon
Nov 82	376	650	Nov 83	387	350
Dec 82	268	400	Dec 83	130	240
Jan 83	281	81	Jan 84	290	600
Feb 83	228	360	Feb 84	86	40

Information from Wildfowlers suggest that numbers may be considerably higher during severe weather - particularly of Wigeon.

5.6.3 Roosts

This section was not important for roosting waders, with no spring tide roosts occurring on the north shore. Although some birds roosted on the merse-edge of Rockcliffe Marsh, most birds either flew inland to roost or flew to the south shore roosts of section 7. On neap tides, much of this section remained exposed at High water, and birds were able to remain on the tide edge.

Roost 6.1 Sarkfoot Point

Grid ref. NY323658

This was an important roosting site for Redshank, which was used by those birds which did not move into inland fields or to section 7 at high water. The roost normally occurred on the broken turf-platform immediately below the merse-edge. The roost could be counted by telescope from NY317661.

Principal species: Redshank only.

Roost 6.2 Outer Rockcliffe

Grid ref. NY313639

This roost was not always used, particularly under windy conditions. The roost occurred on the merse-edge. Observation by telescope from Redkirk Point.

Principal species: Oystercatcher, Cormorant.

5.6.4 Distribution and Movements (Figure 5.7)

The vast majority of waders on this section occurred on the muddier sediments and stony scars of the upper shore, with the main concentrations between Torduff Point and Redkirk Point. Very few waders occurred either higher up the estuary, or out towards Rockcliffe.

As the tide covered the most important areas, the birds generally moved south, some going to the Bowness roost in section 7 (particularly Redshank and Oystercatchers) whilst others, particularly Dunlin, flew to the flats below Burgh Marsh (section 7), which remain exposed on all but high spring tides. Here they were able to continue feeding over high tide. Following periods of heavy rain, the majority of birds from section 6 could be found feeding in the flooded fields behind Browhouses.

5.6.5 Potential Threats

The area is potentially disturbed by salmon stake-netting activities, wildfowling on Rockcliffe Marsh and, most seriously, by frequent punt-gunning activities.

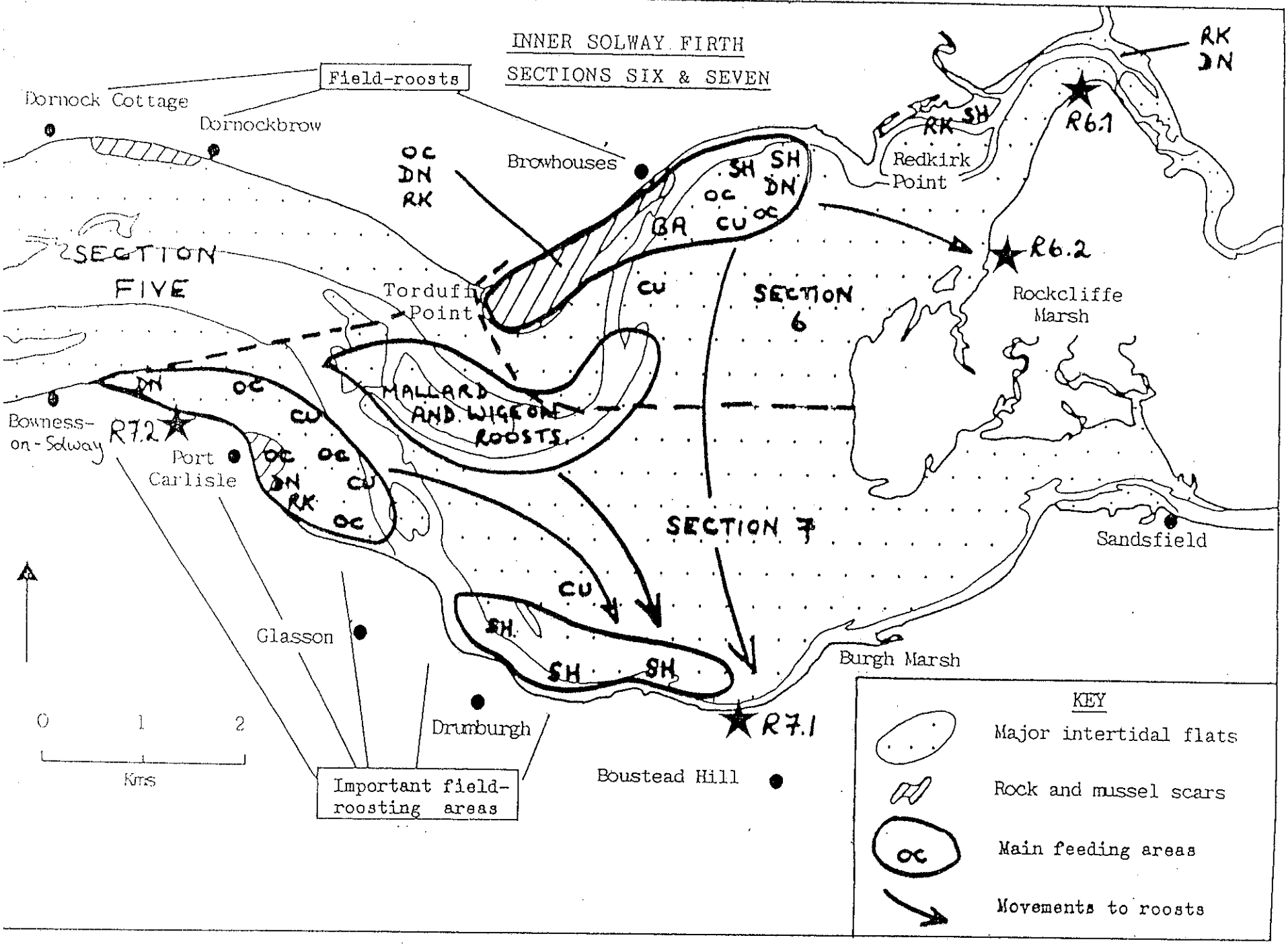


Figure 5.7 Map of Sections Six and Seven, showing principal feeding areas and roosts

5.7 SECTION 7 Bowness-on-Solway to Sandsfield

Grid refs. NY232627 to NY331617

5.7.1 Description (Figure 5.7)

This section is formed by the Channel of the river Eden and includes the estuarine confluence of this river and the river Esk. The upper shore, particularly in the sheltered bays is composed largely of firm muddy/sand sediments. There are small stony scars at Port Carlisle and Glasson. The lower shore is composed entirely of hard sands. The shoreline of the innermost part from Drumburgh to Sandsfield and Rockcliffe comprises extensive saltmarshes. There is also a narrow saltmarsh (ca. 100m wide), between Bowness-on-Solway and Port Carlisle. The remainder of the shoreline from Port Carlisle to Drumburgh is very narrow, and in places flanked by a 30ft turf erosion edge. Extensive pasture fields lie behind the shore for much of this section, and when flooded these may hold important numbers of feeding waders at high tide. The whole area can be accessed and counted easily from several vantage points on the coast road.

5.7.2 Ornithological Importance (Table 5.7)

Waders and Shelduck

This was the least important section for wintering waders and Shelduck. Overall, the most important species was Shelduck (17%) which occurred in nationally important numbers. It was also the second most important section for Curlew (18%).

Wildfowl

This section includes the major roosting areas for geese feeding on Rockcliffe marsh, and in the latter half of each winter may hold up to 90% of the Barnacles and 2-4000

Pinkfeet. The main roosting area is between the tip of Rockcliffe and the channel of the river Eden.

Table 5.7 The Ornithological significance of Section 7 of the Inner Solway to wintering populations of waders and Shelduck. Results are presented for the two winters of 1982-83 and 1983-84, combined. Data are from Low water counts.

	Median Count	Max. Count	Min. Count	Solway Rank	Mean % of Solway total	95% confidence limits
Oystercatcher	324	1317	50	8	2.1	1.1- 3.6%
Ringed Plover	+	6	0	7	0.2	0- 1.4%
Grey Plover	+	1	0	8	-	----
Turnstone	+	6	0	7	0.3	0- 1.7%
Curlew	139	1142	1	2	18.3	5.7-35.7%
Bar-tailed Godwit	18	66	0	5	0.9	0.3- 1.7%
Redshank	108	373	15	5	11.6	6.3-18.4%
Knot	40	1100	0	5	2.1	0.1- 6.4%
Dunlin	338	1340	12	6	5.4	2.1-10.0%
Shelduck	78	1100	0	1	16.9	4.0-36.2%

NB
Single underlining denotes a count of national importance
Double underlining denotes a count of international importance

5.7.3 Roosts

Roost 7.1 Burgh Marsh

Grid ref. NY320605 to NY280598

Roost very variable in location, size and composition. On neap tides it occurs out on the sands, while springs push the birds onto the saltmarsh or even into the fields. Occasionally the entire roost may move to the south side of Rockcliffe Marsh.

Principal species: Curlew, Dunlin, Redshank.

Roost 7.2 Bowness Merse

Grid ref. NY235625

This roost occurs on the 100m wide band of merse which lies between Bowness-on-Solway and Port Carlisle. The birds roost at several positions along the seaward edge of the merse, although Dunlin and Lapwing may also roost around the saltmarsh pools slightly further in. This is the most easily counted roost on the Inner Solway, and can be viewed at close range from a car parked on the coast road. The roost is frequently disturbed by walkers, and occasionally by wildfowlers.

Principal species: Oystercatcher, Dunlin, Redshank, Knot and Bar-tailed Godwit.

5.7.4 Distribution and Movements (Figure 5.7)

The vast majority of birds which feed in this section use the muddier substrates to be found on the upper shore to the west of Glasson. Particularly important areas are on the scar at Port Carlisle, where there is a small freshwater outflow, and below the merse at Bowness. The majority of the Shelduck are usually found on the bay just to the east of Drumburgh. The raised, dry sandy sediments off Rockcliffe marsh remain exposed on all but spring tides. They are little used by feeding waders.

Movements of birds in response to tidal flow may be considerable. On neap tides, many birds may move into this section from sections 6 and 8 to remain feeding on the tide edge over high-water. A large number of dabbling duck (Mallard and Wigeon), plus some Shelduck move into the area on the rising tide, the former from the river channel in

sections 5, 6 and 7, and the latter from the Browhouses area.

5.7.5 Potential Threats

Disturbance to the area comes from walkers flushing the roost on the merse at Port Carlisle, turf-cutting on Burgh Marsh, wildfowlers on these two sites, and the intensive punt-gunning activities which are apparent in the channels of the Esk and Eden at low tide. The latter is particularly worrying since activity has recenty increased, and is being done apparently on a commercial basis.

5.8 SECTION 8 Herdhill Viaduct to Skinburness

Grid refs. NY213627 to NY125560

5.8.1 Description (Figure 5.8)

This relatively large section could not be further subdivided, because of the nature of the movement patterns of the birds. Once again, the majority of the intertidal area is composed of hard sandflats, although there are muddier areas around the Herdhill viaduct and Grune Point (particularly the outer shore). There are some very extensive and ornithologically important scars, particularly at the mouth of Moricambe Bay, and also immediately below the Herdhill viaduct. Much of the upper shore of Cardurnock Flatts, and the inner part of Moricambe Bay are composed of high, hard sandbanks which are only covered by Spring tides. These are not used to any great extent by feeding waders. Access to the area is generally good, and there are numerous observation points along the coast road, and from Grune Point. The extensive nature of Cardurnock Flatts makes low water counting difficult, particularly as most of the birds were concentrated on or around the scars on the lower shore. These could be reached on foot, only on the most extreme

spring tides, and this area was therefore frequently counted during the mid-tide period.

5.8.2 Ornithological Importance (Table 5.8)

Waders

This is overall the second most important section of the Inner Solway. It is the most important section for Curlew (26% of the solway population) and Dunlin (26%), the second most important section for Knot (22%) and Grey Plover (28%). Oystercatchers occur regularly in nationally important numbers, whilst Grey Plovers and Bar-tailed Godwits occasionally do so. This section is extremely important in Autumn, when it may be a major moulting site for Oystercatchers and Bar-tailed Godwit.

Wildfowl

This section is not used to any extent by swans, Barnacle Geese or Greylags. Pinkfeet use the area in the late winter with a small roost on Cardurnock, and a major roost in Moricambe Bay. Numbers peak at 10,000 birds in some years, and are of international importance.

Dabbling duck occur in small numbers throughout the area, with the main concentration at the mouth of Moricambe Bay. A locally important flock of Pintail (50-200 birds) is regularly recorded on Newton Marsh. Scaup feed at the mouth of Moricambe Bay and numbers are often of national importance (peak 974 in 1982-83).

There is a colony of breeding Cormorants (43 pairs in 1984) in Moricambe Bay, which is of local interest.

Table 5.8 The Ornithological significance of Section 8 of the Inner Solway to wintering populations of waders and Shelduck. Results are presented for the two winters of 1982-83 and 1983-84, combined. Data are from Low water counts.

	Median Count	Max. Count	Min. Count	Section Rank	Mean % of Solway total	95% confidence limits
Oystercatcher	3820	6060	2362	3	20.5	16.9-24.4%
Ringed Plover	3	18	0	5	4.7	0.3-13.7%
Grey Plover	58	164	37	2	28.2	17.2-40.6%
Turnstone	1	44	0	5	3.1	0-10.6%
Curlew	288	756	117	1	25.6	16.4-36.2%
Bar-tailed Godwit	1	650	0	3	7.5	0.2-24.3%
Redshank	98	158	56	6	11.1	7.5-15.3%
Knot	700	1400	130	2	22.0	6.3-43.7%
Dunlin	2015	3000	1070	1	25.8	18.1-34.4%
Shelduck	18	115	0	6	5.5	0.3-16.8%

NB
Single underlining denotes a count of national significance
Double underlining denotes a count of international significance

5.8.3 Roosts

This section provides excellent conditions for roosting waders, with many wide saltmarshes. Roosts are often fragmented, and I only describe the major spring tide roosts. The smaller marshes on the inner section of Morecambe Bay (Newton/Calvo/Border) all hold small numbers of roosting waders.

Roost 8.1 West Herdhill

Grid ref. NY207620

The narrow merse to the west of the Herdhill viaduct can hold large numbers of roosting waders. These accumulate from the feeding areas below the merse, and from the

Powfoot/Annan stretch of the north shore. Observation and access are straightforward from the coast road.

Principal species: Oystercatcher, Bar-tailed Godwit, Dunlin, Curlew.

Roost 8.2 Maryland Farm
Grid ref. NY195616

Birds roost on the sands except on spring tides when a large roost develops on the merse-edge. Larger waders roost immediately below the farm (Oystercatcher, Curlew), whilst smaller species (Dunlin, Grey Plover, Knot) roost further west, over the tidal channel. Access and observation from the coast road.

Principal species: Oystercatcher, Curlew, Grey Plover, Dunlin, Knot.

Roost 8.3 Cardurnock
Grid ref. NY162588

The position of this roost is highly variable, and it is often fragmented. On neap tides, birds roost out on the sand. It collects birds mainly from the lower Cardurnock scars. Some interchange with Skinburness roost.

Principal species: Oystercatcher, Dunlin, Knot, Grey Plover, Curlew.

Roost 8.4 Skinburness/Grune
Grid ref. NY136561

Although some birds may spend the entire high water period on Grune (particularly Turnstone), the main roost is on Skinburness Marsh. This collects birds from Moricambe Bay particularly the scars at the mouth, and some (Oystercatcher) from the Silloth area. Access and observation are from the eastern side of Grune.

Principal species: Oystercatcher, Bar-tailed Godwit, Knot, Dunlin, Curlew.

5.8.4 Distribution and Movements (Figure 5.8)

At low water, waders are concentrated mainly in the section between Herdhill viaduct and the beginning of Cardurnock, around the Cardurnock scars, and particularly at the mouth of Moricambe Bay and in front of Grune Point. Shelduck occur mainly in Moricambe Bay itself. There are important loafing areas for Mallard and Wigeon around the scars at the mouth of Moricambe, and these are also good feeding sites for Scaup.

On the rising tide the duck from the mouth of Moricambe drift into the bay to roost below Skinburness Marsh. The waders either move to roost here, or go to the Cardurnock roosts. Occasionally if these latter roosts become flooded, the birds will cross Moricambe to roost on Skinburness Marsh.

The West Herdhill and Maryland roosts both receive birds which have been feeding on the north shore (Powfoot - Dornock), particularly Oystercatchers and Grey Plovers. The Skinburness roost receives some Oystercatchers and Knot which have been feeding south of Silloth. There are movements of Bar-tailed Godwits and Knot between this section and the Southerness area on the north shore, although these are not thought to occur frequently.

5.8.5 Potential Threats

All marshes in this section are leased by the Solway Wildfowlers' Association, and heaviest pressure is around Moricambe. Punt-guns are occasionally observed to work the duck flocks at the mouth of Moricambe.

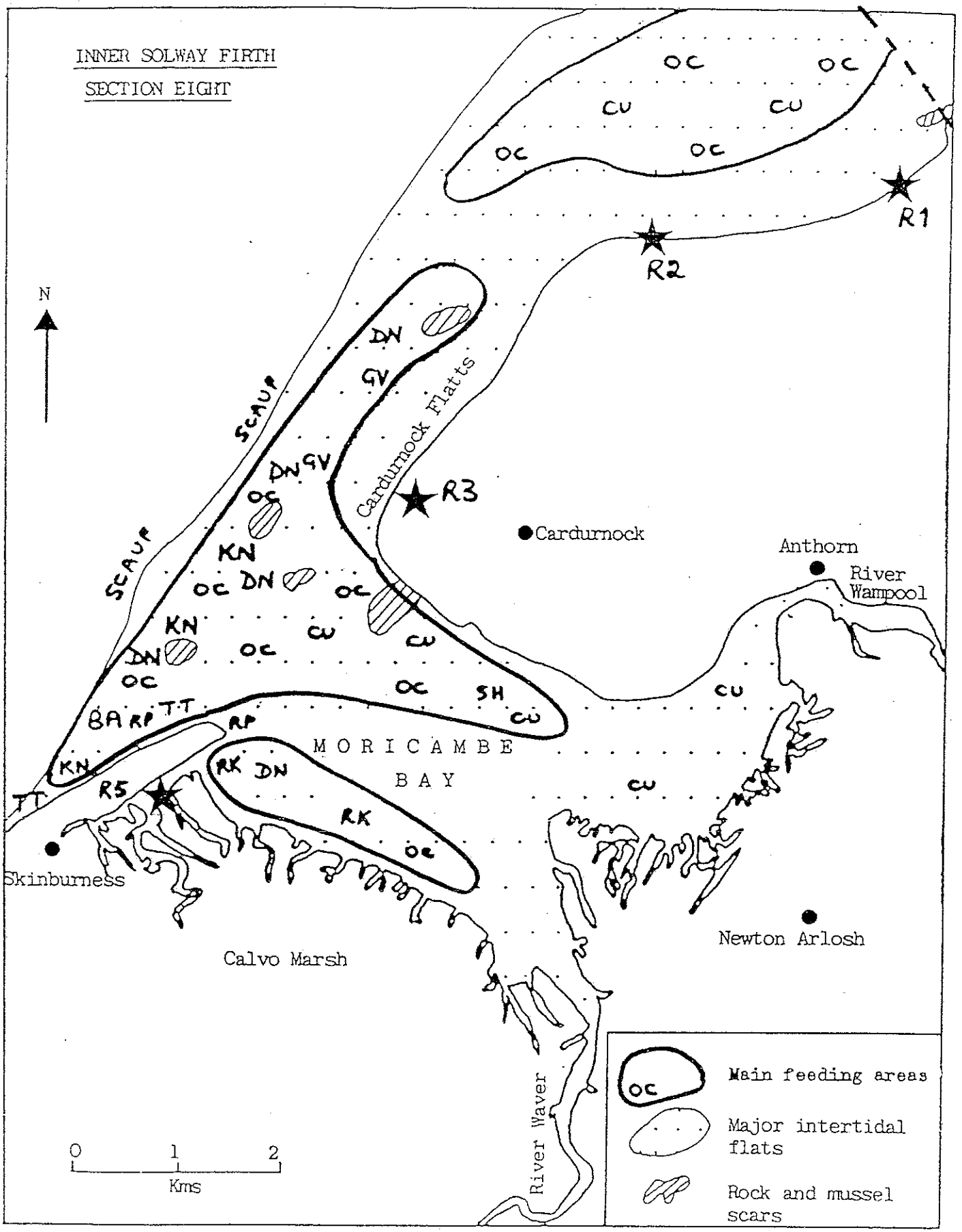


Figure 5.8 Map of Section Eight, showing principal feeding areas and roosts

6. SPECIES APPRAISALS[1]

6.1 OYSTERCATCHER *Haematopus ostralegus*

Qualifying Levels National 3000
NW Europe 7500

Av. peak midwinter count on Solway = 24900 birds.

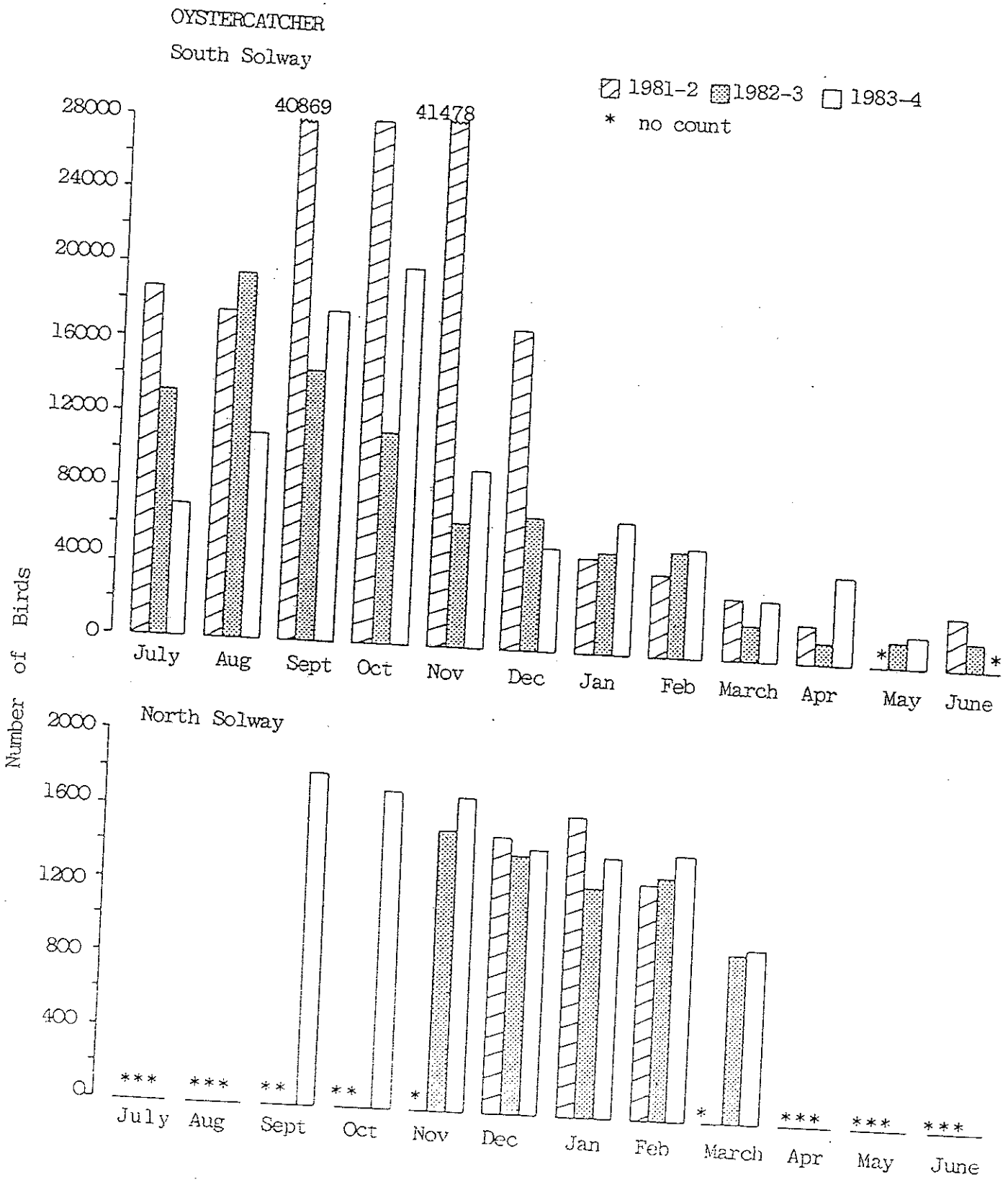
Oystercatchers are numerically the most abundant wader present on the Solway throughout the year, and can be found on all sections. There has been no evidence of any major changes in abundance of wintering birds on the Inner Solway since the counts began in the early 1970s. The average winter peak for the period 1971 to 1984 is 24900 birds, which makes the Inner Solway the third most important estuary for this species in the country, following Morecambe Bay and the Dee. This figure represents more than 8% of the estimated British totals and more than 3% of the NW European totals. The Inner Solway is therefore of major national and international conservation interest for Oystercatchers. Numbers may be even higher in the autumn, when the average peak count is 37000 birds (max. 41946 in September 1974). A single count in November 1981 on Cardurnock produced 41000 birds, and the total number present on the Inner Solway must clearly have been much higher. Thus at this time of year the Solway may support more than 5% of the NW European population.

6.1.1 Seasonal Patterns of Abundance (Figure 6.1.1)

Counts are lowest for the period March to June, when most birds are away on their breeding areas. Those that remain include high proportions of non-breeding immatures plus a population of breeding birds. These have not been censused, although counts on Rockcliffe Marsh alone give a recent peak of 176 pairs (Rankin 1979). Birds start returning from their breeding areas in July, and build up to an autumn peak in

[1] First draft texts for Swans, Geese and dabbling duck were written by M. Wright, and the text on gulls by M. Carrier.

FIGURE 6.1.1. Seasonal patterns of abundance of Oystercatcher on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



September, October or November. The timing and scale of this peak varies from year to year. This pattern is the same on all Irish Sea estuaries (Prater 1981), and presumably involves many moulting birds. Numbers fall off in late November to more stable numbers in December, January and February. This decline is mainly the result of many immature (and some adults) moving further south to winter in France and Iberia (Prater 1981).

6.1.2 Local Distribution. Figure 6.1.2

Oystercatchers were the most numerous and the most widespread wader on the Solway in winter, occurring on scars, muddy bays and the hard outer sandflats. Indeed, they were the only species to occur on these latter areas, and were absent only from those parts which remained dry on neap tides, or were mobile. Many birds also moved onto fields to feed over the HW period.

On the Scottish shore, the main concentrations occur on the extensive sandflats of sections 1, 2, and 3. the winter peaks for the last four years have been as follows:

	Mersehead/ Southerness	Blackshaw/ Caerlaverock	Priestside
1980-81	3880	3950	5000
1981-82	10600	4500	5000
1982-83	5400	4500	5500
1983-84	6250	6800	3553

Very high densities, involving smaller total numbers also occur on the muddy scars at Carsethorn and Newbie, and from the viaduct to Browhouses.

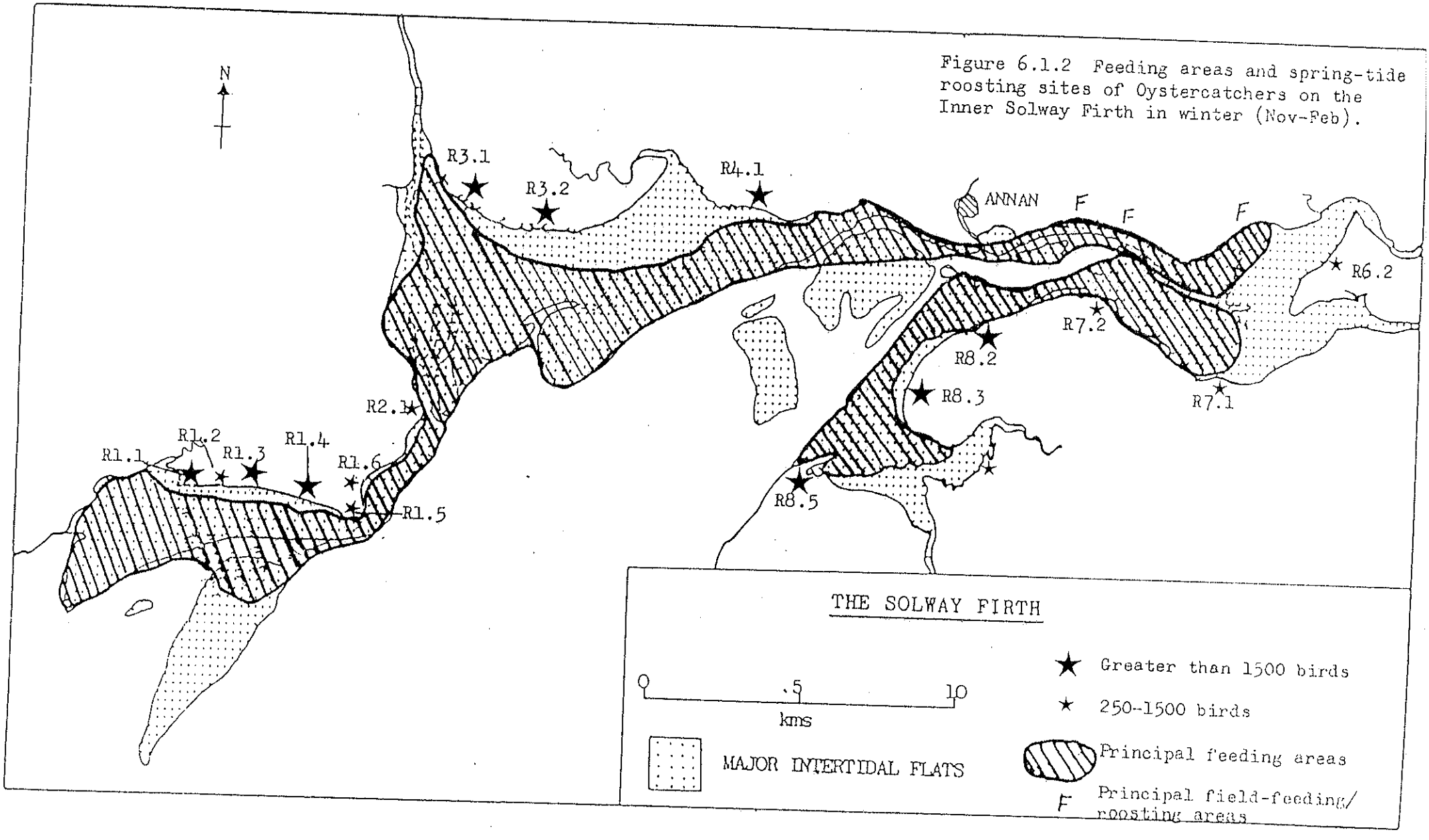


Figure 6.1.2 Feeding areas and spring-tide roosting sites of Oystercatchers on the Inner Solway Firth in winter (Nov-Feb).

On the English shore, the main concentrations all lie to the west of Bowness-on-Solway. The principal roosting areas have had the following winter peaks:

	Cardurnock	Grune/Skinburness
1980-81	8120	6572
1981-82	7114	9530
1982-83	5080	2325
1983-84	4705	2880

The vast majority of these birds feed on the lower shore of Cardurnock Flats, and particularly on the scars at the mouth of Moricambe Bay. At high water, a few hundred birds typically flight to roost at Skinburness from outside the study area (Silloth).

6.1.3 Origins and Movements

Recoveries of Oystercatchers ringed on the Solway as nestlings indicate predominantly southward movements in the first autumn and winter, particularly down the west coast of Britain and into France, although many birds remain on the Solway. The wintering population clearly involves many birds of Solway origin, whilst all others ringed as nestlings came from futher north (Shetland 4, Orkney 2, mainland Scotland 6).

Oystercatchers showed considerable fidelity to individual sites within the Firth of Forth in a study by Symonds et al. (1984). Few birds were marked during the winter as part of this study, and none was sighted elsewhere.

6.2 LAPWING Vanellus vanellus

Qualifying Levels: National 5000

NW Europe +20000

Av. winter peak, Inner Solway = (5000 ++)

It was not possible to interpret the patterns of population change in Lapwing from the estuary counts since important variations in the extent to which fields were covered were possible. Peak estuary counts for the last three winters have been 7771, 2211 and 5429, thus the average winter peak for the area is probably well in excess of the 5000 bird national significance level.

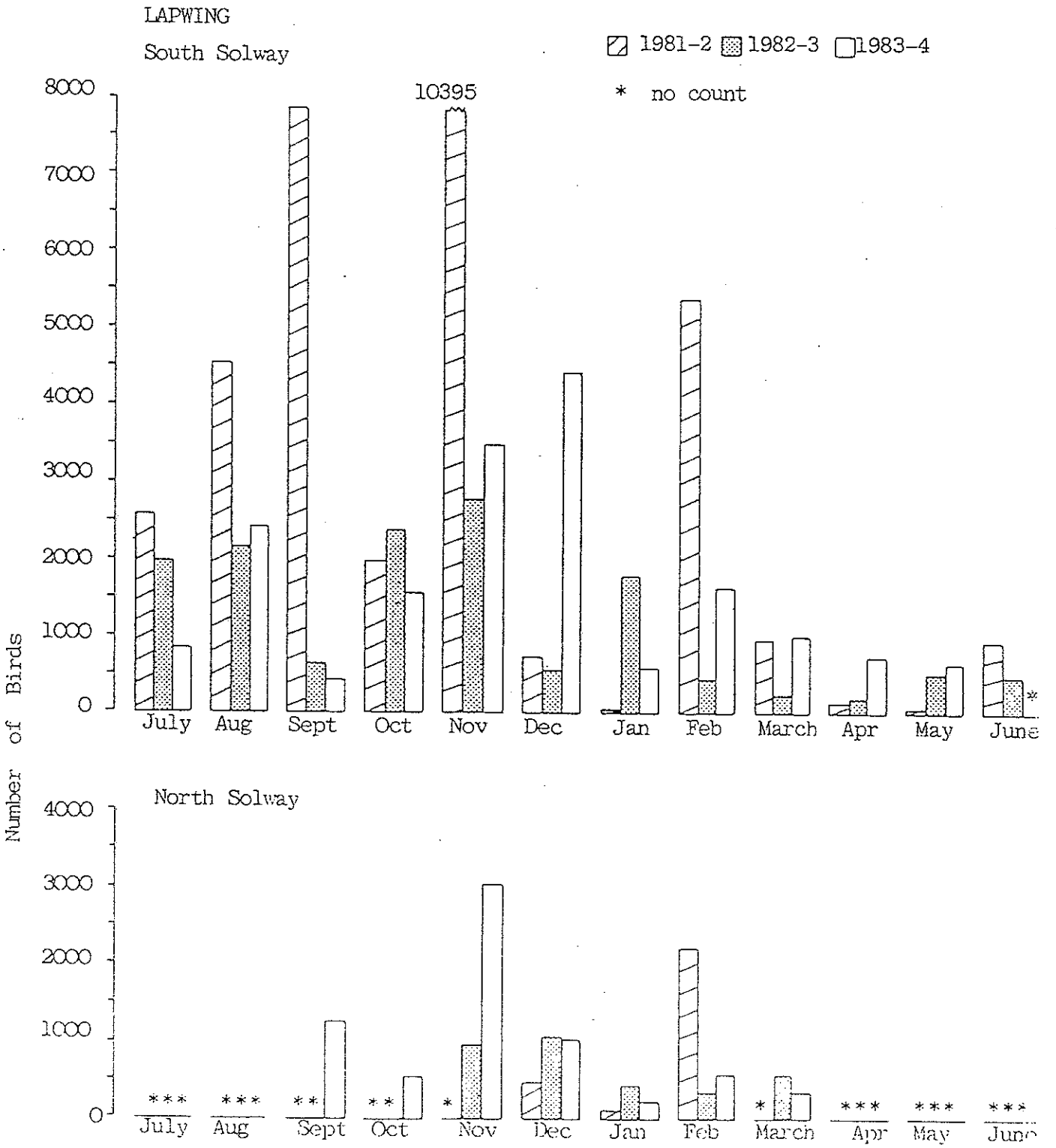
6.2.1 Seasonal patterns of abundance (Figure 6.2.1)

Month-by-month changes in population levels on the Solway are masked by variations in habitat use, and only gross patterns can be detected. Numbers are lowest from March to June when local breeders must comprise the majority of the population. There is an autumn influx starting in July which leads to peaks in any month from September to December. There are large variations between years and months, resulting from the complex pattern of habitat use and migration (Imboden 1974) of this species.

6.2.2 Local distribution

Lapwing were observed feeding on the intertidal areas in only very small numbers, although roosting flocks were recorded frequently throughout the study area. Non-estuarine habitats were not surveyed intensively, but casual observations suggested the main feeding areas to be as follows (most flocks were observed within 2 km of the estuary): Caerlaverock/Priestside, Annan - Gretna, Rockcliffe Marsh, Burgh-by-Sands to Bowness-on-Solway, and marshes and fields surrounding Morecambe Bay.

FIGURE 6.2.1. Seasonal patterns of abundance of Lapwing on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



6.2.3 Origins and movements

Lapwing breed from western Europe to the eastern side of the USSR. No subspecies can be recognised (Mead et al. 1968), making analyses of movements very complex. Analyses by Imboden (1974) suggested that the British wintering population comprised mainly British and Scandinavian breeders, although some birds from central and eastern Europe and Russia also reach here.

6.3 RINGED PLOVER Charadrius hiaticula

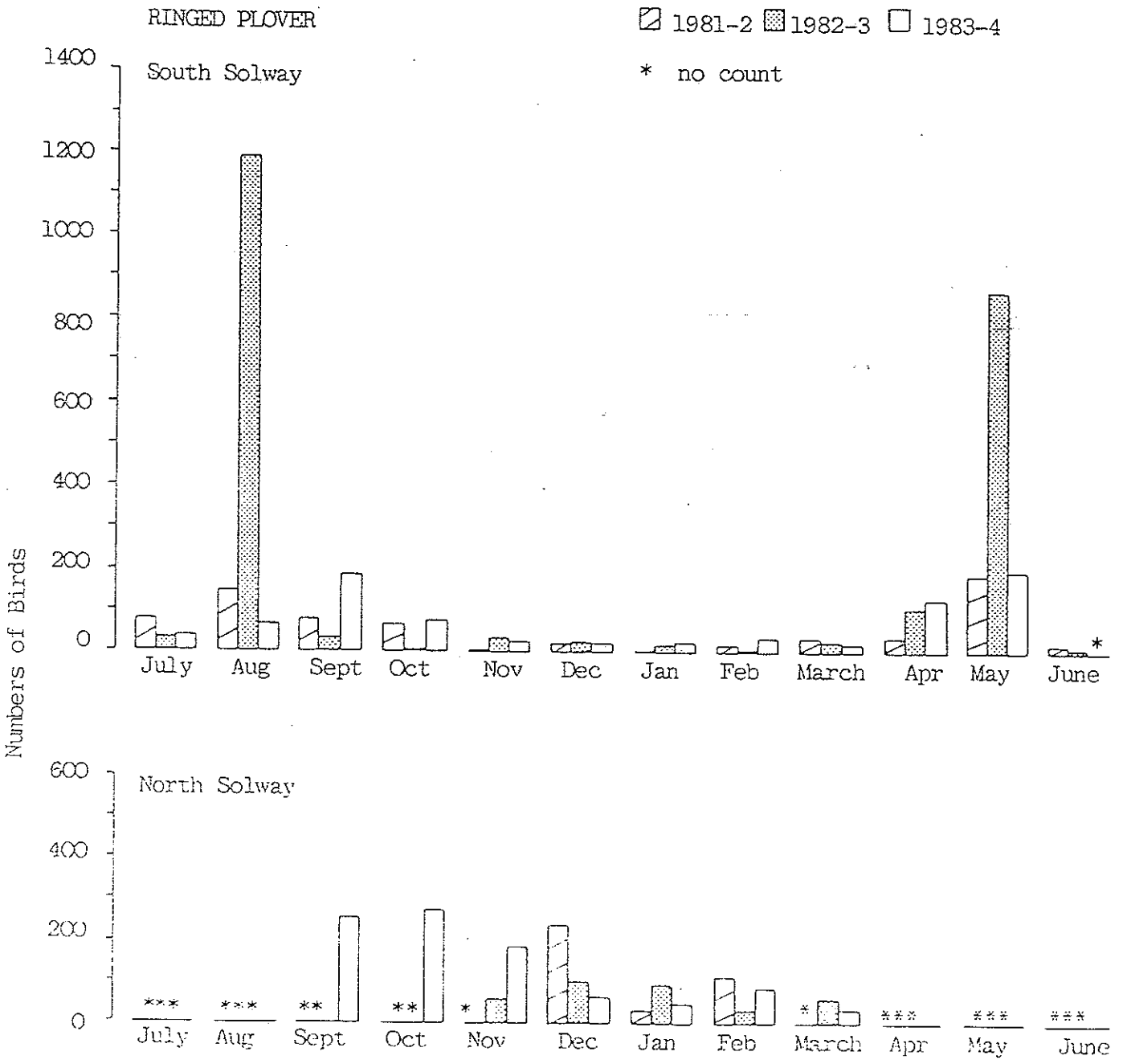
Qualifying Levels: National 120 (passage 300)
(winter pop.) NW Europe 1000
Av. winter peak, Inner Solway (rounded) = 190 birds

Ringed Plovers do not occur anywhere on the Inner Solway in large numbers, in winter. The average peak midwinter count for the last four seasons is 185 birds representing about 1.5% of the estimated British totals. These counts are greatly exceeded by those made in the autumn and spring, when large passage populations are present. In both periods the Solway is of major international importance to this species. Recent peak counts on the south shore alone have been as high as 1190 birds in the autumn, whilst intensive studies of this species on spring migration have suggested that even more Ringed Plovers pass through the Solway in April and May.

6.3.1 Seasonal Patterns of Abundance (Figure 6.3.1)

A small breeding population (< 30 pairs) is present in June and July. These birds are rapidly outnumbered from late July until October by important passage populations. Further studies of turnover are required to assess the numbers of Ringed Plover which visit the Inner Solway during this period. By November, most migrants have departed, to leave a

FIGURE 6.3.1. Seasonal patterns of abundance in Ringed Plover on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



stable wintering population until March. A further spring passage of birds returning to their northern breeding areas then occurs in April and May. This was part of a special study which will be reported elsewhere.

6.3.2 Local Distribution (Figure 6.3.2)

Ringed Plovers tend to occur on the sheltered upper shore areas in winter, rarely being seen on the exposed sandflats. The principal areas on the north shore are around the Southerness Point (15-25 birds), in Carse Bay and on the Carsethorn Scars (20-30 birds), occasional birds on the Priestside scars, and the major concentrations on the muddy scars between Powfoot and Newbie (40-70 birds). Some Ringed Plovers also feed on the Scars below Dornock and to the west of Browhouses, although these birds often roost on the south shore or at Annan Waterfoot.

On the English shore, wintering Ringed Plover are found regularly in only two areas. The first involves birds which feed at low water either on the north shore and come to roost on the south shore at Bowness or between Dykesfield to Glasson (5-15 birds). The second areas where Ringed Plovers regularly occur in winter is on Grune Point (5-15 birds).

6.3.3 Origins and Movements

There is little information from ringing recoveries to identify the origin of Ringed Plovers which occur on the Inner Solway, although more detailed information is available for Morecambe Bay (Clapham 1978). Evidence from the two studies combined suggest that in spring the Solway supports large numbers of passage birds bound principally for Iceland and Greenland, plus a few local breeders. The Autumn passage probably involves some of these birds, as well as breeders

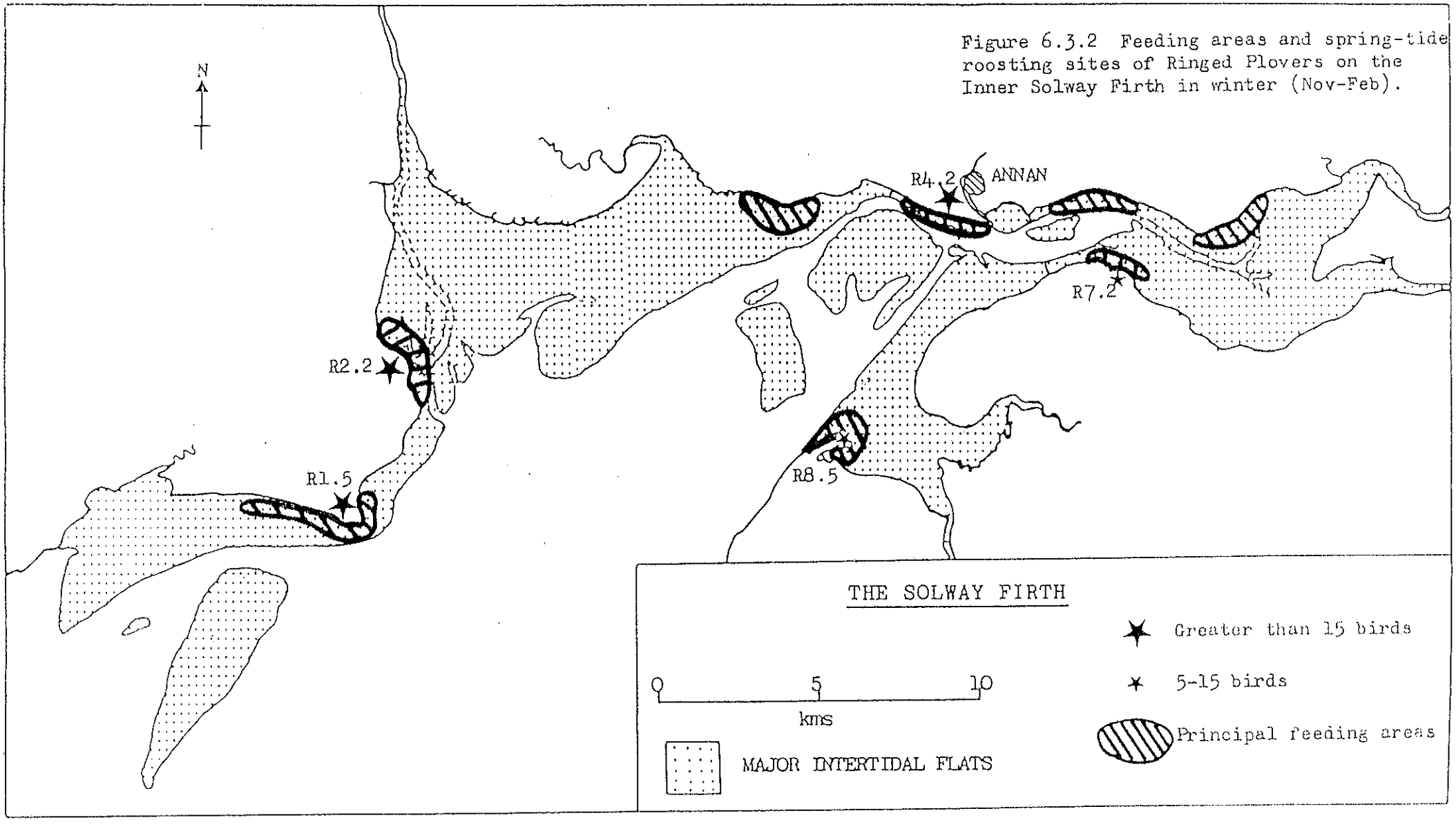


Figure 6.3.2 Feeding areas and spring-tide roosting sites of Ringed Plovers on the Inner Solway Firth in winter (Nov-Feb).

from the North Sea and Baltic coasts. The winter population probably includes mainly local breeders, but also some birds which remain from the Autumn passage.

No wintering Ringed Plovers were marked during this study, but evidence from the predictability of flocks in each area suggest that they show a high degree of site-fidelity.

6.4 GREY PLOVER *Pluvialis squatarola*

Qualifying Levels National 100
NW Europe 800

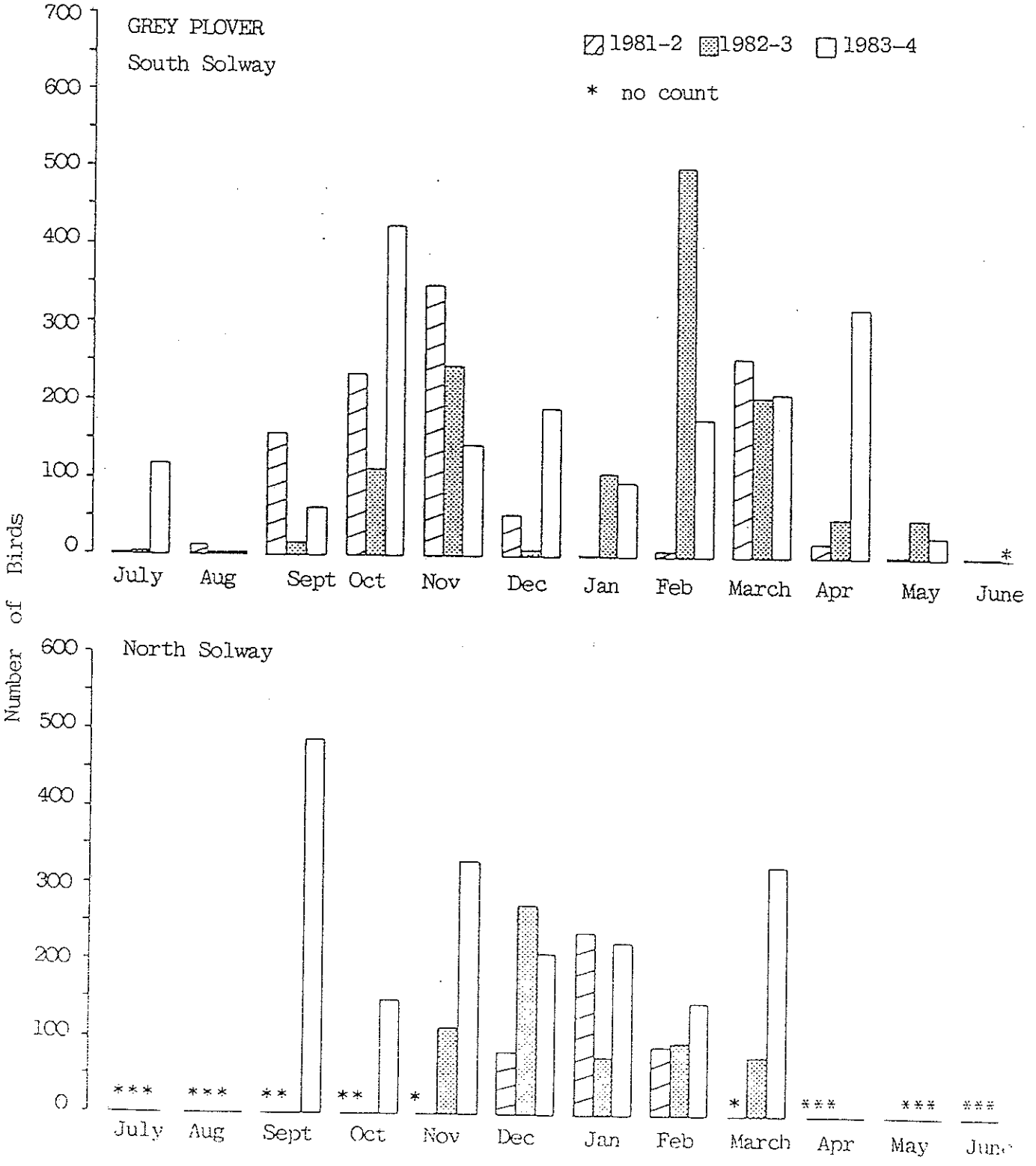
Av. winter peak, Inner Solway = 430 birds

There has been a marked increase in the number of Grey Plovers wintering on the Inner Solway, with less than 50 prior to 1972 and a regular population of up to 450 in the last four winters. This pattern follows trends for the rest of Britain and Western Europe (Moser 1983, Prater 1981). There have been no recoveries from the 44 Grey Plovers which have been ringed on the Inner Solway (all during this study) but it is probable that like all other Grey Plovers which have been ringed in Britain, the entire population comes from the Siberian breeding areas (Branson and Minton 1976). The average peak mid-winter count since 1980-81 is 430 birds, making the Solway of national importance for this species. Passage populations have begun to regularly exceed 500 birds, with the highest count so far recorded being 754 birds in November 1983.

6.4.1 Seasonal Patterns of Abundance (Figure 6.4.1)

The seasonal patterns of abundance are most obvious from counts on the Cumbrian shore where counts have been made throughout the year. Numbers are lowest in June, July and

FIGURE 6.4.1. Seasonal patterns of abundance of Grey Plover on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



August, when most birds are absent on their breeding areas. There is an important Autumn passage from September to November, with peaks occurring in either October or November. Numbers then decrease slightly to a more stable winter level in December and January. A further passage occurs in the Spring, with flocks being present until mid-May although peaks have been recorded as early as February.

6.4.2 Local Distribution (Figure 6.4.2)

On the Scottish shore, Grey Plovers occur very predictably in four main areas: Mersehead Sands/Gillfoot Bay, Carsethorn scars, Priestside and the Newbie Scars. The birds are usually distributed with more than 100 birds each on Mersehead Sands and Priestside and less than 20 birds each of the two scar areas. The principal roosts are at Gillfoot Bay and Priestside, with smaller numbers occasionally at Borron Point, Caerlaverock and Newbie.

On the south shore, Grey Plovers occur from Bowness-on-Solway westwards to Grune Point, although they are not found in the upper areas of Moricambe Bay. Particularly important feeding areas are on the Scars below Bowness, the Herdhill Scars and the Scars at the mouth of Moricambe. The sands of Cardurnock Flatts may also be used on the rising and falling tide. The principal roosting sites for these birds are always on Cardurnock (100-200 birds), with much smaller numbers on Grune.

Wintering Grey Plovers on the Solway exhibit behaviour patterns similar to those described for this species elsewhere (Townshend et al. 1984). Over 80% of the individuals present occurred in flocks of up to 150 birds each, in three main areas: Mersehead Sands, Priestside and Cardurnock. There were, however, much smaller numbers of birds which defended territories on the rocky scars of

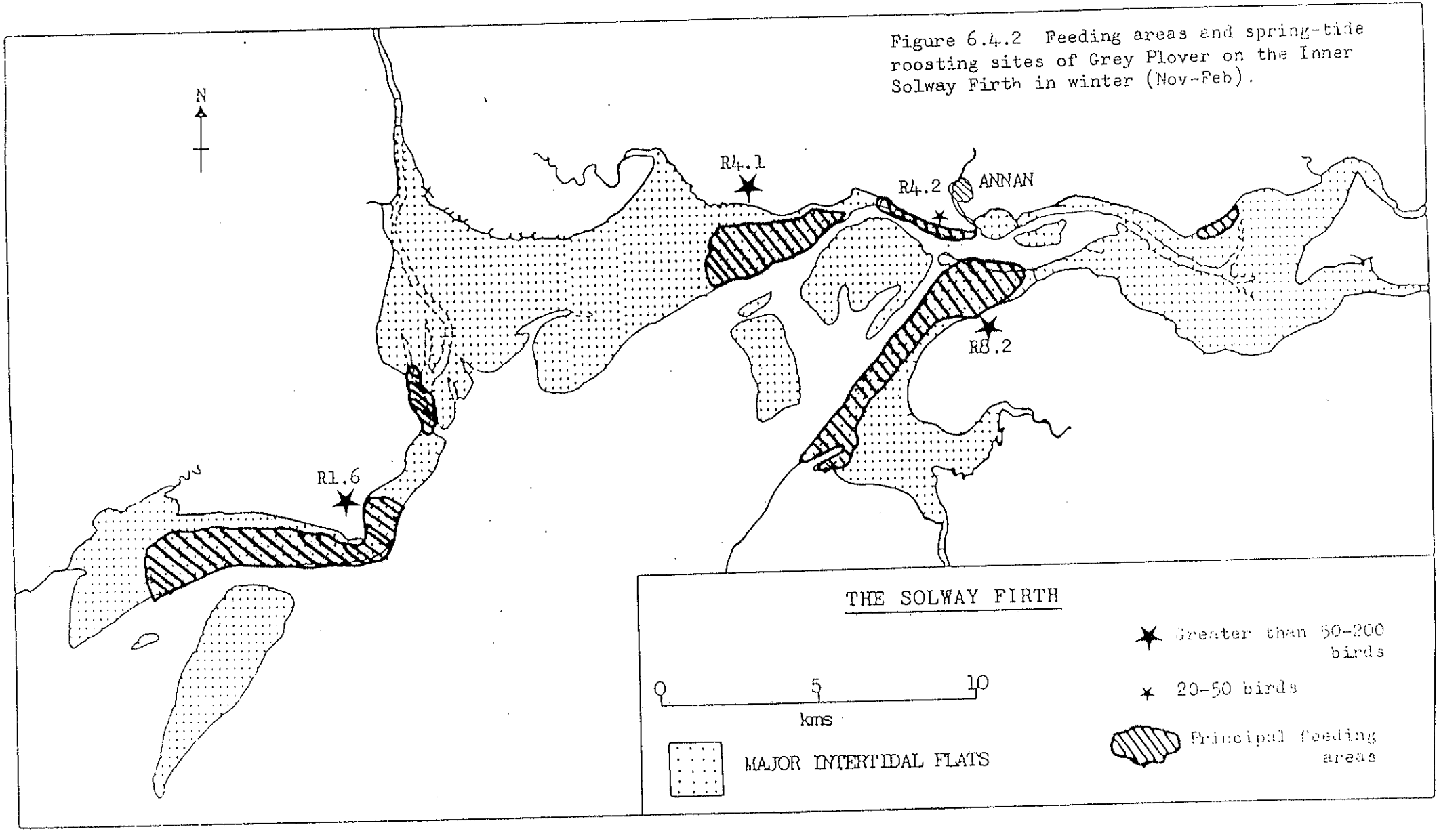


Figure 6.4.2 Feeding areas and spring-tide roosting sites of Grey Plover on the Inner Solway Firth in winter (Nov-Feb).

Carsethorn, Newbie and perhaps those at the mouth of Moricambe Bay. Elsewhere, Dugan (1982) demonstrated that territorial birds have advantages over flock feeders, particularly during periods of severe weather.

6.4.3 Movements

Information on the local movements of wintering Grey Plovers was obtained from observations of 44 individuals which were captured and dye-marked from the Gillfoot Bay roost, on 18.12.83. Subsequent sightings indicated that this roost is used largely by flock-feeding birds from Mersehead Sands and the area around the Southerness Rocks. Two territorial birds from the Carsethorn scars were subsequently found to be marked also, indicating that territorial and non-territorial birds roost together at high-water. The dye remained visible for up to four weeks, and although exhaustive checks were made of the flocks present elsewhere on the Solway, none was found away from the original area of marking. Thus wintering Grey Plovers on the Solway appear to be highly site faithful, as was demonstrated also on the Firth of Forth (Symonds *et al*. 1984).

These findings were supported also by observations of an albino Grey Plover which frequented the roost at Priestside throughout the 1983-84 winter, with no sightings elsewhere.

6.5 GOLDEN PLOVER *Pluvialis apricaria*

Qualifying levels: National 2000
NW Europe 10000

Av. winter peak, Inner Solway = (2000 ++)

Counts of Golden Plovers on the Inner Solway have declined from an average peak of 10292 between 1971-2/1976-7 to 1732

between 1980-1/1983-4. It is not clear whether this difference is due to changes in coverage of field habitats or to a real long-term change in the wintering population. North-west England was identified as a particularly important area for this species in a national winter census carried out for the BTO (Fuller and Lloyd 1981). Complete counts for the Solway area are not available, but the average winter peak must be well in excess of the ca. 2000 birds identified from the BoEE counts. Clearly, the areas is of national significance for Golden Plovers.

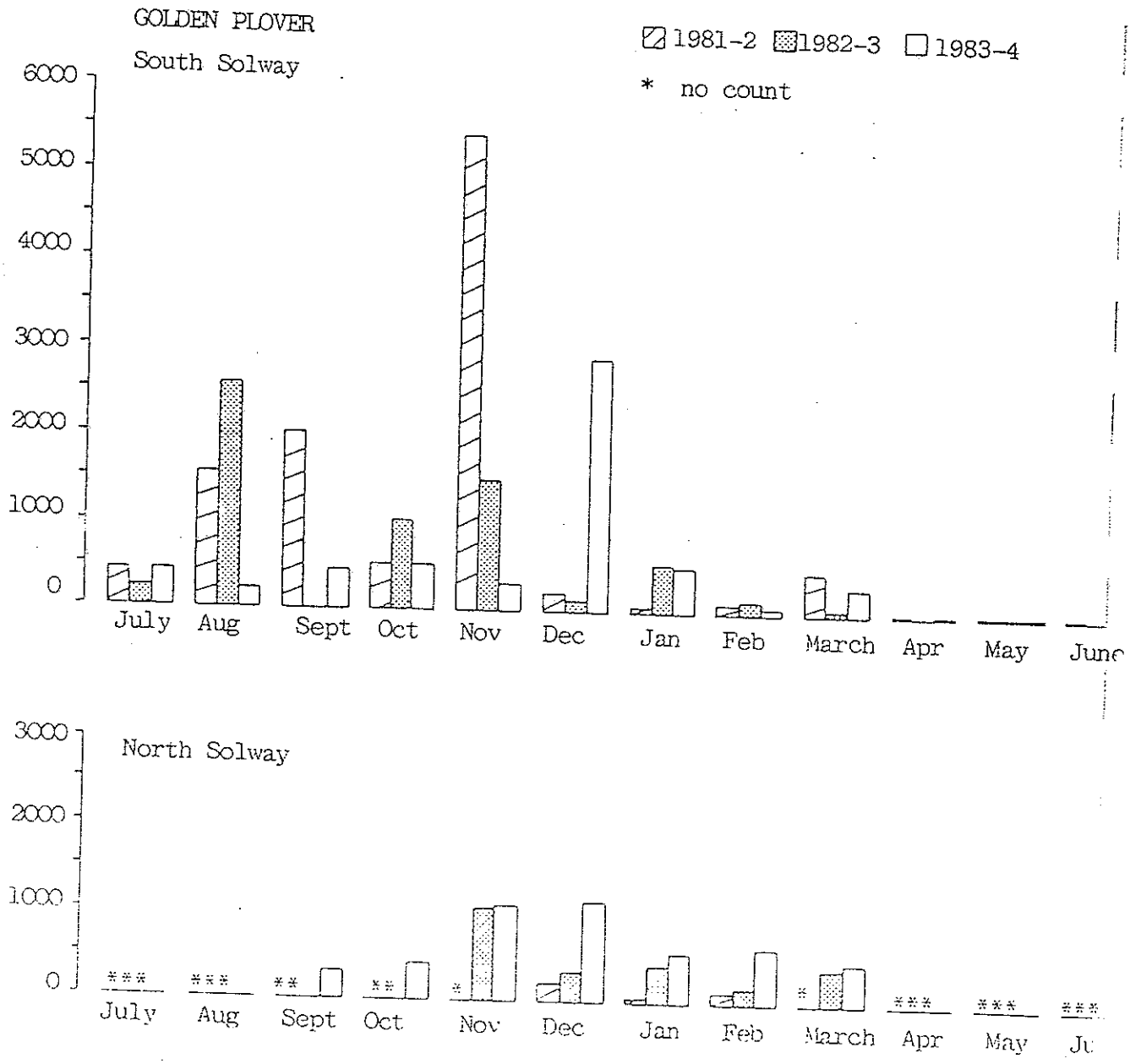
6.5.1 Seasonal Patterns of Abundance (Figure 6.5.1)

Because of the use of alternative habitats, it is very difficult to interpret patterns of population change from estuary counts alone. Gross patterns are, however, apparent. Golden Plovers are absent from the Inner Solway from April to June, when all are on their upland breeding areas. Birds start to return in July and numbers may peak in any month from August to December. There is a definite exodus from the area before the cold weather of January and February, with no evidence of a return passage.

6.5.2 Local distribution

Fuller and Lloyd (1981) studied habitat use by Golden Plovers in a national survey of this species. They showed that coastal habitats were very little used for feeding, but were very important for roosting in Scotland and N. England. These findings were confirmed by this study, most birds feeding in the band of low-lying pastures which surround the Solway, and using the estuary only as a roost. Habitats outside the intertidal areas were not surveyed, but general observations indicated that the most important feeding areas were around Caerlaverock, Annan to Dornock, Rockcliffe Marsh,

FIGURE 6.5.1. Seasonal patterns of abundance of Golden Plover on the Inner Solway. Data are from BoEE counts 1981-82/1983-4.



Burgh-by-Sands to Bowness-on-Solway, and around Moricambe Bay.

6.5.3 Origins and movements

Two races of the Golden Plover winter in Britain: 'apricaria' which breeds from Ireland to Finland, and 'altifrons' which breeds in Iceland, N. Scandinavia and USSR. Ringing recoveries indicate the 'altifrons' do not reach Britain until October, implying that those present in the early autumn on the Solway are probablty 'local' breeders. The two recoveries available support this - both were ringed as nestlings in Cumbria and recovered on the Solway in their first August and December respectively.

No Golden Plovers were marked during this study, and no information is available on their movements either within the Solway or between other estuaries.

6.6 TURNSTONE Arenaria interpres

Qualifying Levels National 250
NW Europe 500

Av. winter peak, Inner Solway (rounded) = 150 birds.

The Turnstone is not a common wader on the Inner Solway because of the lack of suitable rocky and stony habitats. Overall, there has been a significant long-term decline in the numbers wintering on the Inner Solway from an average winter peak of 320 between 1971-1976 to an average winter peak of 157 between 1980-84. This is not in accordance with national trends which have remained stable (Marchant 1982), and may be the result of the sanding-up of several important rocky feeding areas. The winter populations are no longer of national importance.

6.6.1 Seasonal Patterns of Abundance

Birds return from their breeding quarters in August and September, and can be found on the Solway until the end of their spring migration period, in mid-May. Spring migration studies of Turnstones on the Solway will be reported separately, elsewhere. The few birds that spend the summer on the Solway are almost certainly non-breeding birds, mainly immatures.

6.6.2 Local Distribution (Figure 6.6.1)

On the north shore, Turnstones occur around the Southerness Rocks (usually 20+), and on the Carsethorn and Newbie Scars. Occasional birds are seen on the stony substrates between Torduff Point and Browhouses. Recent counts have been as follows:

	1980-81	1981-82	1982-83	1983-84
September	nc	nc	nc	43
October	nc	nc	nc	131
November	nc	nc	106	60
December	nc	118	58	112
January	182	142	102	74
February	118	150	49	88
March	nc	nc	41	72

On the Cumbrian shore, Turnstones are confined almost exclusively to Grune Point, although occasional birds are recorded on other roosts. Numbers on Grune can fluctuate considerably, as a result of birds flying up the coast from Silloth. Recent counts are as follows:

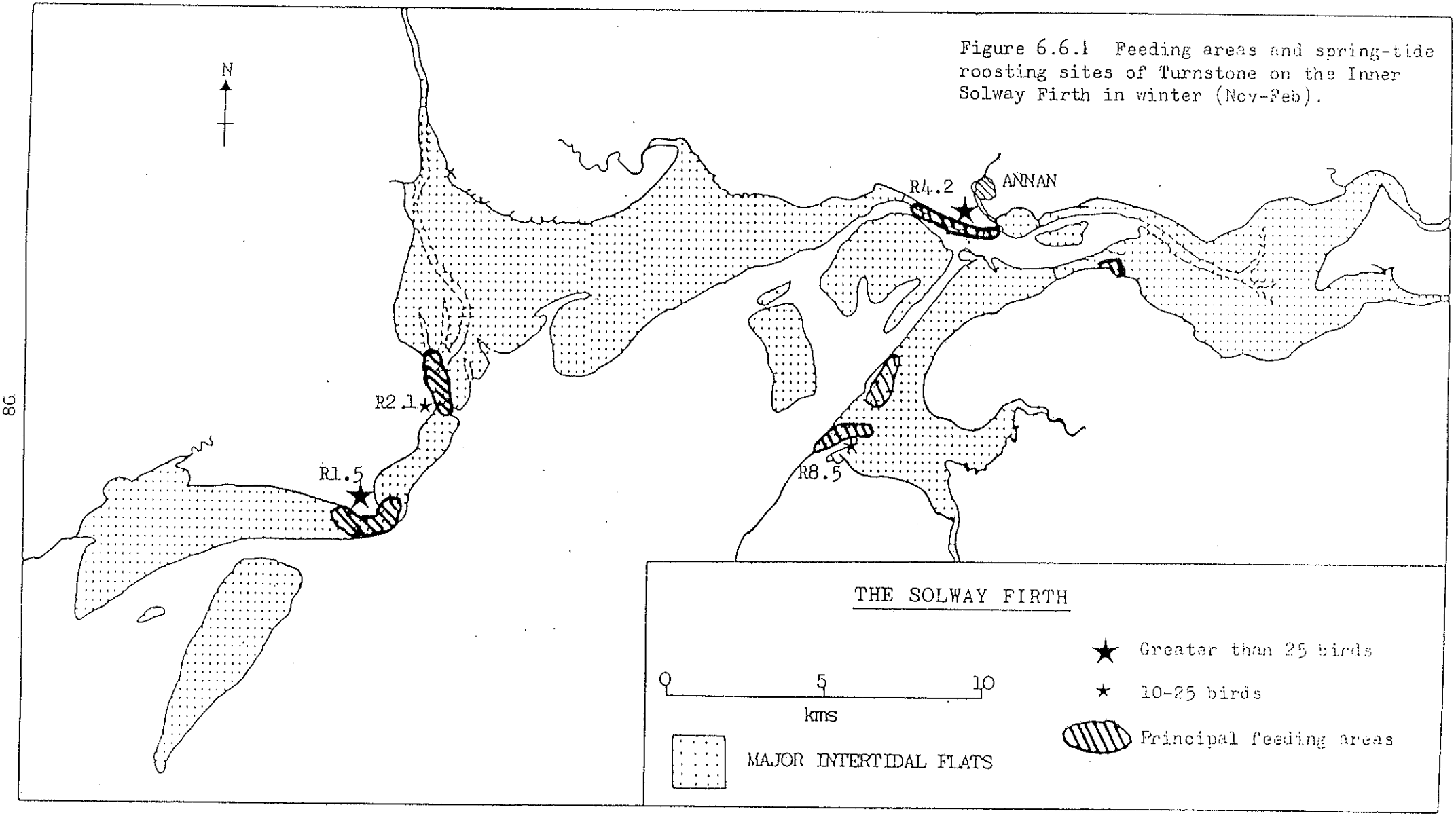


Figure 6.6.1 Feeding areas and spring-tide roosting sites of Turnstone on the Inner Solway Firth in winter (Nov-Feb).

	1980-81	1981-82	1982-83	1983-84
September	0	126	1	49
October	0	0	24	56
November	0	0	6	6
December	0	10	8	70
January	0	20	33	25
February	61	0	9	12
March	0	30	22	2

6.6.3 Origins and Movements

There has been no winter-ringing of Turnstones on the Inner Solway. In a study of the national data, Branson et al. (1978) concluded that most of the Turnstone which winter in western Europe come from the population which breeds in Greenland and NE Canada, with none or very few from the Siberian population. Studies on Morecambe Bay supported these findings (Clapham 1979), although there were two recoveries of birds of easterly origin, also.

No wintering Turnstones were marked during this study. Symonds et al. (1984) have shown that wintering Turnstones on the Forth are extremely site faithful, and no evidence to the contrary was observed for the Solway.

6.7 CURLEW Numenius arquata

Qualifying levels: National 1000
NW Europe 3000

Av. winter peak, Inner Solway (rounded) = 3600

More than 38% of the Curlews wintering in Europe do so on the British and Irish estuaries (Prater 1981). Of these, the estuaries of NW England and SW Scotland are probably the

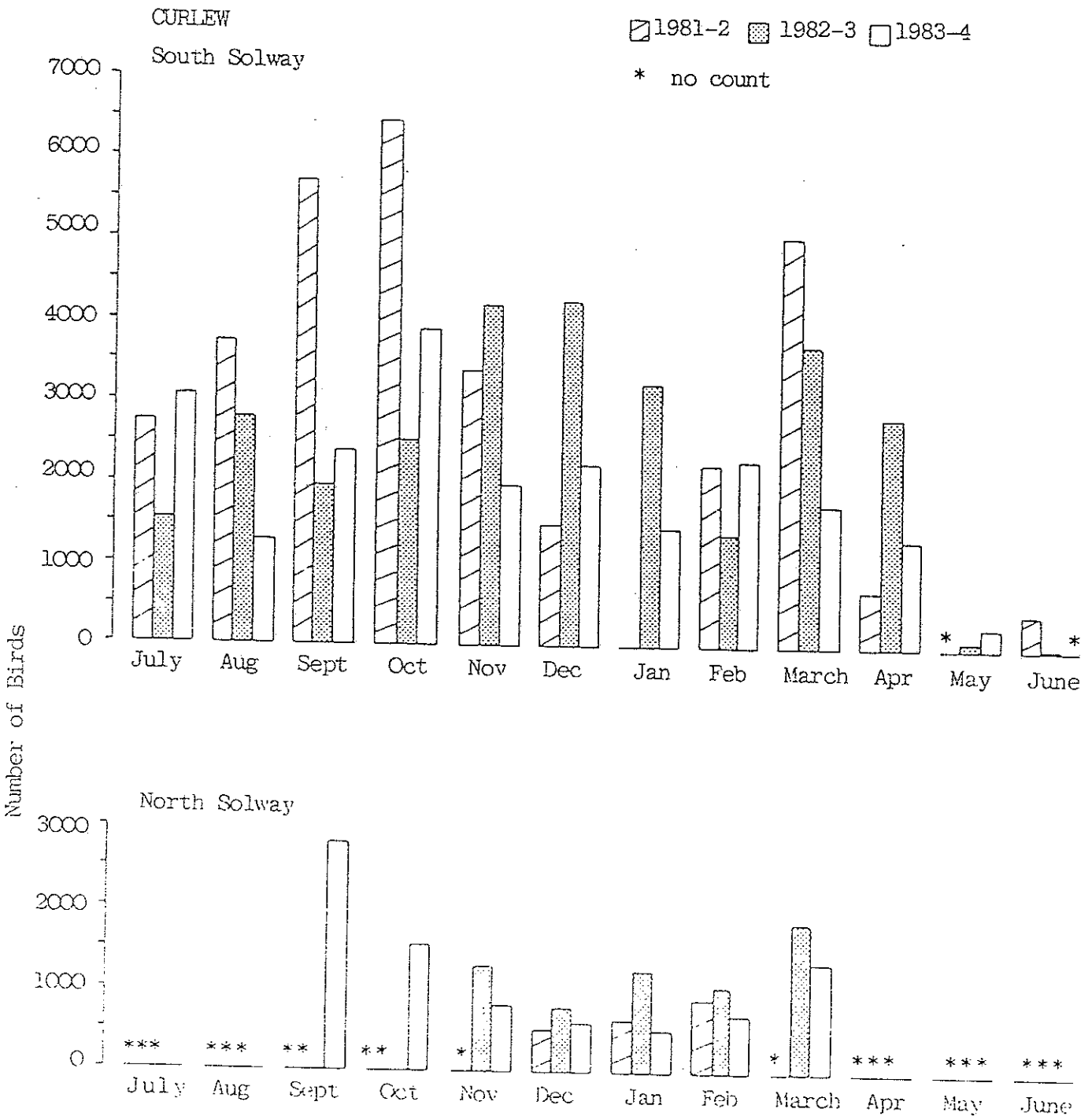
most important. In the last four winters the Solway has held an average winter peak of 3556 birds, which represents 3.6% of the British total, and 1.2% of the NW European population. After Morecambe Bay it is the most important estuary for Curlew in Britain, and is of national and international importance for this species. There is no evidence of any consistent long-term change in the size of the winter peak. Peak numbers occur in the autumn, when few complete counts have been made in recent years. The highest was of over 6500 birds on the south shore alone in October 1981, and counts from earlier years suggest that the population for the whole estuary may at times exceed 10,000 birds (= 3.3% of the NW European total).

Counts of Curlew are complicated by the fact that they make extensive use of inland fields for feeding, particularly over the high water period. It was not possible to visit all suitable areas, and counts must therefore represent only a proportion of the birds present, excluding periods when the fields are frozen and most birds are found on the estuary. Exhaustive checks of fields on the north shore indicated that most field-feeding Curlew remained within 1-2 km of the shore, as was reported by Tasker and Milsom (1979). A high proportion was probably included in most counts. Further information on the importance of field-feeding to Curlew is given by Townshend (1981).

6.7.1 Seasonal Patterns of Abundance (Figure 6.7.1)

Counts are lowest in May and June, when most birds are absent on their inland breeding areas. In July and August there is a influx of birds, leading to peak counts in September and October. Numbers decline to a relatively stable wintering level in November, December, January and February, before a spring peak occurs in March. This early winter decline has

FIGURE 6.7.1. Seasonal patterns of abundance of Curlew on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



been described for several other British estuaries (Bainbridge and Minton 1978, Wilson 1973, Tasker 1979), although whether it is a passage or a shift in feeding habitat is not known.

6.7.2 Local Distribution (Figure 6.7.2)

Up to 1500 Curlew can be found on the north shore in winter. Less than 200 occur to the west of the Nith Estuary, while the main concentrations are around Caerlaverock, Priestside and Dornock, where low-lying pastures offer good feeding.

On Caerlaverock, recent counts are as follows:

	1980-81	1981-82	1982-83	1983-84
September	nc	nc	nc	2212
October	nc	nc	nc	1350
November	nc	nc	1236	567
December	nc	325	609	493
January	435	220	935	380
February	375	1023	585	574
March	nc	nc	1693	928

The entire shore from Browhouses to Priestside holds good numbers of feeding Curlew. Many roost inland on adjacent fields, while those from the eastern part of this section frequently fly to the south shore to roost, particularly around Burgh Marsh. Low water feeding counts for the whole stretch were as follows:

*gales, many birds inland

Nov 1982	39*	Nov 1983	215
Dec 1982	272	Dec 1983	49
Jan 1983	398	Jan 1984	317
Feb 1983	207	Feb 1984	300

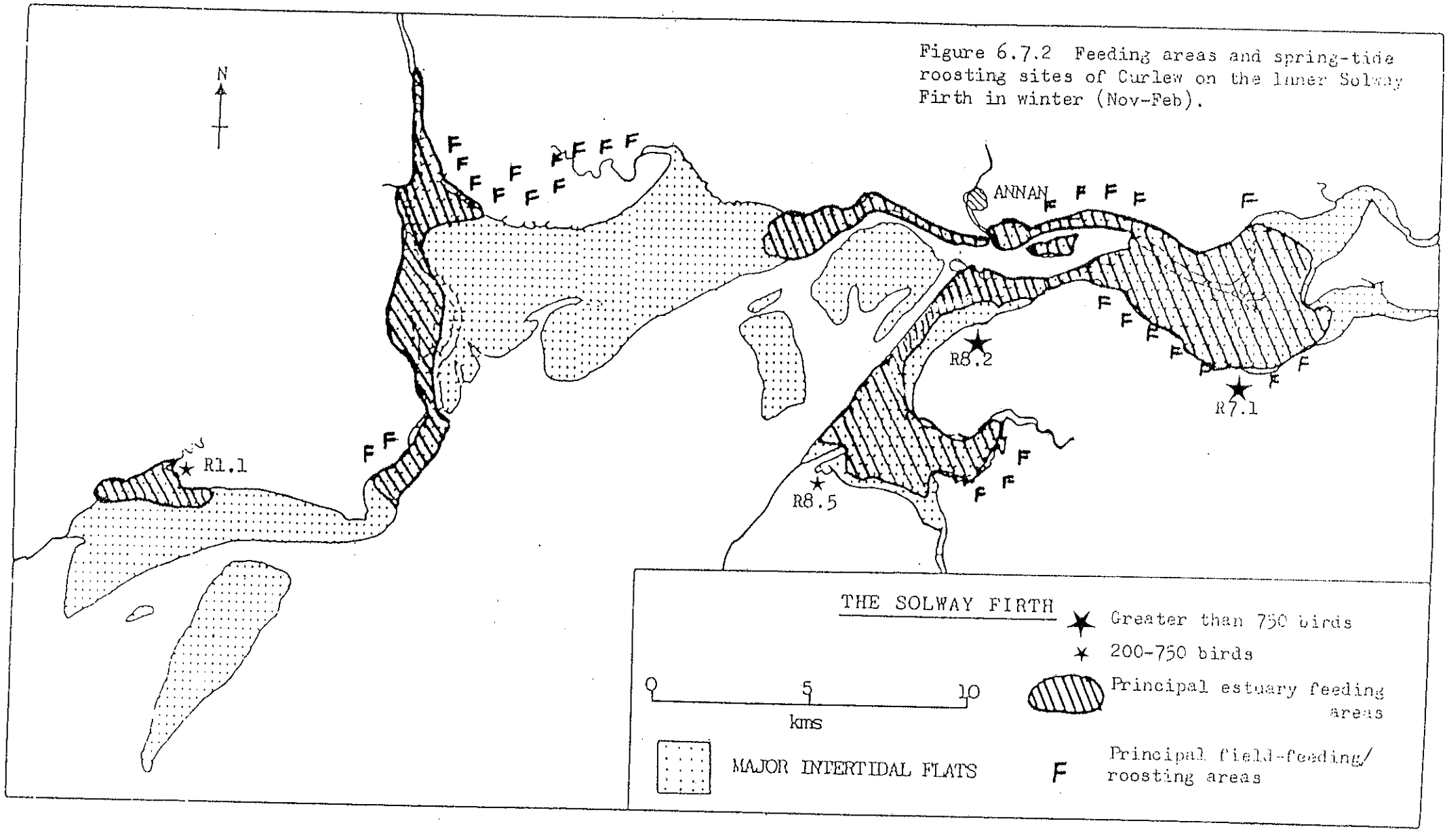


Figure 6.7.2 Feeding areas and spring-tide roosting sites of Curlew on the inner Solway Firth in winter (Nov-Feb).

The south shore supports approximately twice as many Curlew as the north in winter (ca. 2-3000). The most important intertidal feeding areas are Moricambe Bay, and the entire area to the east of Maryland Farm. The high sandflats of Cardurnock are not extensively used. Numbers on the estuary are highest when the alternative field-feeding areas are frozen. Peak winter counts for these two areas have been as follows:

	Moricambe	s.shore east of Cardurnock
1980-81	1659	854
1981-82	-	2073
1982-83	552	3919
1983-84	588	2019

Many of the birds which roost on Burgh Marsh, the most important site for Curlew on the Inner Solway, come from feeding grounds on the north shore.

6.7.3 Origins and Movements

Analyses of ringing data (Bainbridge and Minton 1978) have shown that birds wintering in NW England/SW Scotland include birds which also breed in this area, plus birds from Continental breeding areas (Norway, Sweden and Finland). Ringing recoveries relating to the Solway suggest that the autumn and winter population includes many birds of local, plus some of Continental, origin. Two birds ringed in January and April 1980 were subsequently recovered during the breeding season in Finland.

No information was collected on the within-estuary movement patterns of Curlew, although considerable interchanges between the north and south shores were observed for the inner estuary.

6.8 BAR-TAILED GODWIT *Limosa lapponica*

Qualifying Levels National 450

NW Europe 5500

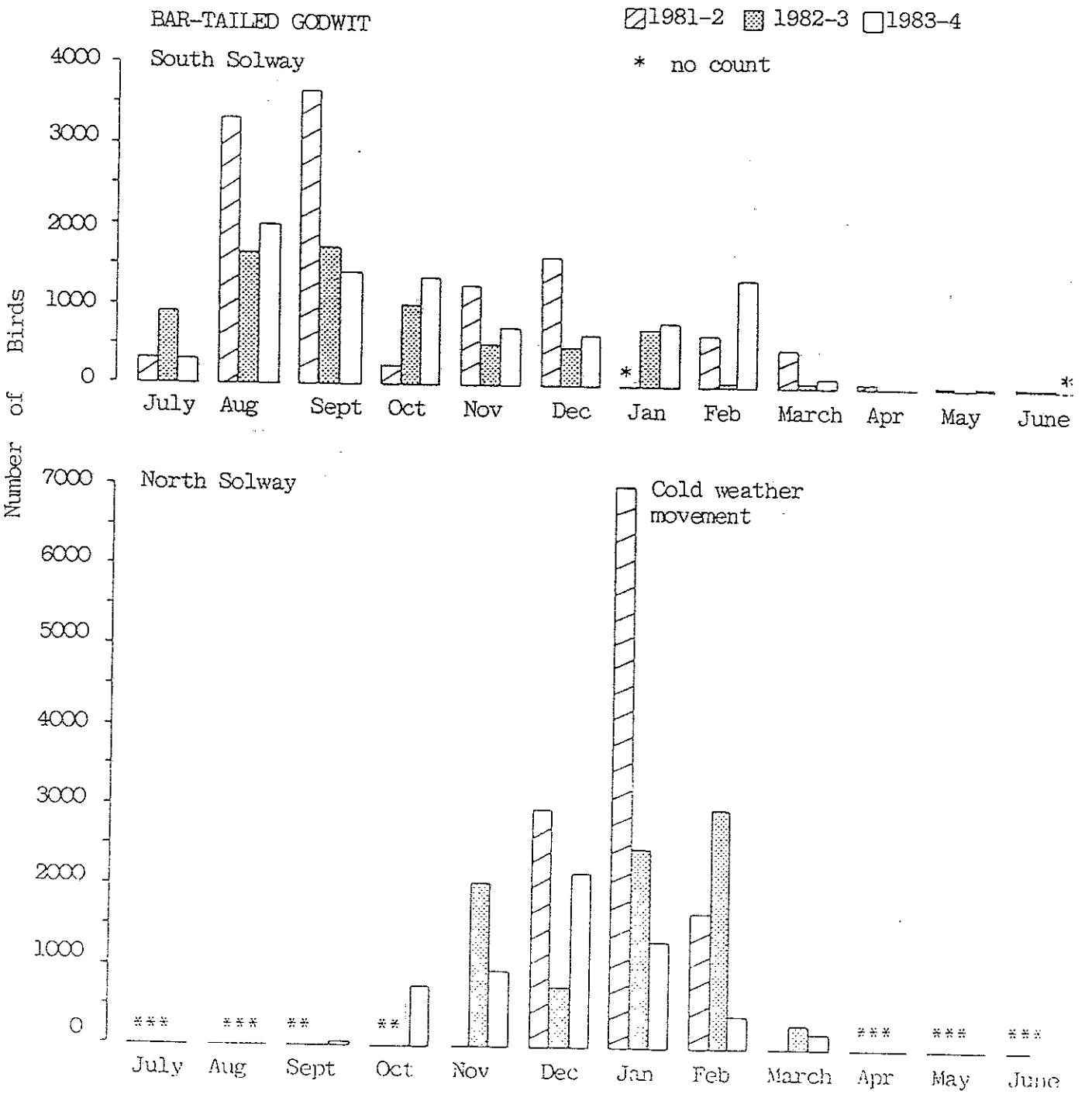
Av. winter peak, Inner Solway (rounded) = 4300 birds.

The predominantly sandy substrates of the Inner Solway offer good feeding conditions for wintering Bar-tailed Godwits. The average winter peak count over the last four seasons has been 4205 birds, making the Solway the sixth most important site for this species in Britain. This figure represents 9.3% of the British wintering population, making the Solway of great national conservation value for this species. The average count is not of international significance, but a peak count of over 7000 birds in the severe weather of the 1981-82 winter indicates that the Inner Solway may become of particular importance for Bar-tailed Godwits during these critical conditions. Numbers were high at this time at several other sites in Britain, suggesting an influx of continental origin (Marchant 1982).

6.8.1 Seasonal Patterns of Abundance (Figure 6.8.1)

Some Bar-tailed Godwits return to the Solway in July, but the main influx occurs in August and September. No counts have been made in recent years during this period on the north shore, but counts from the English shore indicate that there may be an important Autumn passage, perhaps involving moulting flocks. Almost all birds in this Autumn period are recorded on the Cardurnock area. Numbers decline to a

FIGURE 6.8.1. Seasonal variations in abundance of Bar-tailed Godwit on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



wintering level in October, which is maintained until February, when the birds start to depart. There are almost no birds present in April, May and June. The apparent fluctuations in the winter numbers on the south shore are a result of interchange with birds on the north shore, as discussed below.

6.8.2 Local Distribution (Figure 6.8.2)

On the Scottish shore, Bar-tailed Godwits occur in two areas:

Mersehead Sands/Gillfoot Bay

This is the most important section of the Inner Solway for this species in winter, supporting especially large numbers during periods of severe weather (max. 7000 in Jan. 1982). At low-water, the birds feed principally on the sands to the east of the Southerness rocks, flying very predictably into Gillfoot Bay, about 2½ hours before high-water, where they feed for a further 2 hours, before moving onto the Gillfoot Bay roost. They are very intolerant of disturbance (walkers) and do not therefore use other roosts in this area. On the falling tide, these movement patterns are repeated in reverse. There is considerable interchange with birds from the south shore (see below). Recent counts for this area have been:

	1980-81	1981-82	1982-83	1983-84
September	nc	nc	nc	0
October	nc	nc	nc	740
November	nc	nc	1760	900
December	nc	2501	673	1252
January	4	7000	2000	1185
February	4550	1600	2780	400
March	nc	nc	15	81

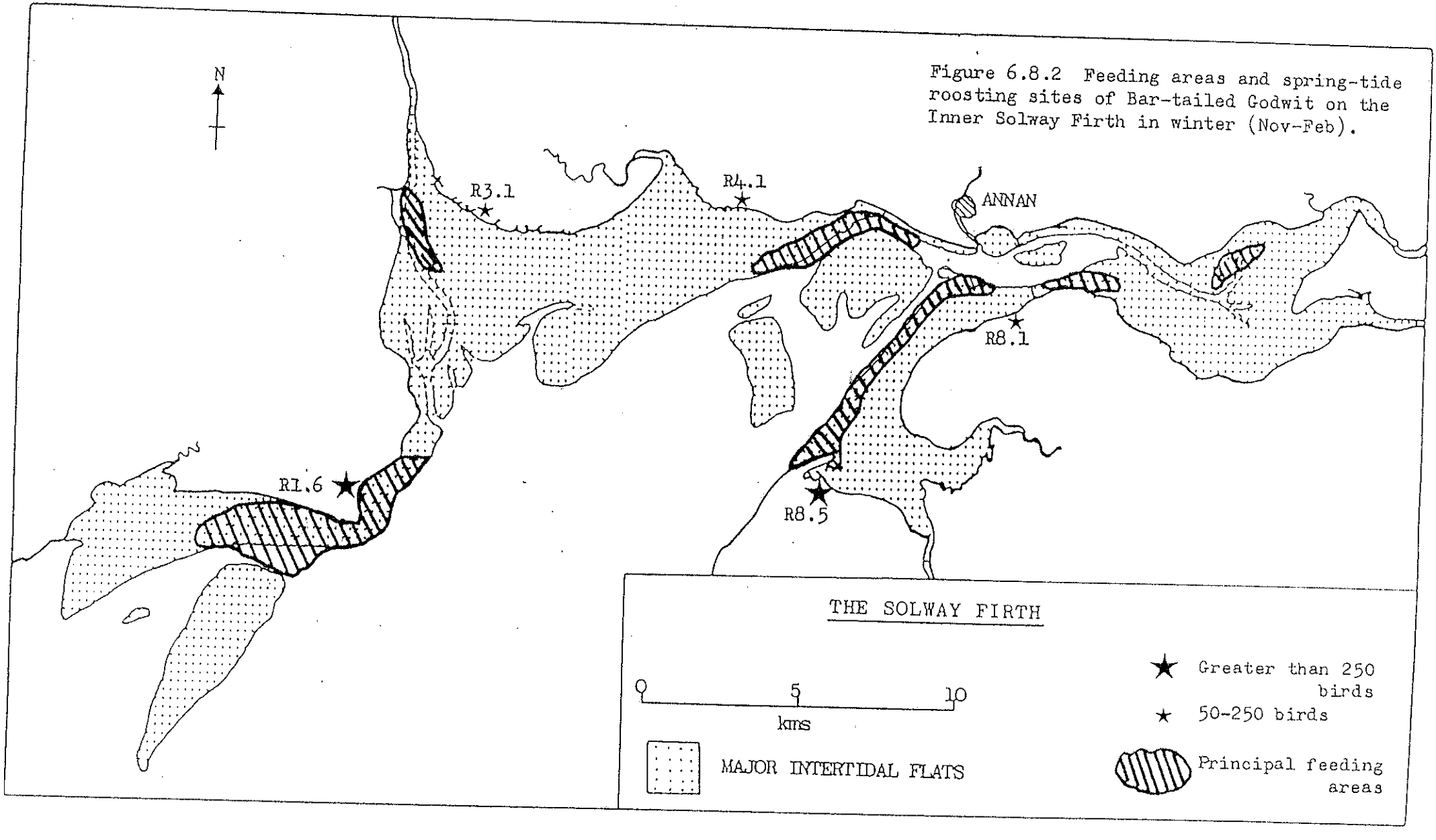


Figure 6.8.2 Feeding areas and spring-tide roosting sites of Bar-tailed Godwit on the Inner Solway Firth in winter (Nov-Feb).

Priestside/Powfoot

This flock is much smaller than that at Mersehead, and is rather more erratic in numbers. Birds usually feed either well out on Priestside Bank, or directly in front of Powfoot Village. On Spring tides they roost at East Howcreek or Lochar. Recent counts on this section are as follows:

	1980-81	1981-82	1982-83	1983-84
September	nc	nc	nc	2
October	nc	nc	nc	3
November	nc	nc	250	18
December	nc	300	40	840*
January	500	7	520	0
February	322	30	219	12
March	nc	nc	220	0

*This flock included one out of 12 birds marked at Southerness, indicating that the high numbers were the result of a displacement of that flock.

Small numbers are occasionally recorded at Caerlaverock (usually less than 100), where they feed in the channel of the Nith.

On the English shore, Bar-tailed Godwits are found mainly on the outer parts of the estuary, to the west of Bowness merse. Two areas regularly hold good numbers:

Herdhill Viaduct-W. end of Cardurnock

The birds are concentrated chiefly at the eastern end of this section, with most birds roosting on, or to the east of, the Maryland Farm roost. Recent counts are as follows:

	1980-81	1981-82	1982-83	1983-84
August	610	2920	1430	2005
September	3800	3420	1698	1095
October	2160	220	632	484
November	0	555	139	185
December	0	44	110	128
January	0	0	545	0
February	580	602	25	365
March	110	102	3	107

The importance of this site in Autumn cannot be underestimated, and suggests that it is the site of an important moulting flock. This requires further study.

Grune Point

This area is particularly important for Bar-tailed Godwits in the latter part of the winter, when many birds from the north shore may move here. The main feeding areas are in the mouth of Moricambe Bay, particularly in front of Grune Point itself. All birds roost on the protected site on Skinburness Marsh with a few occasionally on Calvo Marsh. Recent counts are as follows:

	1980-81	1981-82	1982-83	1983-84
August	75	10	172	nc
September	700	200	30	300
October	0	27	0	600
November	450	3	100	500
December	500	1550	100	674
January	300	1	200	809
February	5	nc	1	1374
March	200	26	3	10

Smaller numbers of Bar-tailed Godwits also use the area from Dykesfield to Glasson. Numbers are usually less than 50, but a maximum of 370 was recorded in October 1982.

6.8.3 Origins and Movements

There have been no recoveries of Bar-tailed Godwits ringed on the Solway. A catch of 12 individuals on 18.12.83, which were dye-marked did not yield any sightings outside the estuary. Subsequent observations of these birds confirmed that the Gillfoot Bay roost is used predominantly by birds feeding on Mersehead Sands. Symonds et. al. (1984) concluded that Bar-tailed Godwits were fairly mobile within an estuarine complex. This was confirmed by the erratic fluctuations in numbers on individual sites, and by the movements of 2 dye-marked individuals from the Gillfoot Bay roost, to the Grune area. This was part of a much larger movement involving 750-1000 birds. Similarly, 1 bird out of 840 at Priestside was observed to be marked from this catch.

6.9 REDSHANK Tringa totanus

Qualifying Levels: National 1000 (passage 1200)
NW Europe 2000

Av. winter peak, Inner Solway (rounded) = 1510 birds

Redshank are absent from large areas of the Inner Solway because of their preference for muddy substrates. Peak winter counts are, however, of national significance, with the average for the last four winters being 1508 birds, or just over 1.5% of the national estimated totals. Numbers have declined significantly since the period 1971-77, when the average peak midwinter count was 3208. A small part of this difference may be the result of poorer count coverage on the Inner north shore, and absence of counts on Rockcliffe marsh. This could only account for a maximum of 500 birds. National trends have also shown a decline (Marchant 1982), although the cause remains unknown.

There is less information available concerning the size of the Autumn passage. A peak of 2432 birds in October 1983, and a peak of 2079 birds on the south shore alone in November 1981 clearly indicate that the population is of international importance at this time of year.

6.9.1 Seasonal Patterns of Abundance (Figure 6.9.1)

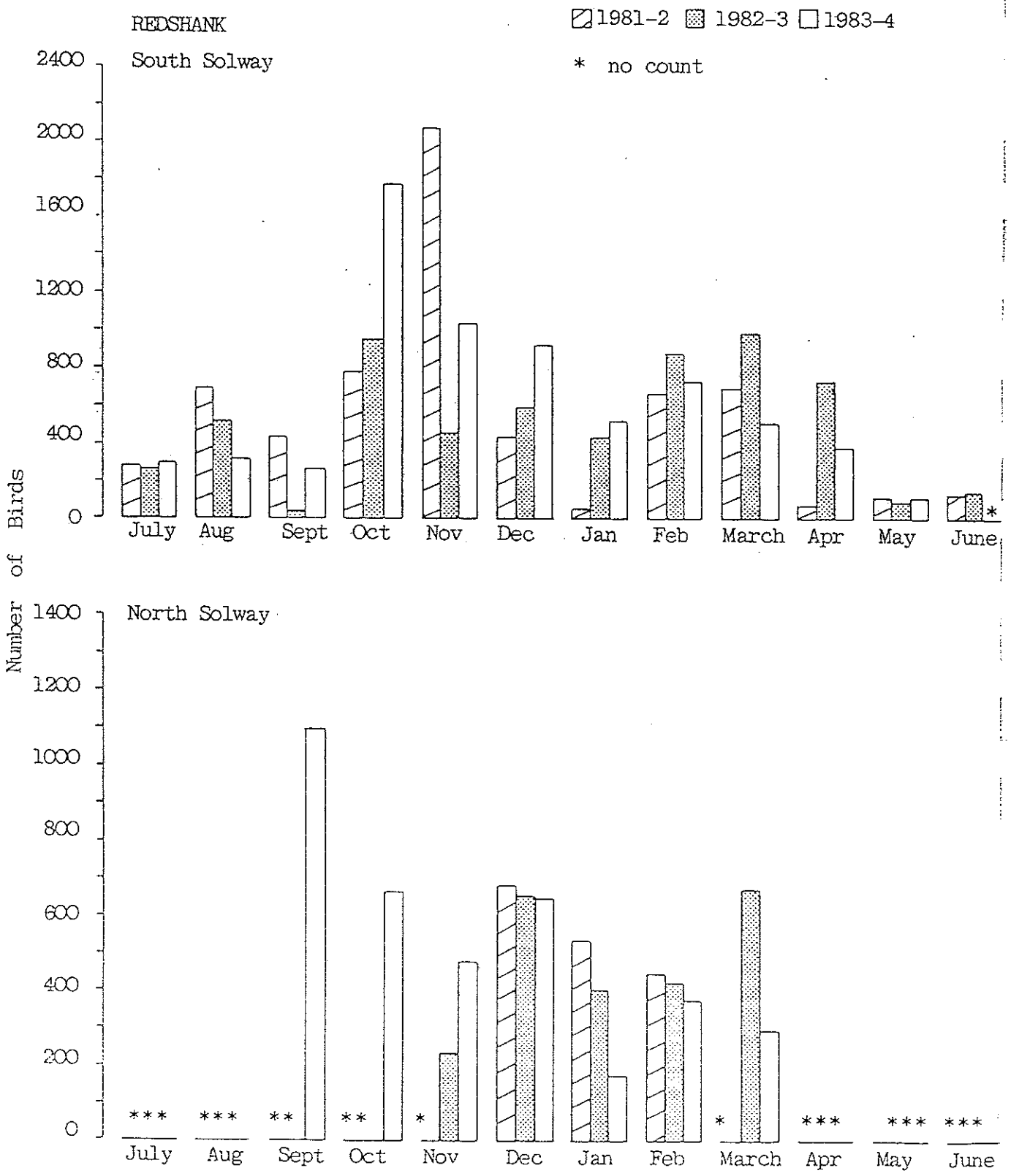
A population of presumed local breeders is present in May and June. In September, October and November there is an important Autumn passage of birds, which presumably moult on the Solway. These birds have departed by December, to leave a more stable wintering population from December to March. There is evidence of a slight drop in numbers in January, which could either be a result of birds moving out of the Solway to avoid periods of severe weather, or a result of increased field-feeding.

6.9.2 Local Distribution (Figure 6.9.2)

On the north shore, small numbers of Redshank occur anywhere where muddy substrates predominate. Small flocks occur at the mouth of Southwick Water, around the Southerness rocks, and in Gillfoot Bay, but totals for these areas rarely exceed 100 birds. The first major concentration to the west is in Carse Bay, where recent counts have been as follows:

	1980-81	1981-82	1982-83	1983-84
September	nc	nc	nc	470
October	nc	nc	nc	340
November	nc	nc	0	80
December	nc	150	20	224
January	450	1	152	25
February	nc	80	102	51
March	nc	nc	165	nc

FIGURE 6.9.1. Seasonal patterns of abundance of Redshank on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



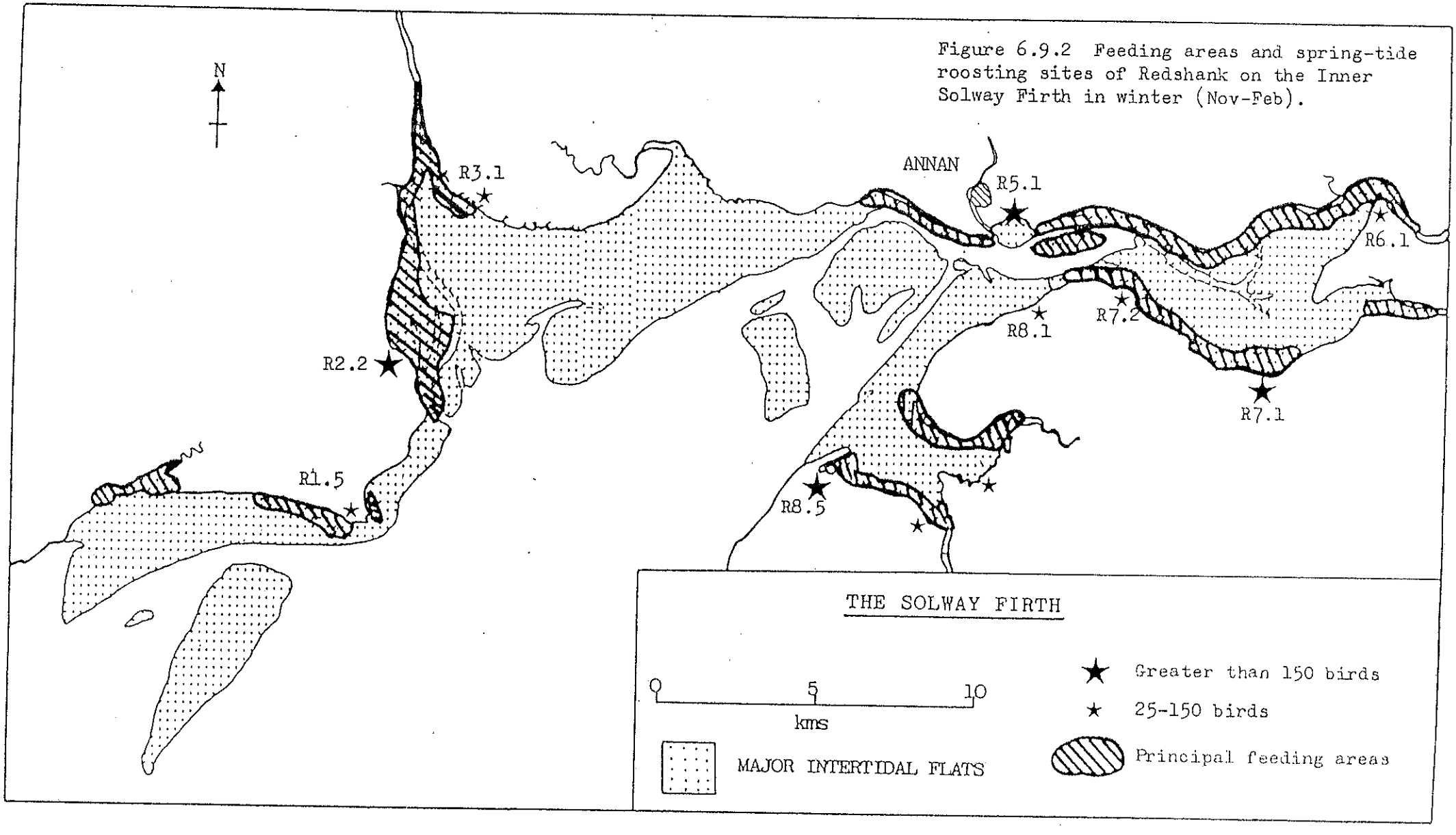


Figure 6.9.2 Feeding areas and spring-tide roosting sites of Redshank on the Inner Solway Firth in winter (Nov-Feb).

Many of the birds feed on the muddy scars at low-water, moving into Carse Bay as these are covered by the tide, to gain extra feeding time. The roost is normally in Carse Bay, although the birds may fly onto adjacent fields when flooded, or roost on the floodpool at Kirkbean. The current wintering population in this section is between 150 and 220 birds.

Small numbers of Redshanks feed up the Nith estuary as far as Glencaple, as well as on the muddy merse-erosion scars below Caerlaverock. Winter roost counts in this section rarely exceed 90 birds.

The largest numbers of Redshanks on the Scottish shore feed on the muddy and muddy-scar substrates from Powfoot, east to Browhouses. Many of these birds roost on inland fields, or cross to the south shore to roost at Bowness, or on Rockcliffe Marsh. Low-water counts made on this entire stretch for this survey were as follows:

	1982-83	1983-84
November	380	601
December	362	551
January	321	551
February	394	579

On the English Shore, the largest counts of Redshank were made between Sandsfield and Bowness. Although many of these birds also fed in this area, large numbers crossed from the north shore at high-water. Recent counts on this section have been as follows:

	1980-81	1981-82	1982-83	1983-84
August	nc	74	374	294
September	467	44	nc	33
October	1047	84	556	577
November	665	185	276	374
December	170	138	446	468
January	77	28	349	414
February	512	415	247	510
March	72	386	594	30

The area from the Herdhill viaduct to the mouth of Moricambe Bay generally holds rather few Redshank, due to its predominantly sandy substrates. Moricambe Bay and its associated marshes, plus the muddy areas around Grune Point are however important feeding areas. The birds roost in several areas, including Skinburness Marsh, Border Marsh, Calvo Marsh and Newton Marsh: Recent counts for the whole of this area have been as follows:

	1980-81	1981-82	1982-83	1983-84
September	200	303	82+	220+
October	792	687	350+	347
November	994	1659	135	341
December	1503	250+	93	431
January	763	21+	9	51
February	348	224	546	130
March	50+	215	350+	484

6.9.3 Origins and Movements

The British wintering Redshank population includes birds both of Icelandic and British origin (Prater 1981). Of the 41 ringing recoveries concerning the Solway area, 31 relate to birds ringed as nestlings in the area. Twelve of these were subsequently recovered in their first Autumn, still on the Solway while the remainder showed predominantly southerly movements in their first Autumn and winter to Ireland, S and SW England and France. A single bird recovered on the Solway in midwinter had been ringed as a nestling in the Lothian region of E Scotland.

No catches of Redshank were made during this survey, but elsewhere (Symonds et al. 1984) Redshank show a high degree of within-season fidelity to their wintering sites.

6.10 KNOT *Calidris canutus*

Qualifying Levels: National 2500

NW Europe 3500

Av. winter peak, Inner Solway (rounded) = 6300

There has been a decline in the number of Knot wintering on the Inner Solway, from an average peak winter count of 18,520 between 1971 and 1976, to an average peak of 6272 between 1980 and 1984. This parallels the national and NW European trends which have been in decline since the early 1970s. The current wintering population on the Solway is both of national and international importance, representing 2.5% and 1.8% of the British and NW European totals respectively.

6.10.1 Seasonal Patterns of Abundance (Figure 6.10.1)

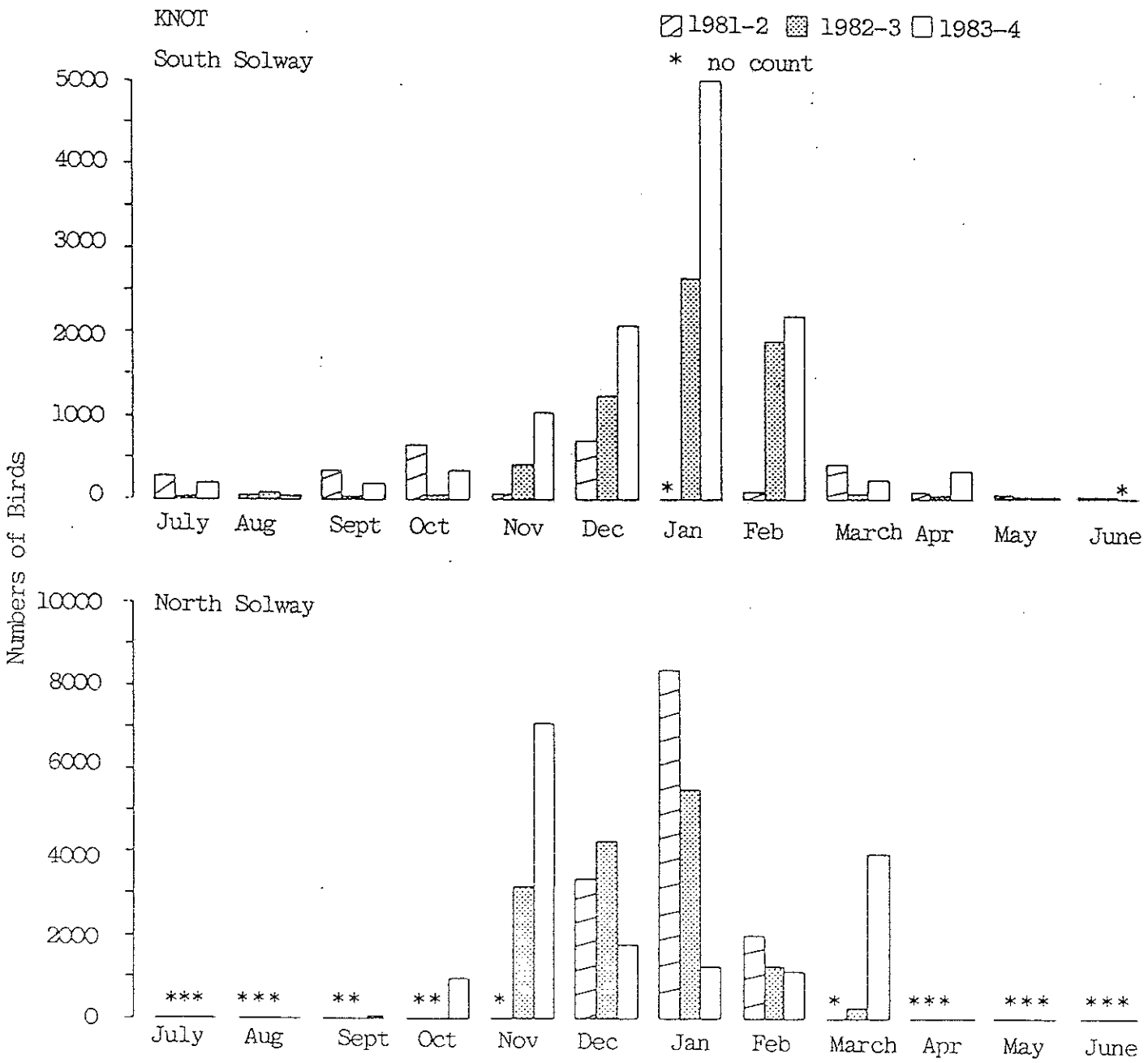
There is little evidence that the Solway is an important moulting site for Knot, with very low numbers present during the autumn. The main influx occurs in November and December, with a peak count in January. The peak is only of short duration, before the birds depart again, being virtually absent from March through to July.

6.10.2 Local Distribution (Figure 6.10.2)

Knot feed both on the muddy/stony scar areas of the Inner Solway and on parts of the harder sandflats. On the north shore, the most important areas are around Southerness, Caerlaverock and Priestside, where peak counts in recent years have been as follows (individual counts are not presented because of the sharp nature of the winter peak):

	Southerness/ Mersehead	Caerlaverock	Priestside to Newbie
1980-81	3650	0	1003
1981-82	6700	100	1700
1982-83	1100	1000	4000
1983-84	1052	200	1300

FIGURE 6.10.1. Seasonal patterns of abundance of Knot on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



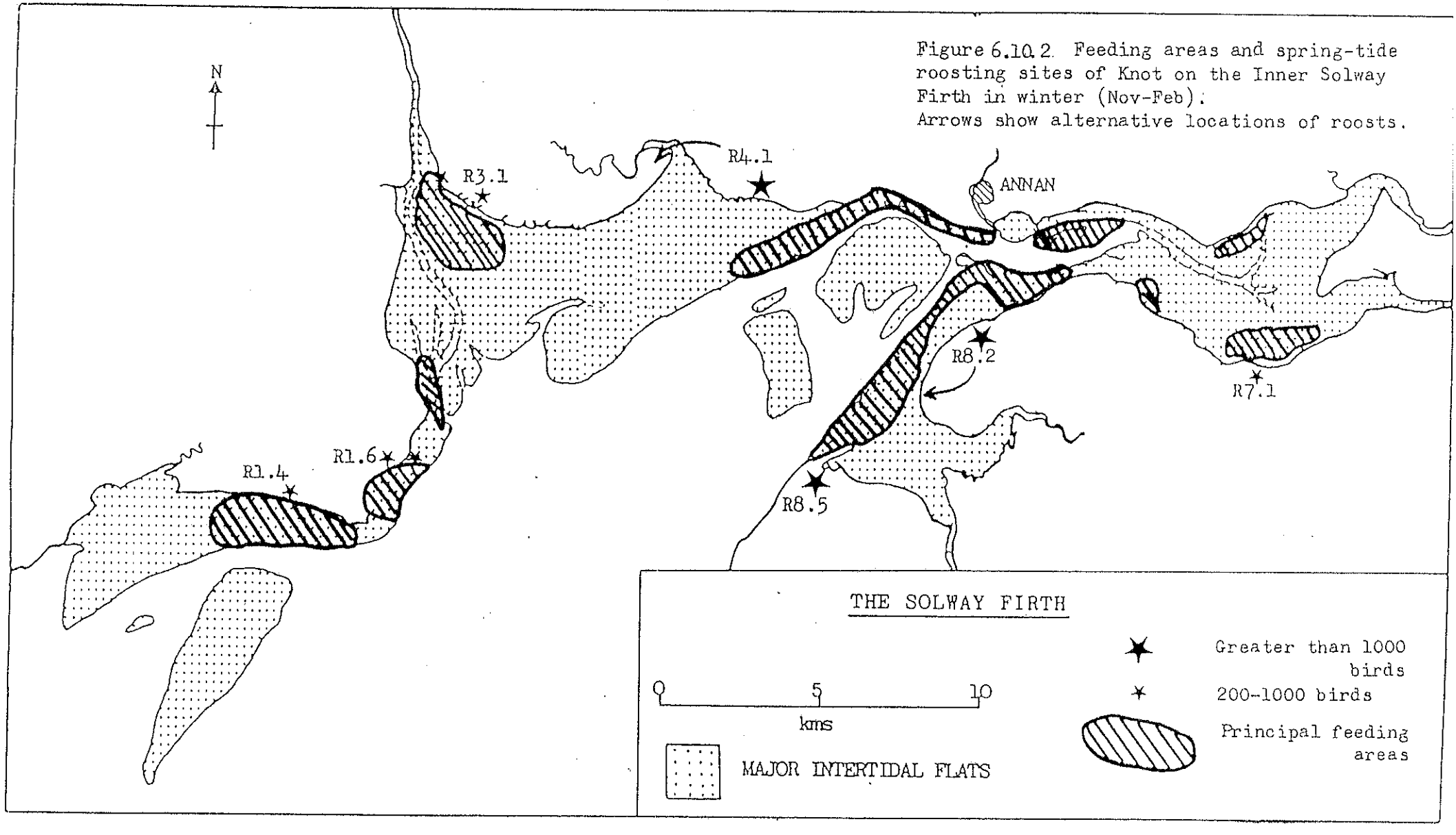


Figure 6.10.2. Feeding areas and spring-tide roosting sites of Knot on the Inner Solway Firth in winter (Nov-Feb).
Arrows show alternative locations of roosts.

The main feeding area for the Southerness flock lies to the east of the Point, where large mixed-species flocks of Bar-tailed Godwit and Knot occur. A large proportion of these birds flight into Gillfoot Bay at high water to gain extra feeding time, and a sheltered high water roost. Small numbers (usually less than 150) often feed on the Carsethorn scars, and these also roost in Gillfoot Bay on spring tides. The birds from the Priestside roost gather from feeding areas between the Newbie Scars, Powfoot and Priestside Bank. Further feeding areas occur on the stony scars from Seafield to Browhouses, excepting the stretch between Dornock and Torduff Point. Most of the birds from these areas roost on the south shore.

On the English shore, large numbers of Knot occur in three areas only, and peak winter counts are as follows:

	Grune/ Skinburness	Cardurnock	Dykesfield to Glasson
1980-81	300	30	300
1981-82	500	165	80
1982-83	155	1690	600
1983-84	2000	1775	1200

The relatively high numbers observed in 1983-84 are perhaps atypical, since fewer birds were present on the north shore, suggesting an interchange. The principal feeding areas are around the mouth of Moricambe Bay (particularly on the scars). The birds on the Dykesfield to Glasson areas feed mainly on the north shore (Seafield - Browhouses) moving into this area to gain extra feeding time over high water. Small numbers also feed on the Herdhill and Port Carlisle Scars.

6.10.3 Origins and Movements

The recoveries of all Knot ringed in winter (Nov - Feb) on the Inner Solway are shown in Table 6.10.1. These clearly indicate that, as with all other wintering Knot in Britain (Dick et. al. 1976) they belong to the N. Greenland/NE Canadian population, which apparently stages in Iceland in spring (Wilson 1981). The main influx of Knot into Iceland occurs in early May (Wilson 1981), and it is clear from the counts and recoveries that these birds do not leave directly from the Solway but move into Morecambe Bay. Autumn recoveries suggest that Knot move into the Solway in winter from moulting areas on the Wash, Morecambe Bay, Ribble and Dee.

Symonds et al. (1984) demonstrated that winter Knot were highly mobile within individual sites on the Firth of Forth. Very considerable mobility was also observed on the Solway, particularly between Southerness/Grune Point and Priestside/Cardurnock.

6.11 DUNLIN Calidris alpina

Qualifying Levels: National 5500 (pasage 2000)
NW Europe 20000

Av. winter peak, Inner Solway (rounded) = 10100

Dunlin are the second most numerous wintering wader on the Inner Solway, after Oystercatcher. There has been a decline in the peak winter numbers on the Inner Solway from an average of 13721 from 1971-77 to 10003 between 1980-84. The reasons for this decline are not known, although the national trends also show a similar pattern (Marchant 1982). The average peak count for the four winters since 1980-81 represents 1.8% of the estimated British totals, and is thus of national importance. The population does not attain international significance.

Table 6.10.1 Finding/ringing locations of all Knot ringed/recovered on the Solway in winter (Nov-Feb). The data indicate that most Knot visiting the Solway in winter have moulted on either the Wash or in the Dee/Ribble/Morecambe Bay area. In spring these birds stage on Morecambe Bay, and migrate via Iceland to the breeding grounds in Greenland and NE Canada.

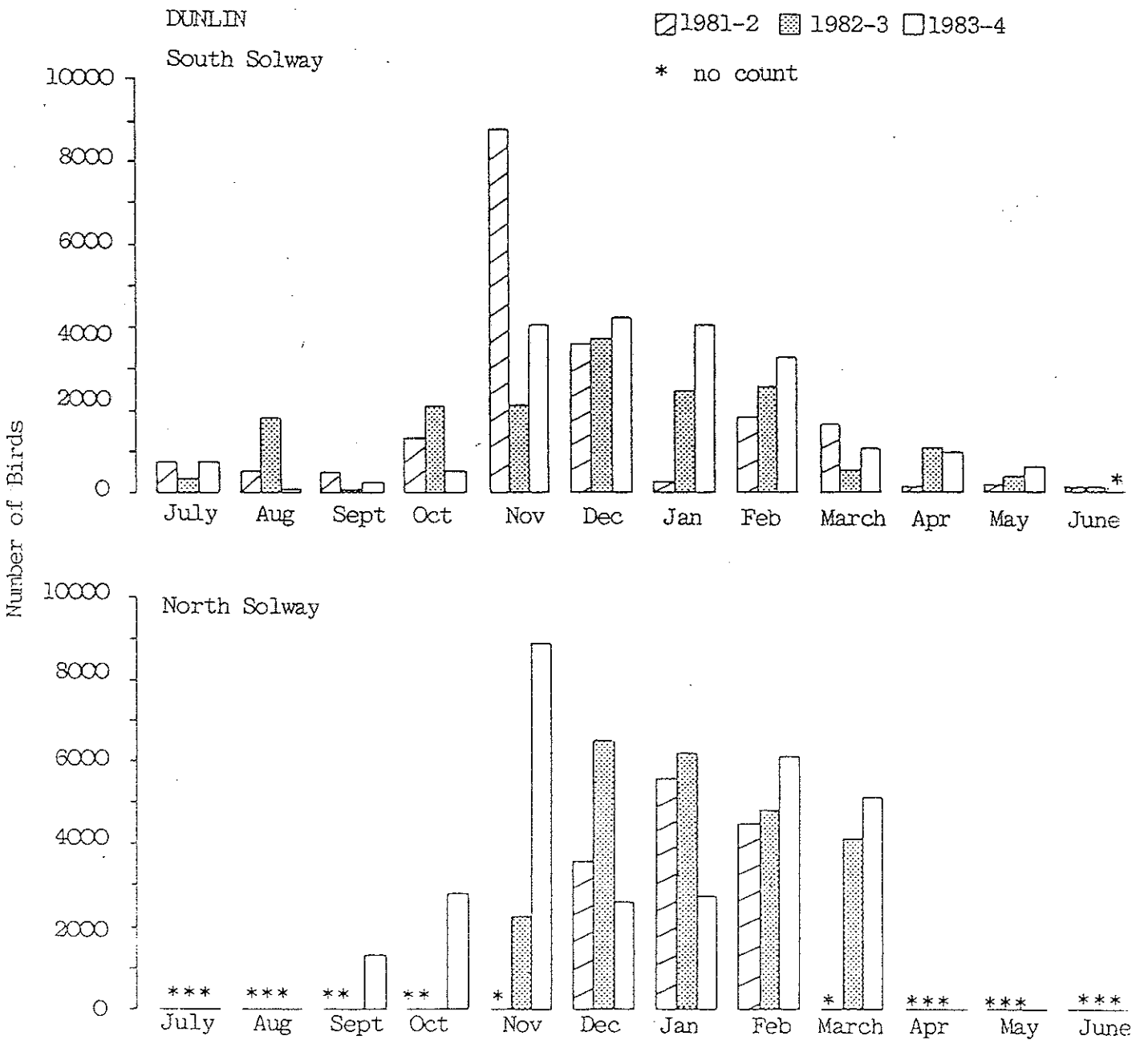
	France	Wash	Dee	Ribble	Morecambe Bay	Tees	Moray Firth	Iceland	Greenland	Canada
July		1								
August	1	5	1	1	1					
September				2	1					
October		2			2					
November			1							
December					2					
January		1								
February					1	1	1			
March					2					
April					2					
May					5					
June								3	1	1

Three races of Dunlin visit the Solway at different times of year. These are C.a. alpina which breeds in northern Scandinavia and the USSR, C.a.schinzii which breeds in NW Europe, Iceland and SE Greenland and C.a. arctica which breeds in NE Greenland. Attempts were made to assign ringed birds to these three races, using morphometric and plumage data.

6.11.1 Seasonal Patterns of Abundance (Figure 6.11.1)

Very few Dunlin spend the summer on the Inner Solway, although these include a small breeding population of 4-7 pairs on Rockcliffe Marsh (Rankin 1979). There is a return passage of birds from their northerly breeding grounds in July, August and September. This presumably involves mainly schinzii birds, although further studies are required including measures of turnover to assess the number of birds which visit the estuary. In October and November, there is a massive influx of principally alpina Dunlin, which leads to a midwinter peak, in November or December. Patterns of inter-estuarine movements of Dunlin are being studied intensively elsewhere (Pienkowski 1983), and preliminary findings suggest that most of these Dunlin are moving into the Solway area from moulting sites in Eastern England and the Waddensea. Numbers on the Solway decline from February to March, by which time the vast majority of alpina Dunlin have gone. In early April and May there is an important passage of schinzii and a few arctica Dunlin, which use the Solway as a major staging post on migration to their northern breeding areas. This was part of a special investigation which will be reported elsewhere. Almost all migrant Dunlin leave the Solway by the end of May.

FIGURE 6.11.1 Seasonal patterns of abundance of Dunlin on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



6.11.2 Local Distribution (Figure 6.11.2)

Dunlin occur on most areas of the Inner Solway, excepting the outer mobile sandflats. Large flocks can be seen both on muddy areas such as Carse Bay, and on the sandier habitats of Mersehead and Cardurnock.

On the north shore, the eastern end of Mersehead Sands held an average winter peak of 2063 birds in the last four years. These birds roosted mainly around Southerness, or at the eastern end of Preston Merse. Carse Bay was an important feeding area for 200-500 birds, most feeding on the muddy Carsethorn Scars at low water, and moving into Carse Bay toward high water. Many birds fed at the mouth of the river Nith, and in the Channels of Blackshaw Bank. They were very difficult to count at low-water, but roost counts on Caerlaverock have given an average peak count of 1780 birds in the last four years.

The average peak count for the roosts above Priestside Bank is 3775 birds, making this the most important section on the north shore for this species. Most birds actually feed on Priestside Bank, and from here to Annan Waterfoot. To the east of Annan there are no further roosts of Dunlin on the north shore, most birds flighting to the south shore (Bowness) or onto inland fields, if flooded. There are, however, two important feeding areas, the first below Dornock where up to 1000 Dunlin were regularly found and the second around Browhouses where 150-300 Dunlin fed on the upper shore.

On the English shore, the main areas for roosting and feeding Dunlin are on Cardurnock and the lower Moricambe scars. Most birds feed on the lower shore, the upper sandflats being hard and dry. The average winter peak for this section in the last four years is 3815 birds. Elsewhere, Grune and Moricambe

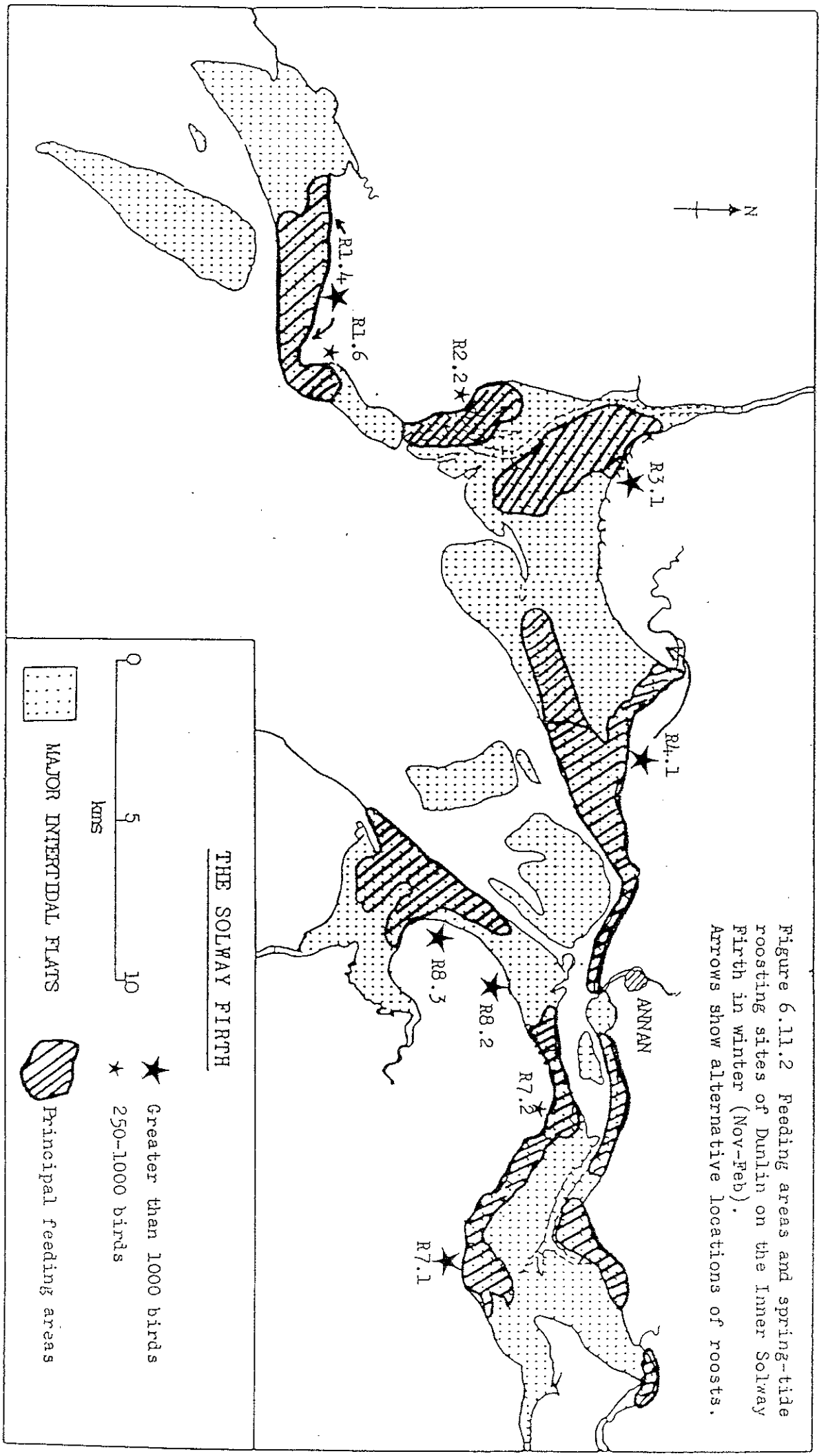


Figure 6.11.2 Feeding areas and spring-tide roosting sites of Dunlin on the Inner Solway Firth in winter (Nov-Feb). Arrows show alternative locations of roosts.

support up to 100 birds, whilst the whole area to the east of Bowness can hold up to 1500 birds over high water, although these feed largely on the north shore.

6.12 PURPLE SANDPIPER *Calidris maritima*

Qualifying Levels:	National	180
	NW Europe	?

The rocky outcrops at Southerness Point on the north shore is the only part of the Inner Solway to support a regular population of wintering Purple Sandpipers although some birds are occasionally recorded at Lot's Wife. Birds are present from August to April inclusive, although the peak counts always occur in the period December to March. Birds are easily missed during the counts, but the figures suggest a regular wintering population of 20-35 individuals. The highest count was of 44 in January 1984. These numbers are not of national significance.

There have been no recoveries to date, to indicate the origins of Purple Sandpipers ringed on the Solway in winter.

6.13 SWANS

MUTE SWAN *Cygnus olor*, BEWICK'S SWAN *Cygnus columbianus bewickii* and WHOOPER SWAN *Cygnus cygnus*

		Whooper	Bewick
Qualifying Levels:	National	50	50
	NW Europe	100	120

The most important area of the Solway for swans is Caerlaverock, where up to 150 Whooper, 70 Bewick's and 50 Mute Swans are regularly found in winter. These swans normally feed on the Wildfowl Trust Refuge or on farmland in the vicinity and roost at night on freshwater ponds or lakes.

However, small parties, typically 5-30 birds, quite often roost out on the foreshore of Blackshaw Bank and there is a record of 181 swans roosting out on the sands off Kenneth Bank at dusk on 25th November 1982. Nearly all these birds were Whoopers. Swans also sometimes roost out on Priestside Bank (usually Whoopers) and rarely elsewhere. The numbers of Bewick's are of national conservation significance, while those of Whoopers are of both national and international importance.

6.14 GREYLAG GOOSE Anser anser

Qualifying Levels: National 900
NW Europe 900

Av. winter peak, Inner Solway (650) birds

Greylag Geese formerly occurred on the Solway foreshore in considerable numbers but in the middle years of this century a change in their distribution took place. Most of the birds moved inland and they are nowadays found roosting on freshwater lochs such as Castle Loch, Lochmaben, Lochrutton and Loch Ken or on rivers such as the Nith and Dee. However, the foreshore inter-tidal areas are still used by roosting flocks in a number of places (Figure 6.14.1).

On the Scottish shore the main areas used are the Blackshaw and Priestside Banks. In November and December Greylag regularly form a roost on the eastern side of Blackshaw Bank, near the Lochar channel, flighting inland at dawn to feed on Longbridgemuir. The peak numbers recorded for this roost in each of the last five winters have been:-

18th December 1979	310
22nd December 1980	700
5th December 1981	460
13th December 1982	1,400
19th December 1983	360

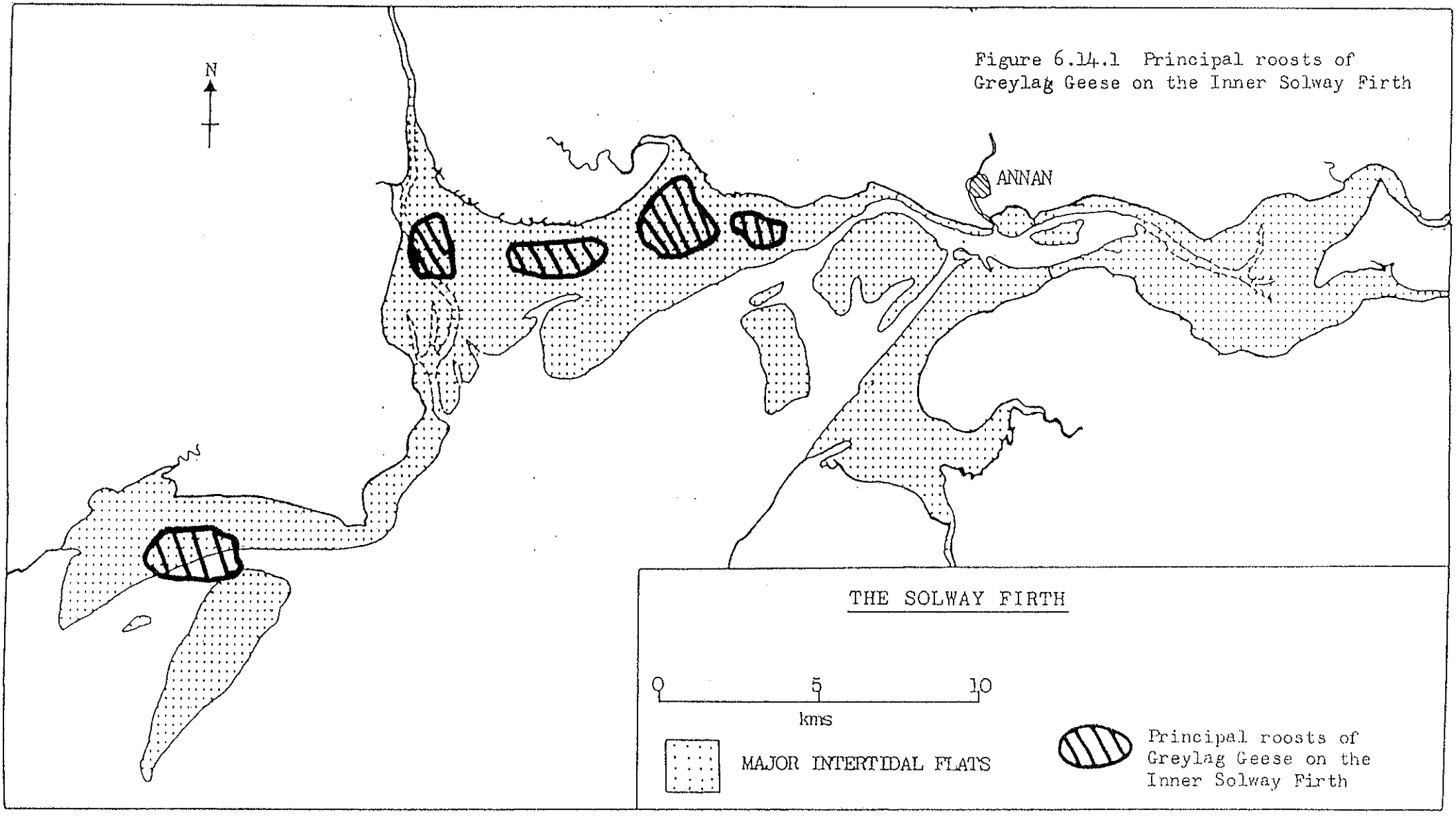


Figure 6.14.1 Principal roosts of Greylag Geese on the Inner Solway Firth

This roost normally disperses in late December but in mid to late winter smaller numbers (up to 250 birds) often roost on Blackshaw and Priestside, but may be irregular in their appearance. Similar numbers occasionally roost on Mersehead Sands. In late winter (January to March) there is a regular roost of up to 300 birds, exceptionally more, in the Nith estuary, off Burnfoot, with the birds flighting off to the Kirkcudbrightshire shore. Numbers at all these roosts may be increased if a spell of severe weather causes inland freshwater lochs to freeze over (eg December 1982).

On the Cumbria shore Greylag are quite scarce and no site now holds a regular wintering flock. Parties are occasionaly seen in the Rockcliffe area but rarely exceed 100-200 in number. They may have been more frequent in past years for there are counts for Rockcliffe of 1,000 on 11th January 1970 and again on 17 January 1971. Small flocks are also occasionally seen around Moricambe Bay.

Thus, numbers of Greylag on the Inner Solway usually peak in December. The average winter peak is estimated at 650 birds, from the Caerlaverock counts. This number is not of national significance, but in periods of severe weather, the Solway may be of critical importance.

6.15 PINK-FOOTED GOOSE Anser brachyrhynchus

Qualifying Levels: National 900
NW Europe 900

Av. winter peak, Inner Solway = (20000+) birds.

Pink-footed Geese were at one time scarce on the Solway, but over the past few decades they have replaced the Greylag as the dominant grey goose of the Inner Solway foreshores. The total number of Pink-footed Geese roosting on the Inner Solway normally reaches at least 20,000, perhaps 25,000, at

some stage in the second half of a normal winter, which is about 20% of the current world population of 115,000 birds. Exceptionally the Solway population may reach 30,000 or more for a few days, which is over 25% of the world population. On 23/24th January 1984 the combined counts for the Priestside and Blackshaw Bank roosts was a minimum of 25,000 geese. Unfortunately no other counts were made around the Solway at this time but it is known from reports from local wildfowlers that birds were present in numbers in all areas and it is likely that the grand total was well in excess of 30,000 birds.

During the 1950s and 1960s the number of Pink-feet increased, reaching a peak in the 1960s, when up to 10,000 or more were present on the Scottish shore for most of the period from October to March. Since that time there has been a change in the patern of occurrence, with fewer birds (usually 2-5,000) present between October and December, but with larger numbers regularly arriving in the late winter, especially if a spell of severe weather affects east and central Scotland. This decrease in numbers on the Solway has occurred at a time when the overall population of Pink-feet wintering in Britain has been increasing. The changes in status have been related to changing agricultural practices (Owen 1979) and in particular to the higher acreage of barley now grown in east and central Scotland, which provide good stubble feeding for the Pink-feet in the early part of the winter. However, a further factor may be the intense commercialised shooting pressure on the Solway foreshore roosts; as they flight inland over the merses and on their feeding grounds inland. Many local wildfowlers believe that this pressure is a factor in the bird's local decline in recent years.

Since 1957 a shooting permit scheme has been in operation on Caerlaverock National Nature Reserve. The bag returns for Pink-feet since that year indicate that a decrease set in about the winter of 1974-75. The number of birds shot each year on the shooting zone are:-

57-8	112	70-1	101
58-9	186	71-2	121
59-60	148	72-3	169
60-1	51 *	73-4	134
61-2	97	74-5	58
62-3	160	75-6	95
63-4	75	76-7	108
64-5	103	77-8	51
65-6	104	78-9	139
66-7	37	79-80	59
67-8	0 *	80-1	27
68-9	111	81-2	76
69-70	124	82-3	36

*Foot and mouth epidemics curtailed shooting

The average bag for the 15 seasons from 1957-58 to 1973-74 (exluding the foot and mouth epidemic years) was 119 birds, while for the 9 seasons from 1974-5 to 1982-3 it was 72 birds. Shooting pressure appears to have been reasonably constant.

In spite ~~of~~ this decline in the early part of the winter the Inner Solway is still a very important estuary for Pink-feet and it provides a safe roost for a significant proportion of the world population. It may still provide the best estuarine roost in Britain for this species (Dr. M. Ogilvie pers. comm.), as in most other areas the geese roost on freshwater.

6.15.1 Scottish Shore Roosts (Figure 6.15.1)

Priestside The most important roosts on the Inner Solway are on the huge sand-banks of Blackshaw and Priestside. The favoured site is centred on the Rough Scar area of Priestside and the eastern end of Blackshaw. From this roost the geese flight over Brow Well to feed on Longbridgemuir or over the Priestside merses to feed on the Kinmount Estate, where they are given some protection from shooting. Monthly maxima of

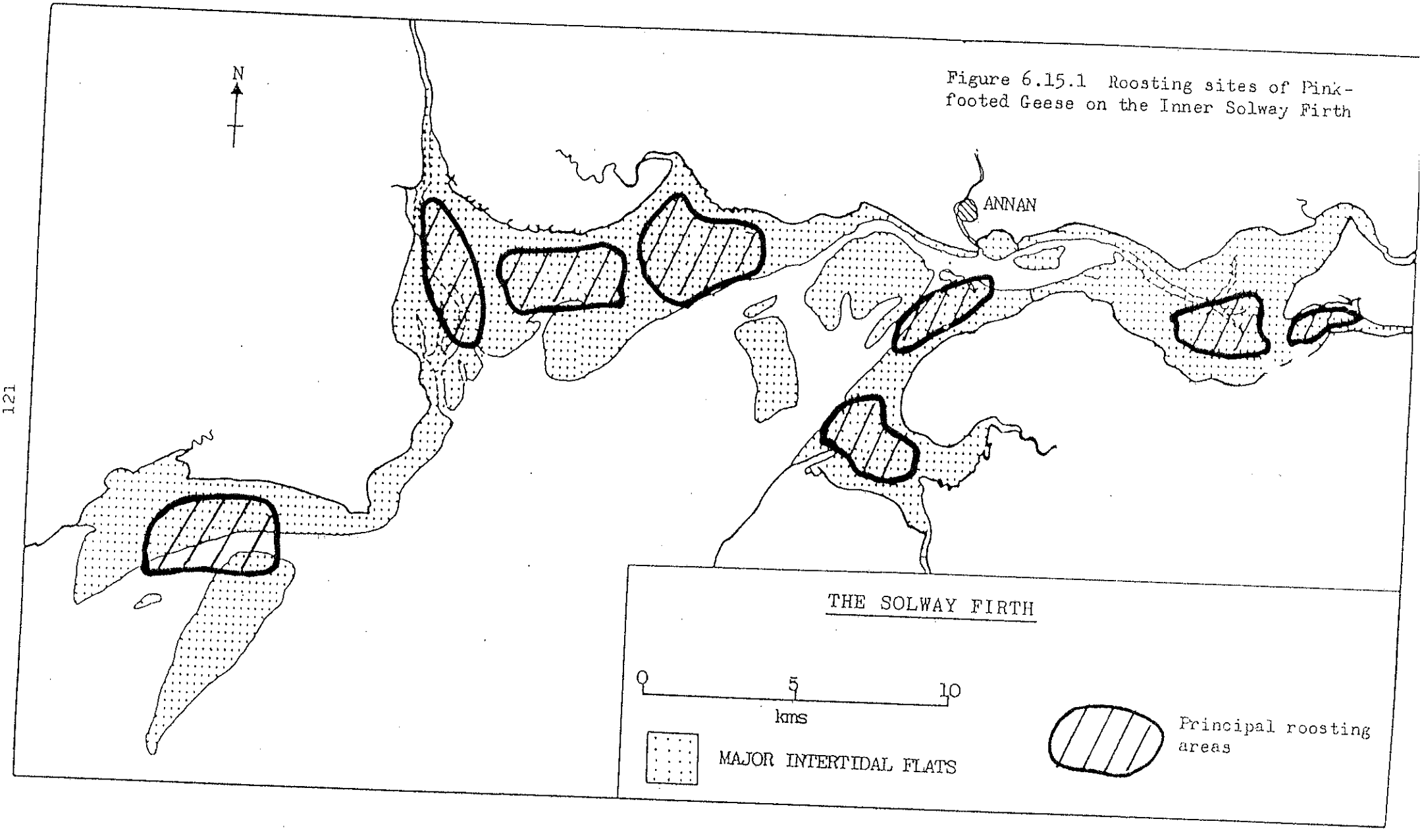


Figure 6.15.1 Roosting sites of Pink-footed Geese on the Inner Solway Firth

geese counted on this roost during the 1982-83 and 1983-84 winters were as follows:-

	1982-83	1983-84
October	2,600	2,500
November	3,000	4,000
December	6,000	1,500
January	2,600	20,150
February	6,000	3,700
March	2,530	9,800

As the figures indicate, the numbers of geese on this roost vary widely through the winter. The Solway is a natural staging post for Pink-feet moving between east and central Scotland and Lancashire and some birds appear to stay for only a few days before moving south in winter or north in the spring. A further factor is the heavy shooting pressure to which this roost is subjected by irresponsible wildfowlers. Although the Solway Wildfowlers' Association forbid their members to "sand-crawl" and the national organisation, BASC, condemns the practice, this roost is still heavily disturbed by marsh cowboys.

The high count of 20,150 in January 1984 was due to a heavy snowfall over much of Scotland, which forced birds to move south.

Blackshaw Another regular roost occupies the central part of Blackshaw Bank, the birds flighting inland to feed on the Caerlaverock Estate or the Lochar Moss. This roost is occupied irregularly by up to a few hundred birds between October and December but during January to March it is regularly used by up to 2000-3000 birds. Monthly maxima counted during the past two winters have been:-

	1982-83	1983-84
October	120	0
November	0	320
December	400	1,000
January	2,500	5,000
February	3,000	3,000
March	310	1,200

This roost is within the boundaries of the Caerlaverock NNR and receives full protection.

River Nith In late winter a roost regularly develops in or near the channel of the River Nith, on the western boundary of Caerlaverock NNR. The roost site may be in the mouth of the Nith, between Lantonside and Ingleston, or as far down as Carse Bay. The birds usually flight up the Nith to feed on Kirkconnell merse, but also flight off to the Caerlaverock or Kirkcudbrightshire shores. Although this roost is not regularly used until February, the numbers using it are often quite high and the peak in the 1982-83 winter was 6,000 birds on 14th February 1983 and in the 1983-84 winter 7,000 birds on 1st March.

Mersehead Another late-winter roost is formed on Mersehead Sands, with the geese flighting a short distance inland to feed on farmland between Southerness and Mersehead. This roost is used from January to April and typically holds up to 1,000, but occasionally as many as 2,000 or more geese. This roost is subjected to considerable shooting pressure.

There is interchange of geese between the above four roosts and to some extent the boundaries drawn between them are artificial.

6.15.2 Cumbria Shore Roosts (Figure 6.15.1) There have been no comprehensive roost-counts in recent years, and the text is therefore based on counts from 1969-76.

Rockcliffe Rockcliffe Marsh and nearby farmland is used extensively by Pink-feet, particularly in the late winter/early spring period. One of the main roost areas for the geese is on sand-banks to the south of the salt-marsh, near to the channel of the River Eden. They also roost out on sand-banks to the south-west and west of the marsh (M. Carrier and M. Nugent, pers. comm.).

Rockcliffe Marsh is privately owned and there are problems of access. It is also a most difficult area to cover and can be dangerous. Because of these problems there are no regular recent counts but a series of monthly counts are available for the winters from 1969-70 to 1975-76 and these give an indication of the importance of the area.

	69-70	70-71	71-72	72-73	73-74	74-75	75-76
October	47	0	219	420	250	420	520
November	32	500	20	3,500	48	280	2,000
December	1,000	820	464	750	620	240	1,200
January	2,200	5,057	93	1,600	614	143	2,750
February	2,000	2,070	4,000	2,300	320	2,350	4,460
March	2,500	3,000	1,220	3,634	1,300	7,250	2,900

Bowness/Cardurnock Smaller numbers of Pink-feet roost on the foreshore north of the Bowness to Cardurnock marshes. Again the pattern is largely of use in the late winter period (January to April) with typically up to a few hundred birds present, exceptionally 1,000 or more.

Morecambe Bay Morecambe Bay provides the second most important roost site on the south side of the Solway, after

Rockcliffe. The roost site is in the bay itself and the geese flight to feed on the salt-marshes surrounding the bay, as well as inland.

A series of monthly counts taken for the winters between 1969-70 and 1975-76 contain most of the available data. This area is hardly used at all up to the end of December; the highest recorded count for the October-December period is only 107 on 9th November 1969. The counts for the seven winters for January to March are as follows:-

	69-70	70-71	71-72	72-73	73-74	74-75	75-76
January	48	16	82	80	250	72	0
Februray	1,210	132	182	110	962	17	8
March	3,450	3,250	9,680	2,630	1,050	10,080	1,840

This is an important late winter roost site for Pink-feet, with a very obvious peak in March.

There is certainly some interchange of birds between these three roost areas on the Cumbrian shore and also to an unknown extent with the geese on the Scottish side.

6.16 BARNACLE GOOSE *Branta leucopsis*

Qualifying Levels: National 80
(winter pops.) NW Europe 100
Current winter pop. on Inner Solway = 8400 birds.

The entire population of Barnacle Geese which breeds on Spitsbergen in the Svalbard group of islands winters on the Solway Firth. This population has wintered on the Solway since records began and at the beginning of this century they were described as very abundant. In the early 1930s an estimate of about 5,000 was made but by 1948-49 only 3-400

remained. The reasons for the decline are not fully understood, but three factors are likely to have contributed to it; viz. a series of poor breeding seasons due to bad weather on the Arctic breeding grounds; the use of large areas of the foreshore as practice bombing ranges during the war years; and the increasing popularity of wildfowling.

The decline led to the setting up of the Caerlaverock National Nature Reserve in 1957 and to the Barnacle Goose receiving full legal protection in Britain and Spitsbergen. Subsequently a Wildfowl Trust Refuge was also established at Caerlaverock in 1970. Following these measures the population recovered to reach 9,000 by October 1980. In the winter of 1983-84 the population numbered 8,400 birds and it appears to be fairly stable at the present time. This figure is about 30% of the Barnacle Geese wintering in Britain and represents approximately 11% of the current world population of about 75,000 birds. The Solway birds are the only Barnacle Geese regularly found on mainland Britain.

The Barnacle Geese are very precise in their annual movements. The first birds invariably re-appear at Caerlaverock during the last week of September, with the mainflock arriving during the first week of October. The entire flock is then present on the Solway until the last week of April or first week of May, when the birds leave for Norway, en route to Spitsbergen.

The Barnacles use three separate areas of the Inner Firth (Figure 6.16.1).

Caerlaverock is the principal station for the geese from October to February. The whole population assembles there in early October and the National Nature Reserve, the Wildfowl Trust Refuge and adjacent farmland are intensively used

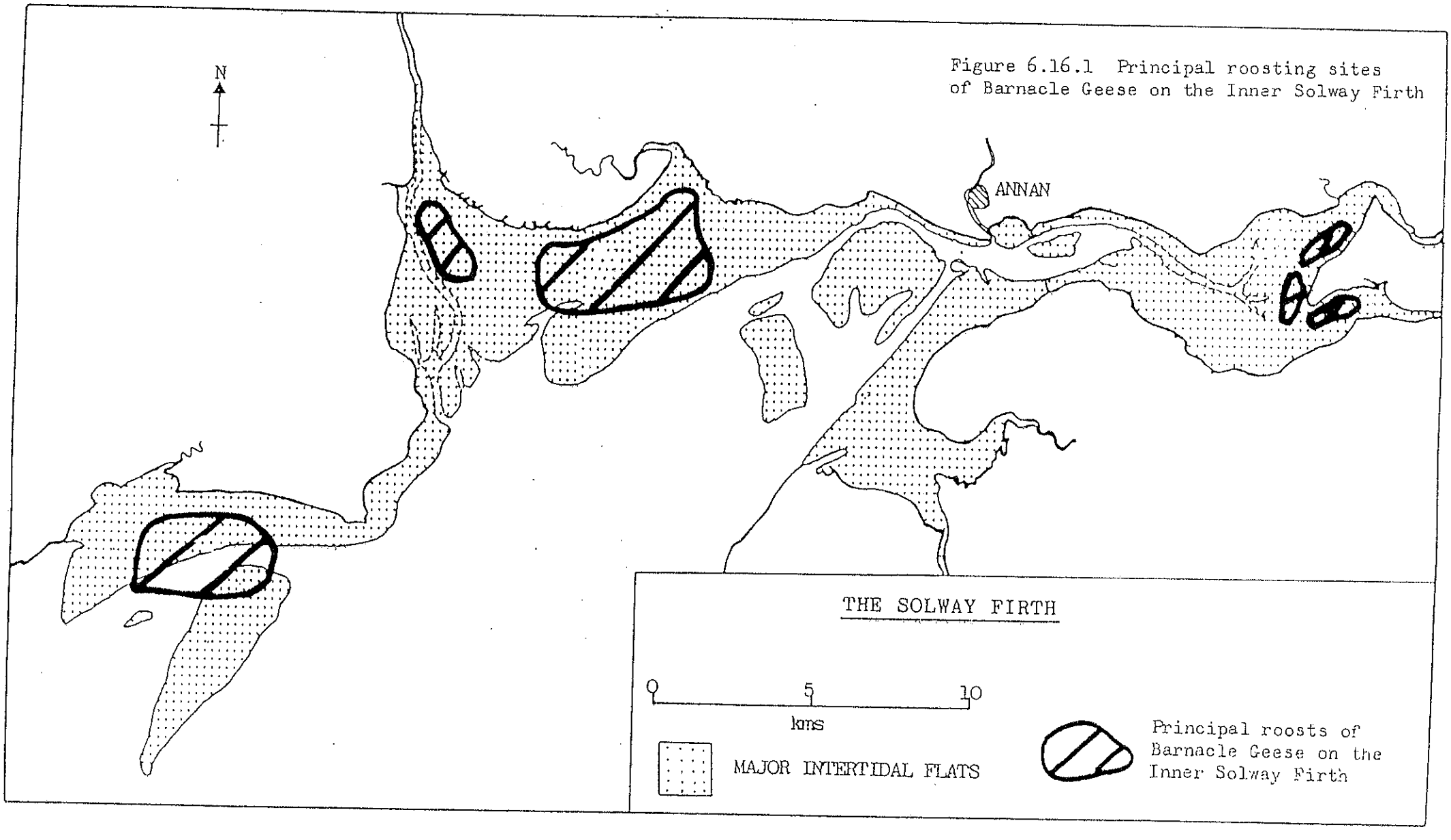


Figure 6.16.1 Principal roosting sites of Barnacle Geese on the Inner Solway Firth

for the next few weeks for feeding by day. After mid-November some birds move away to use the Rockcliffe and Southerness areas, but the majority of the flock is usually present at Caerlaverock until late February.

The main roost area at Caerlaverock is directly out on the foreshore south of the sanctuary merse of the NNR and the Wildfowl Trust Refuge. Late in the day the geese habitually gather on or close to the Refuge or sanctuary merse and at dusk they fly about one kilometre offshore to roost on Blackshaw Bank. A high tide or strong winds during the night may move the birds closer to the Priestside shore. There is a minor roost area, used occasionally by up to a few hundred birds, to the west of the main roost, near the River Nith channel.

Rockcliffe There is a fairly regular movement of Barnacle Geese between Caerlaverock and Rockcliffe during the period mid-November to late February. Up to 3,000 geese may be found at Rockcliffe during this period and occasionally (especially during the full moon) the whole flock may move there for a few days. Rockcliffe is regularly shot over during the season (both legally and illegally) and this disturbance often pushes the geese back to Caerlaverock.

Once the shooting season and its consequent disturbance ends on 20th February, 90% or more of the flock moves to Rockcliffe within a few days and spends March and April feeding on the salt-marsh there before returning north. However, during the past 3 springs, 2000-3000 geese have returned to Caerlaverock for part of April, and this pattern may be changing somewhat. The Barnacle Geese at Rockfcliffe roost close to the marsh, using sandbanks (in order of importance) to the north, west and south of the outer part of the salt-marsh, as plotted on the map. These sandbanks are

generally within ½ kilometre of the salt-marsh edge (M. Nugent, pers. comm.).

Southerness/Mersehead The area used by the geese is the six kilometres of coast between Southerness Point and the Southwick Water, with the birds roosting out on Mersehead Sands by night and feeding on farmland up to one kilometre inland by day. There is a regular interchange of birds between this area and Caerlaverock. From a few hundred up to 2,000 Barnacles are found here from November to March and, exceptionally, more may occur. During six weeks of severe weather in December 1981 and January 1982, 5-6,000 Barnacle Geese were in the Southerness/Mersehead area, where ground conditions were more open than in the rest of the Inner Solway. Disturbance from shooting along the shore regularly effects geese here too and Barnacles are often illegally shot in this area.

6.17 MALLARD Anas platyrhynchos

Qualifying Levels: National 4000
NW Europe *10000
Av. winter peak, Inner Solway = (2000 birds)
*maximum permissible; represents under 1%

Mallard are the second most numerous duck on the Inner Solway (after Wigeon) with 1-2000 using the Firth in an average winter, sometimes more. The population is not of national conservation significance.

6.17.1 Scottish shore (Figure 6.17.1) Mallard are recorded regularly at all the count sites between Mersehead and the mouth of the River Annan. The most important site is Caerlaverock with an autumn and winter flock of several hundred birds. The monthly maxima recorded here over the past five winters is as follows:-

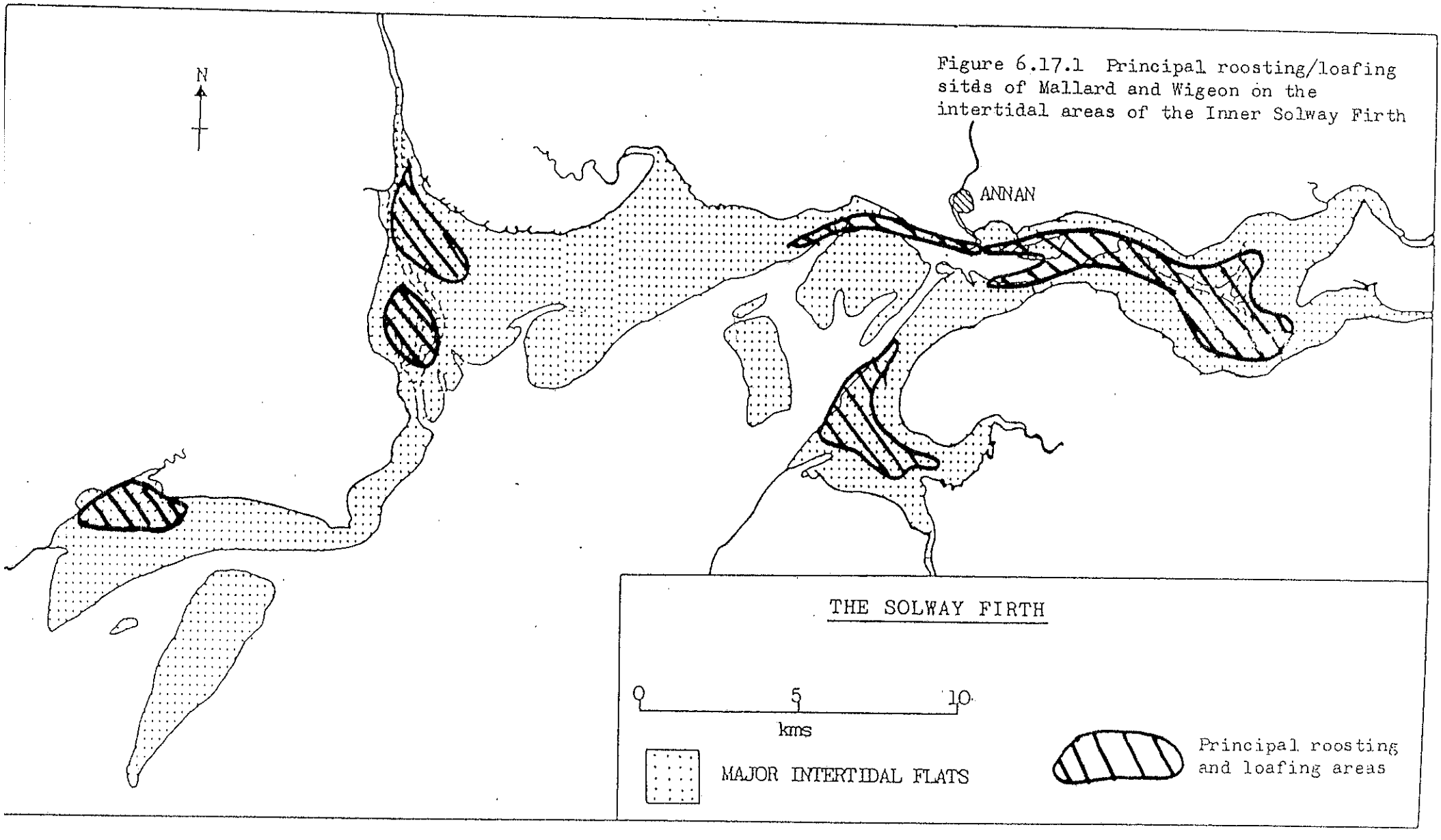


Figure 6.17.1 Principal roosting/loafing sitds of Mallard and Wigeon on the intertidal areas of the Inner Solway Firth

	79-80	80-81	81-82	82-83	83-84
September	146	171	204	300	443
October	420	139	198	295	552
November	125	201	282	223	352
December	135	158	244	252	315
January	118	208	348	238	237
February	104	165	132	243	155
March	89	39	97	73	109

This flock feeds largely on the merse or inland at night, but many birds use the foreshore as a safe roost or 'loafing' area by day. This applies to birds throughout the Solway. Counts for all other sections of the north shore rarely exceed 100 birds.

6.17.2 Cumbria shore (Figure 6.17.1) Mallard are also regular at all the sites from Rockcliffe to Moricambe Bay and overall the numbers exceed those for the north shore. An analysis of the counts for the whole of the south shore for the winters from 1971-72 to 1983-84 is as follows:-

	71-72	72-73	73-74	74-75	75-76	82-83	83-84
September	793	894	553	1,379	1,351	321	507
October	660	435	810	1,045	609	580	328
November	447	862	1,146	844	1,094	804	858
December	698	1,032	825	590	877	801	361
January	260	523	647	470	149	414	515
February	208	662	229	616	749	385	173
March	459	973	266	219	213	183	144

Within the individual sections Rockcliffe generally held 100-300 birds, with a peak count of 521 on 21st September 1975; the Burgh Marsh to Cardurnock stretch 300-600 birds

with a peak count of 779 on 11th November 1973 and Moricambe Bay 50-200 birds but with a peak count of 522 on 15th September 1974. (Note that the counts for 1982-3 and 1983-4 excluded Rockcliffe).

Some more recent counts indicate higher figures for Mallard, especially in the Cardurnock area. M. Carrier believes that this is due to better coverage, rather than an increase in numbers. 1,198 Mallard were counted at Cardurnock on 25th October 1980 and on 17th January 1981 the total count was:-

Skinburness	100
Newton Marsh	62
Cardurnock	1,743
Port Carlisle	109
	2,014

There are no recent counts for Rockcliffe because of access problems and the dangerous nature of the site.

6.18 TEAL Anas crecca

Qualifying Levels: National 1000
NW Europe 2000

Av. winter peak, Inner Solway (900)

Teal are probably the least marine of all the ducks which use the Inner Solway and the flocks are usually found on the salt-marshes rather than out on the foreshore. The estimated average winter peak of 900 birds is not nationally significant.

6.18.1 Scottish shore Nearly all the birds found are at Caerlaverock, where their favoured areas are near the secluded Lochar channel, the east merse, Powhillon and the

ponds at Eastpark. The foreshore is only occasionally used when the birds are disturbed. Monthly maxima at Caerlaverock over the past five winters are:-

	79-80	80-81	81-82	82-83	83-84
September	77	173	350	950	265
October	282	450	875	850	480
November	132	470	312	1,200	310
December	60	440	30	350	710
January	100	68	200	449	828
February	200	80	218	59	330
March	70	250	54	68	52

There has been a definite increase in Teal at Caerlaverock and the 1,200 in November 1982 is a record count for the area. Peak numbers usually occur in October or November and there is normally an exodus from the area with the onset of colder weather. During a severe spell of cold, such as occurred in December 1981 and January 1982, Teal desert the Inner Solway entirely.

Birds are occasionally noted in Carse Bay, where the maximum recent count is 34 on 20th January 1980 and at the mouth of the Annan, where the highest count is 59 on 14th November 1982.

6.18.2 Cumbrian shore Teal are not particularly numerous, although they do occur on all the salt-marshes. The monthly counts for the whole of the south shore for the winters from 1971-72 to 1975-76 and 1982-83 and 1983-84 are:-

	71-72	72-73	73-74	74-75	75-76	82-83*	83-84*
September	277	354	87	177	358	-	22
October	111	83	34	41	36	120	42
November	40	77	73	52	111	22	66
December	78	48	105	90	128	3	23
January	33	27	82	76	24	28	49
February	12	27	87	51	82	0	12
March	8	16	39	21	46	0	5

*excludes Rockcliffe Marsh

Rockcliffe is the most important site and often holds 200-300 birds in September with a peak count of 518 on 15th November 1970. Elsewhere counts are usually below 50 birds but there are counts of 100 on Calvo marsh on 27th September 1980; counts for Cardurnock of 120 on 27th September 1980 and 360 on 22nd February 1981; 200 at Dykesfield on 13th September 1981 and 120 on Burgh marsh on 15th November 1981.

6.19 WIGEON Anas penelope

Qualifying Levels: National 2000
NW Europe 5000

Av. winter peak, Inner Solway = 2000 birds

Wigeon are the most numerous duck on the Inner Solway and the counts indicate that in an average winter at least 2000 birds use the Firth and sometimes considerably in excess of this figure. The population thus represents just over 1% of the estimated national totals, but is not of international significance.

6.19.1 Scottish shore (Figure 6.17.1) The principal site for this species is Caerlaverock, where the birds inhabit the channels of the River Nith, the foreshore off the merse edge and the merse itself. The monthly maxima recorded for this area over the past five winters have been:-

	79-80	80-81	81-82	82-83	83-84
September	26	99	187	260	150
October	410	457	583	650	622
November	547	593	704	850	1,130
December	478	812	715	1,124	813
January	604	720	1,002	957	920
February	420	885	710	929	712
March	318	345	464	520	285

The pattern is one of a steady build-up to a mid-winter peak. A spell of hard weather which feezes over inland waters usually increases the number of birds on the shore.

Elsewhere on the Scottish shore Wigeon are only found in small numbers. They are scarce on Priestside and around Southerness, though 80 were seen in the latter area on 22nd January 1984. They are fairly often recorded near the mouth of the River Annan, with a peak count of 107 on 7th February 1982.

There is little information available for the Esk channel off Browhouses but Wigeon certainly use this part of the coast and M. Carrier has a count of 355 here on 17th September 1983. Information from Wildfowlers suggest that numbers here may be much higher during severe weather.

6.19.2 Cumbria shore (Figure 6.17.1) Wigeon occur in quite high numbers from Rockcliffe Marsh all the way to Moricambe Bay. There were a regular series of counts in the early 1970s and an analysis of counts from 1971-72 to 1983-84 for the whole of the south shore is as follows:-

	71-72	72-73	73-74	74-75	75-76	82-83	83-84
September	1,490	754	1,199	894	905	5	935
October	159	1,021	990	1,698	678	518	751
November	1,186	1,471	843	5,615	1,258	897	731
December	854	1,387	1,949	732	899	525	427
January	1,292	786	1,295	311	1,236	462	796
February	486	1,593	2,141	2,194	691	620	84
March	171	453	684	205	583	59	106

The pattern here is not quite so clear as on the north shore and numbers appear to peak at any time between November and February, or even in September. The very high count of 5,615 on 17th November 1974 was split as follows:-

Rockcliffe	220
Burgh Marsh	1,800
Bowness Viaduct	2,500
Cardurnock	300
Newton marsh	375
Grune/Skinburness	420
	5,615

Quite large numbers of duck, mainly Wigeon and Mallard, drift into the head of the Solway on the flooding tide and they are counted from Bowness Viaduct. The maximum count for Rockcliffe is of 1,112 birds on 16th September 1973 (an early date) and the maximum count for Moricambe Bay is 1,724 birds on 10th February 1974.

6.20 PINTAIL Anas acuta

Qualifying Levels: National 250
NW Europe 750
Av. winter peak, Inner Solway = (340 birds)

Pintail are among the most marine of British dabbling ducks and the flocks spend a good deal of their time well out on the foreshore. The Inner Solway is the best area in Scotland for this species and is currently about the sixth best site in Britain (Salmon 1983). Peak counts are in the Autumn, and appear to show a recent decline. Although a peak of 1500-2500 birds was recorded in 1979-80 and 80-81, the peaks in the last three winters have not exceeded 500-800 birds. Nevertheless, the area remains of national and possibly international importance for this species.

6.20.1 Scottish shore (Figure 6.20.1) On the Inner Solway the best site for Pintail is the estuary of the River Nith, between Carse Bay and the Caerlaverock foreshore. The monthly maxima recorded for this flock over the past five winters are:

	79-80	80-81	81-82	82-83	83-84
September	800	400	550	520	143
October	2,400	1,200	150	800	267
November	nc	400	180	350	283
December	nc	60	252	120	410
January	309	498	360	50	36
February	nc	175	133	30	219

In some years there is a fairly rapid build-up in late September/October and a high peak in late October. The attraction at this time is the local barley stubbles and if there has been an abundant spillage the numbers of birds may remain high for a few weeks. The birds are usually out on the vast foreshore by day and flight inland at dusk to feed on the stubbles, on both the New Abbey and Caerlaverock sides of the estuary. Most of these birds appear to pass on south, but 2-400 remain for the winter.

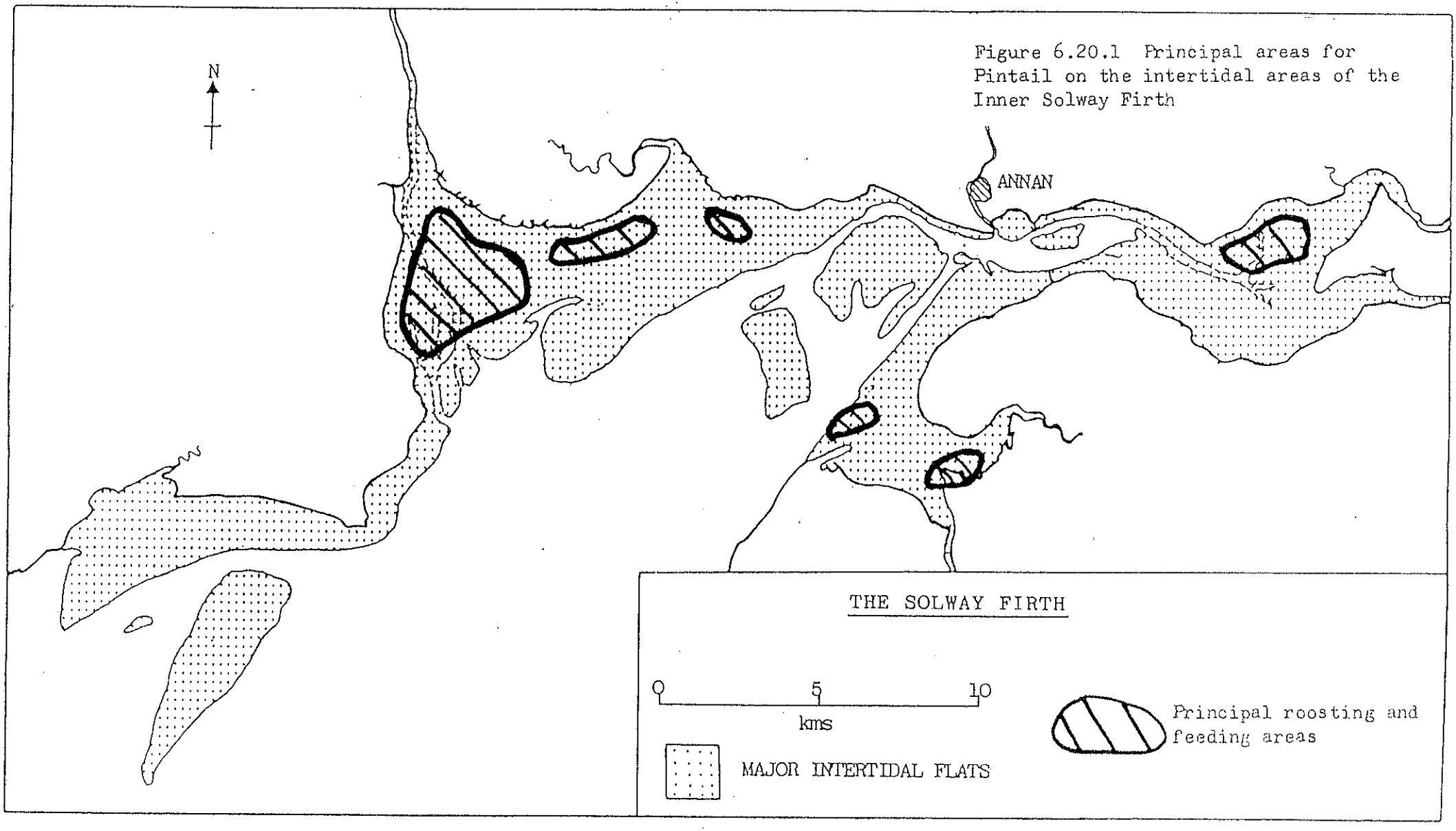


Figure 6.20.1 Principal areas for Pintail on the intertidal areas of the Inner Solway Firth

Pintail are occasionally seen on Priestside, with 175 on 22nd February, the highest number on record. In September and October a flock of 1-200 Pintail is frequent in the Esk channel between Torduff Point and Browhouses. 154 were noted here on 25th October 1983.

6.20.2 Cumbria shore (Figure 6.20.1) Pintail are recorded fairly regularly in small numbers at several sites, usually no more than 20 birds. Moricambe Bay is the best area with the following counts of 50 or more:

191 on 15th September 1974 50 on 7th December 1979
136 on 21st December 1980 78 on 15th November 1981

The three later counts are all from Newton Marsh. The only other count of over 50 is 76 birds on Rockcliffe on 16th September 1973.

6.21 SHOVELER Anas clypeata

Qualifying Levels: National 90
NW Europe 1000

Av. winter peak, Inner Solway = (50) birds

Shoveler are not a numerous duck on the Inner Solway, although small numbers regularly occur in most areas. Peak counts generally occur in October and November, although few counts are available at this time for the whole estuary. However, peaks of 58 and 82 were recorded in 1982-83 and 1983-84, with no counts on Rockcliffe (although in previous years few were recorded here). The area probably does not attain national importance for this species in winter, although numbers in Autumn are higher.

On the Scottish shore, Caerlaverock is the most regular site and usually holds up to 20 between September and November,

with a few later in the winter. The maximum count here is 65 on 19th September 1981. Records from Priestside are scarce but they are more frequent again between Powfoot and the mouth of the River Annan, with a highest recent count on this stretch of 45 on 10th October 1983. There is an older record of 342 Shoveler counted on 19th September 1971 between Powfoot and the Annan.

A similar picture is obtained from the Cumbrian shore, although peak counts rarely exceed 20 birds. An exceptional count of 120 was made on 17th October 1971 for the Bowness section.

6.22 GOLDENEYE Bucephala clangula

Qualifying Levels: National 150
NW Europe 2000

Av. winter peak, Inner Solway = (150 birds)

Goldeneye occur in small numbers all around the Inner Solway, in winter. The principal feeding areas identified from the low-water counts were in the main river-channel between Dornock and Bowness-on-Solway, the channels of the Esk, Eden, Nith and Annan, and below the Scars at Newbie and the mouth of Moricambe Bay, (Figure 6.22.1).

The results of the high-water counts indicate a wintering population for the Inner Solway of between 50-200 birds. The counts for 1982-83 and 1983-84 were as follows:

	1982 - 83			1983 - 84		
	North	South	TOTAL	North	South	TOTAL
September	nc	0	-	0	0	0
October	nc	17	-	9	9	18
November	20	0	20	61	30	91
December	88	74	162	13	11	24
January	45	37	82	11	33	44
February	52	13	65	3	6	9
March	11	93	104	20	6	26

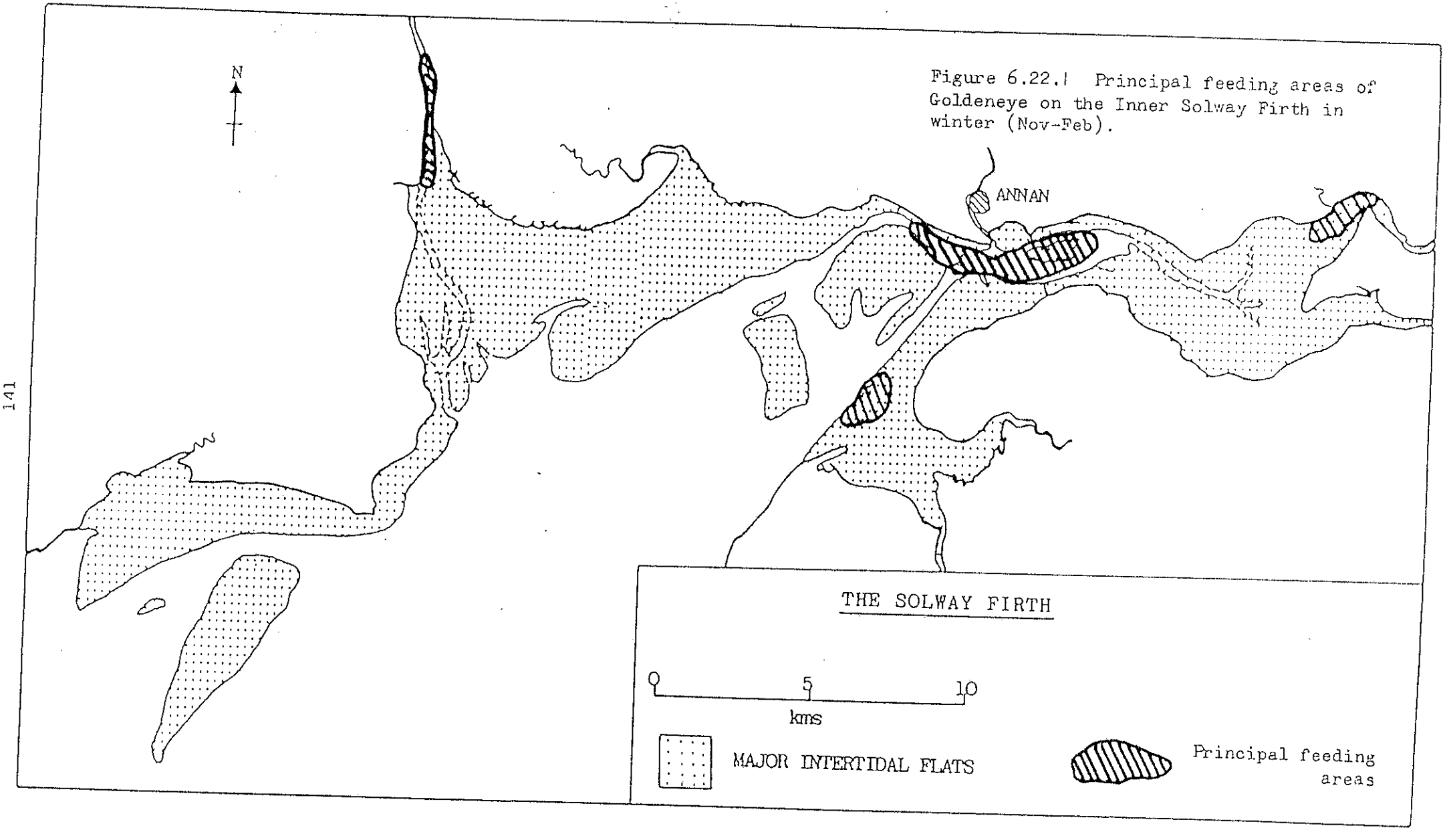


Figure 6.22.1 Principal feeding areas of Goldeneye on the Inner Solway Firth in winter (Nov-Feb).

6.23 RED-BREASTED MERGANSER *Mergus serrator*

Qualifying Levels: National 100
NW Europe 400

Av. winter peak, Inner Solway = (50) birds.

Red-breasted Mergansers are recorded regularly on the Inner Solway, although never in large concentrations. Highest numbers were usually found either passing Grune Point, Bowness Viaduct or roosting in Carse Bay. The wintering population never reaches national importance. The monthly count totals for the whole of the Inner Solway in 1982-83 and 1983-84 were as follows:

	1982-83	1983-84
September	nc	16
October	nc	58
November	10	57
December	41	16
January	19	30
February	8	19
March	7	17

6.24 SHELDUCK Tadorna tadorna

Qualifying Levels: National 750
NW Europe 1250

Av. winter peak, Inner Solway (rounded) = 1400 birds

The Inner Solway is of national and international importance for wintering Shelduck, the average winter peak of 1373 (1980-84) representing 1.8% of the estimated British wintering population, and 1.1% of the NW European population. The average figure is perhaps slightly exaggerated by the count of 2451 in February 1982 which clearly represented a cold weather influx, which was also noted elsewhere (Salmon 1982). In normal years, peak populations occur in the autumn, although counts at this time have been made for the south shore only.

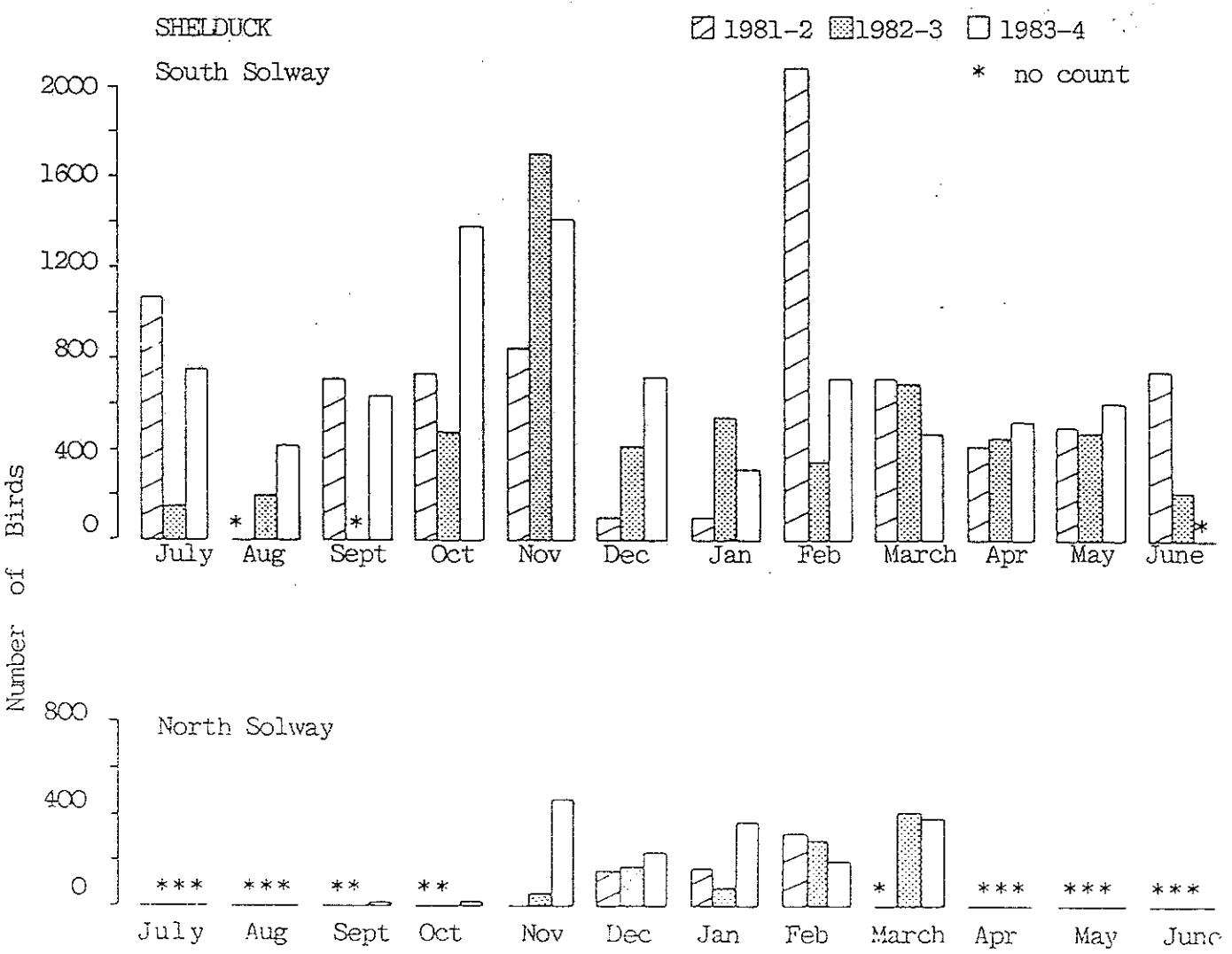
6.24.1 Seasonal Patterns of Abundance (Figure 6.24.1)

Population levels of Shelduck on the Inner Solway remain relatively stable throughout the year, with a peak in October/November. The origins and destinations of the birds in this peak are unclear. The peak for February 1982 was the result of a cold weather movement. In July and August, between 200-1000 Shelduck are found on the south shore, representing a high proportion of those in the county at this time (most birds have gone to the German Waddensea to moult) (Prater, 1981). Although small moulting flocks have been found elsewhere in Britain (Eltringham and Boyd 1963, Bryant and Waugh 1976), it is not known whether those present on the Solway at this time are also moulting.

6.24.2 Local Distribution (Figure 6.24.2)

Shelduck are found principally in the muddier areas of the Inner Solway, either near freshwater outflows, or in sheltered bays.

FIGURE 6.24.1. Seasonal patterns of abundance of Shelduck on the Inner Solway. Data are from BoEE counts 1981-2/1983-4.



On the north shore, 30-200 birds can usually be found on the upper shores of Mersehead Sands, particularly around the mouth of Southwick Water and to the east of Southerness. Carse Bay and the mouth of the River Nith hold up to 100 birds and smaller numbers are usually found on the shore from Powfoot to Priestside. The muddy bay between Browhouses and Gretna supports the largest and most predictable concentrations. Low water counts of this flock were as follows:

Nov 1982	1	Nov 1983	82
Dec 1982	116	Dec 1983	109
Jan 1983	132	Jan 1984	75
Feb 1983	78	Feb 1984	96

Although this area was not counted at high water, general observations suggested that the flock usually moved to the south shore at high water, to roost.

On the English shore, Shelduck use two main areas for feeding. The first, and the most important on the Inner Solway, is off Burgh Marsh where many Shelduck feed at low water under the merse edge, and are joined at high water by birds from other areas including the north shore. High water counts for this section have been as follows:

	1980-81	1981-82	1982-83	1983-84
August	-	110	175	428
September	165	460	0	651
October	295	655	406	954
November	1	320	1600	1100
December	26	66	372	700
January	375	56	480	280
February	304	1914	252	660
March	58	527	572	292

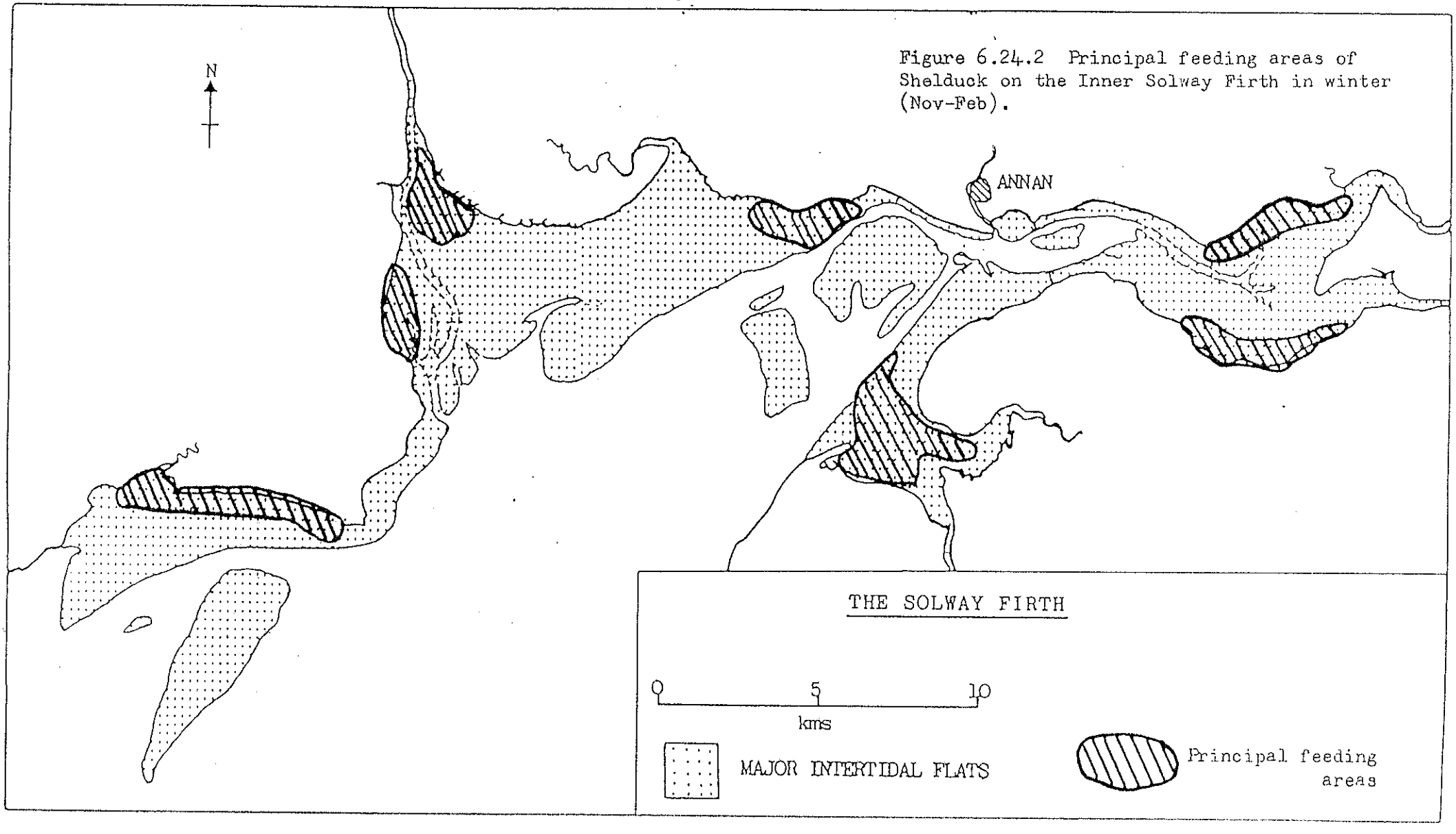


Figure 6.24.2 Principal feeding areas of Shelduck on the Inner Solway Firth in winter (Nov-Feb).

The other main feeding area is in Moricambe bay, particularly around the mouth, and at the SW end of Cardurnock. Counts for the whole area (Cardurnock - Grune inclusive) have been as follows:

	1980-81	1981-82	1982-83	1983-84
August	24	42	16	-
September	60	254	0	1
October	140	85	71	408
November	65	530	113	286
December	130	37	39	32
January	118	57	46	43
February	282	201	98	63
March	234	193	115	176

The birds roost in several areas, Border, Newton, Calvo, Skinburness and Cardurnock Marshes all holding good numbers.

6.25 SCAUP Aythya marila

Qualifying Levels: National 50
NW Europe 1500

Av. winter peak, Inner Solway (rounded) = 520 birds

The average midwinter peak count of Scaup on the Inner Solway for the four winters 1980-81 to 1983-84 is 518 birds. This is a nationally significant population, representing some 10.4% of the estimated national total. The British population showed a dramatic decline in the mid 1970s as a result of the closure of raw sewage outflows on the Firth of Forth where up to 90% of the population wintered at this time (Campbell 1978, 1979, Salmon 1982). As a result, the relative importance of other sites has increased, and the high counts of January 1982 made the Inner Solway the second most important site for Scaup in Britain in that winter (Salmon 1983).

Scaup arrive on the Solway in September and October, and do not leave until early May. Three areas are used for feeding (Figure 6.25.1).

1. Carse Bay A regular flock occurs here, feeding at the base of the Carsethorn mussel scars. At high water, the flock moves into Carse Bay.

2. Powfoot - Newbie The flock feeds on the scars between Newbie and Powfoot, and usually spends the HW period either here, or moves up on the rising tide to Burgh Marsh.

3. Cardurnock and Moricambe Flocks of Scaup feed on the scars at the mouth of Moricambe Bay and the Cardurnock scars. Many of these birds move into Moricambe at high water, and can often be found behind Grune Point. Some birds from the eastern end of Cardurnock may move to the Burgh Marsh area at high-water.

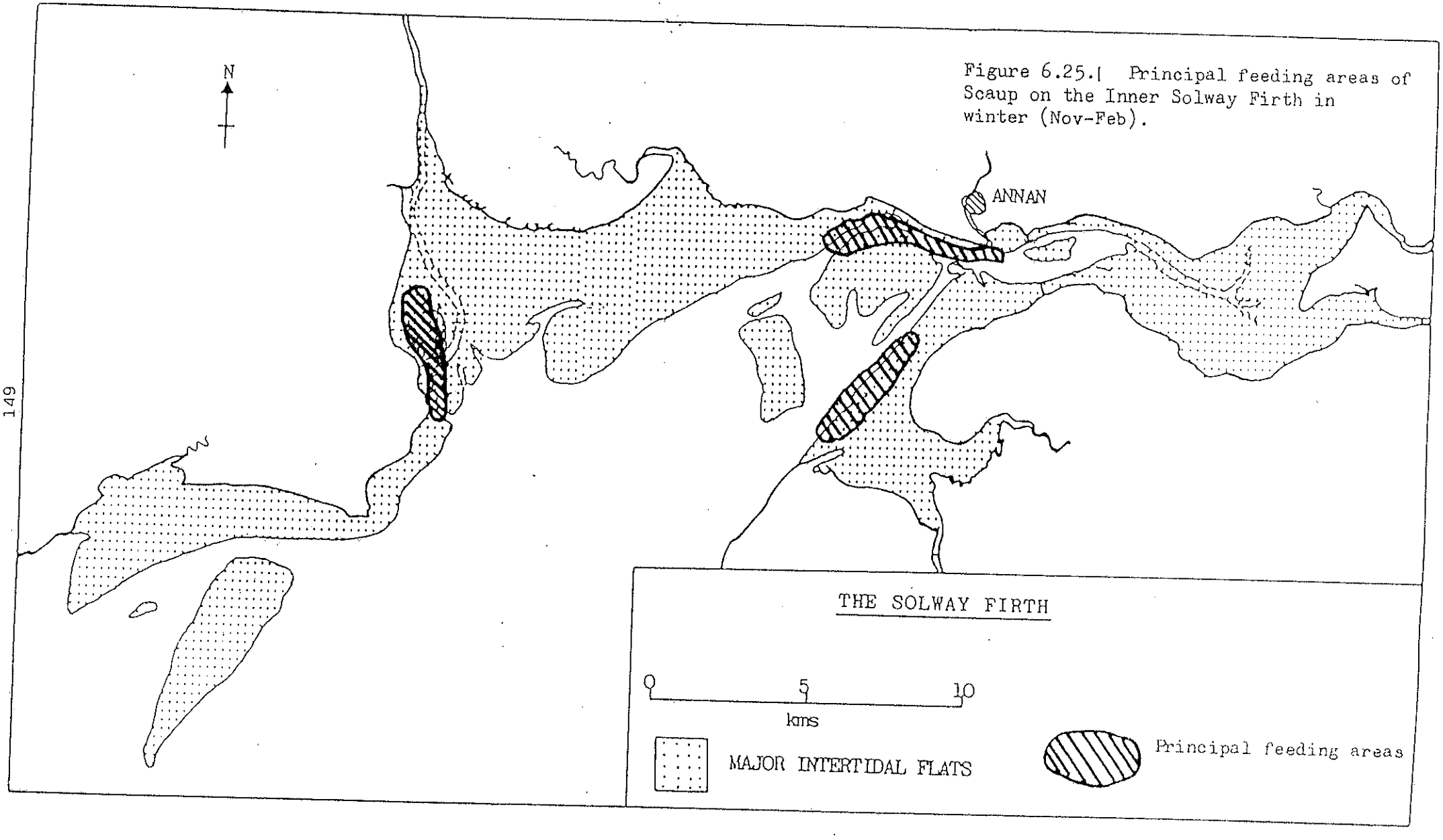


Figure 6.25.1 Principal feeding areas of Scaup on the Inner Solway Firth in winter (Nov-Feb).

Peak counts for these three areas are as follows:-

	80-81	81-82	82-83	83-84
Carse Bay	0	0	220	120
Powfoot/Newbie	110	360	876	605
Moricambe	-	74	974	121

6.26 GULLS

The Solway is an important estuary for roosting gulls in winter, although rather few use it as a feeding site. Most movements are therefore to inland feeding areas. Little detailed work has been undertaken, but the results of a full census on Feburary 22/23rd 1983, which covered all major roosts was as follows:

Black-headed Gull	42500
Common Gull	17225
Herring Gull	4200
Gt. Black-backed Gull	342
Lesser Black-backed Gull	30

The main roosting areas were on the sandbanks off Burgh Marsh and Rockcliffe Point, and at the mouth of the Nith. This figure is considered to be well below the usual winter peak.

6.27 CORMORANT Phalacrocorax carbo

Cormorants are present on the Inner Solway throughout the year. A breeding colony was discovered in May 1983, in Moricambe Bay and the same colony was found to hold 43 pairs in 1984. The colony is located high above the sands on a wartime bombing target in the middle of the Bay.

In winter most birds are counted on the South shore, where they roost over high-water both at the breeding site, and on Rockcliffe Marsh. At low water, many birds can also be found roosting on the sandbanks near their principal feeding areas, which are the river channels of the Esk, Eden, Annan, Nith, and in Moricambe Bay. The counts indicate a wintering population of between 100 - 200 birds. The results for the last two winters are as follows:

	1982 - 1983			1983 - 1984		
	North	South	TOTAL	North	South	TOTAL
September	nc	121	-	59	314	373
October	nc	68	-	43	78	121
November	22	96	118	23	138	161
December	14	30	44	14	100	114
January	31	61	92	31	128	159
February	8	35	43	26	73	99
March	13	29	42	16	186	202

7. RESULTS: AN OVERVIEW OF THE NATIONAL AND INTERNATIONAL SIGNIFICANCE OF THE SOLWAY FOR ESTUARY BIRDS

Although this report has concentrated on the distribution and abundance of estuary birds on the Inner Solway, it is important to place the whole Firth into the context of other wintering areas in Western Europe.

The Solway Firth comprises a number of smaller bays, plus the main intertidal flats of the Inner Solway (Figure 3.1). The relative importance of these other areas is shown in Table 7.1. None of the smaller bays holds nationally important numbers of any species, although all are of local interest. The Inner Solway is clearly the most important area, and holds higher numbers of every species except for Turnstone which are more numerous on the Outer south shore. This latter area holds 3 species of national importance (Oystercatcher, Turnstone, Curlew), one of which (Oystercatcher) also attains international importance.

The Inner Solway ranks sixth in Britain in terms of the total number of waders present (Table 7.2), and approximately tenth when compared with other principal areas on the Atlantic coasts of Europe and NW Africa (Prater 1976). For individual species, 10 waders and 8 wildfowl occur in numbers exceeding 1% of the national total, while 5 species of wildfowl (Whooper Swan, Pink-footed Goose, Barnacle Goose, Shelduck, Pintail) and 3 species of wader (Oystercatcher Knot, Curlew) occur in numbers exceeding 1% of their NW European wintering totals (Table 7.3). The entire Svalbard breeding population of the Barnacle Goose winters on the estuary.

	L. Ryan	Luce Bay	Wigtown Sands	Fleet Bay	Kirk. Bay	Auchenc. Bay	Rough Firth	Inner Solway	Outer Solway (S)	TOT
Yrs.of counts available since 1979	(4)	(5)*	(5)*	(2)	(1)	(1)	(5)	(4)	(1)	
Oystercatcher	650	380	1500	84	73	480	1100	24900	7700	368
Lapwing	800	1400	790	4	550	100	57		1200	
Ringed Plover	58	26	0	2	7	4	3	190	97	3
Grey Plover	0	2	2	0	0	0	0	430	23	4
Golden Plover	640	1400	740	0	220	0	0	(2000+)	500	53
Turnstone	95	76	0	0	0	0	0	160	390	7
Curlew	330	220	650	130	46	110	110	3600	1400	659
Bar-tailed Godwit	3	6	11	0	0	2	0	4300	220	454
Redshank	64	87	380	48	58	51	220	1600	310	281
Knot	49	5	0	0	0	25	7	6300	170	655
Dunlin	200	640	1700	170	350	10	43	10100	440	1365

Table 7.1 Average peak midwinter (Dec-Feb) counts for waders on the Solway Firth 1979-80 - 1983-84. Sites are shown in Figure 3.1. Counts between 100 and 1000 were rounded up to nearest ten, and counts between 1000 and 100,000 were rounded up to nearest hundred. Single underlining denotes counts of national importance, and double underlining denotes counts of international importance.

* Counts pre-1979. More recent counts not available.

	1980-81	1981-82	1982-83	Average (rounded up)
Wash	168600	119800	180000	156200
Morecambe Bay	174800	-	105000	139900
Dee	101200	99900	91100	97400
Ribble	61700	66000	70800	66200
Humber	-	83600	47800	65700
Solway	54600	66200	52800	57900
Severn	43400	62100	41700	49100
Foulness	40000	69700	34500	48100
Lindisfarne	52600	24800	38200	38600
Chichester Harbour	35200	36200	42800	38100

Table 7.2 Peak winter numbers of waders at the top ten British estuaries. Peak counts are obtained by summing the highest count for each species, regardless of the month (Dec. Jan. or Feb.). Annual and average peaks have been rounded up to the nearest 100 birds.

	Average peak count	% British	% NW Europe
Whooper Swan	(150)	3.0	1.5
Pink-footed Goose	(20000)	22.2	22.2
Barnacle Goose	8400	100.0	100.0
Shelduck	1380	1.8	1.1
Wigeon	(2000 +)	1.0	ns
Pintail	(800)	3.2	1.1
Scaup	520	10.4	ns
Goldeneye	(150)	1.0	ns
Oystercatcher	24900	8.3	3.3
Ringed Plover	190	1.6	ns
Golden Plover	(2000 +)	1.0 +	ns
Grey Plover	430	4.3	ns
Lapwing	(5000 +)	1.0 +	ns
Knot	6280	2.5	1.8
Dunlin	10010	1.8	ns
Bar-tailed Godwit	4210	9.3	ns
Curlew	3560	3.6	1.2
Redshank	1510	1.5	ns

Table 7.3 The relative importance of wader and wildfowl species occurring in nationally or internationally important numbers on the Inner Solway (see Appendix 1 for criteria for inclusion). Peak counts in brackets are estimates since complete counts are not available. Data from BoEE counts. All peak counts have been rounded up to the nearest ten birds.

8. DISCUSSION

8.1 Long-term Population Changes

One aim of the Birds of Estuaries Enquiry counting programme is to provide a mechanism for monitoring population changes in estuary bird populations, and a national index of abundance is calculated each year. A national index may mask long-term patterns on individual estuaries, particularly if different factors determine the population size on each estuary.

I have thus examined the patterns of long-term population changes for waders on the Solway by comparing the peak midwinter counts for those years in which counts were available (see Appendix A2). The results are summarised in the table below.

Species	Change since 1971-72	Statistical Significance (t test)	Average Rate of Change per year
Oystercatcher	none	ns	-
Ringed Plover	none	ns	-
Grey Plover	increase	$0.02 < P < 0.05$	+ 24
Turnstone	decrease	$P << 0.001$	- 18
Curlew	none	ns	-
Bar-tailed Godwit	none	ns	-
Redshank	decrease	$0.01 < P < 0.02$	-185
Knot	decrease	$0.001 < P < 0.01$	-1370
Dunlin	none	ns	-

Summary of long-term population changes in wintering waders on the Solway. Lapwing and Golden Plover were excluded from the analysis because of their extensive use of fields for feeding. Coverage of these habitats has not always been comparable.

Thus, populations of five species have remained stable; the Grey Plover has increased, and three species have decreased (Turnstone, Redshank and Knot).

Grey Plover The increase observed on the Solway has also been noted on other British estuaries, and suggests a steady westward expansion of the regular wintering distribution of this species.

Knot The British wintering population has shown a major decline since a peak in the early 1970s (Prater 1981). The pattern observed on the Solway is thus likely to be a result of the same factor that has caused declines on other estuaries.

Turnstone The national index of wintering Turnstones has remained approximately stable over the last 10 years. In contrast, the wintering population on the Solway has halved in this period. This suggests that some factor specific to the Solway may have been responsible for this decline. Turnstones are restricted to feeding on the few low stony-scars of the Inner Solway. There is strong evidence from local ornithologists and wildfowlers that there have been major sediment changes on the Solway in recent years, particularly an increase in the amount of sand. This is supported by Perkins (1973), who states that "...since 1964, the shores of the Solway have received vast amounts of fine sand." It appears that this may have buried many potential feeding areas for Turnstones, particularly in the area of Powfoot, where much deposition has occurred.

Redshank The wintering population of Redshank on the Inner Solway has approximately halved since 1971. The national index also shows a decline, but it is quite likely that sanding up of the Redshank's preferred muddy feeding areas on the Solway has been a major factor. In support of this,

the patterns for Dunlin and Curlew (Appendix A2), two other species preferring muddy substrates, also show evidence of downward trends, although these are not significant on the 8 years of counts available.

Thus, long-term changes in the populations of some wintering waders have occurred on the Inner Solway since the early 1970s. Some of these mirror national trends, whilst others may be a result of sediment changes.

8.2 Conservation and threats

Conservation status (Figure 8.1)

The entire area of the Inner Solway, contained by a line joining Southerness Point to Grune Point, is recognised as a Grade I NCR and has been recommended as a Ramsar Site.

On the English shore there are two designated SSSIs, the first encompassing Moricambe Bay and the second covering the area inland from a line joining Drumburgh to Gretna and including Rockcliffe Marsh. The Cumbria Trust for Nature Conservation has a form of reserve agreement over Rockcliffe Marsh.

The entire Scottish shore from Gretna to the western end of Mersehead Sands has SSSI status, with the exception of a 3 km section between Newbie and the mouth of the River Annan. This is a prime roosting site for spring passage migrants. In addition to SSSI status, the entire area of Blackshaw Bank is included in the Caerlaverock NNR, whilst the Scottish Wildlife Trust has small reserves at Drum Burn and Lot's Wife.

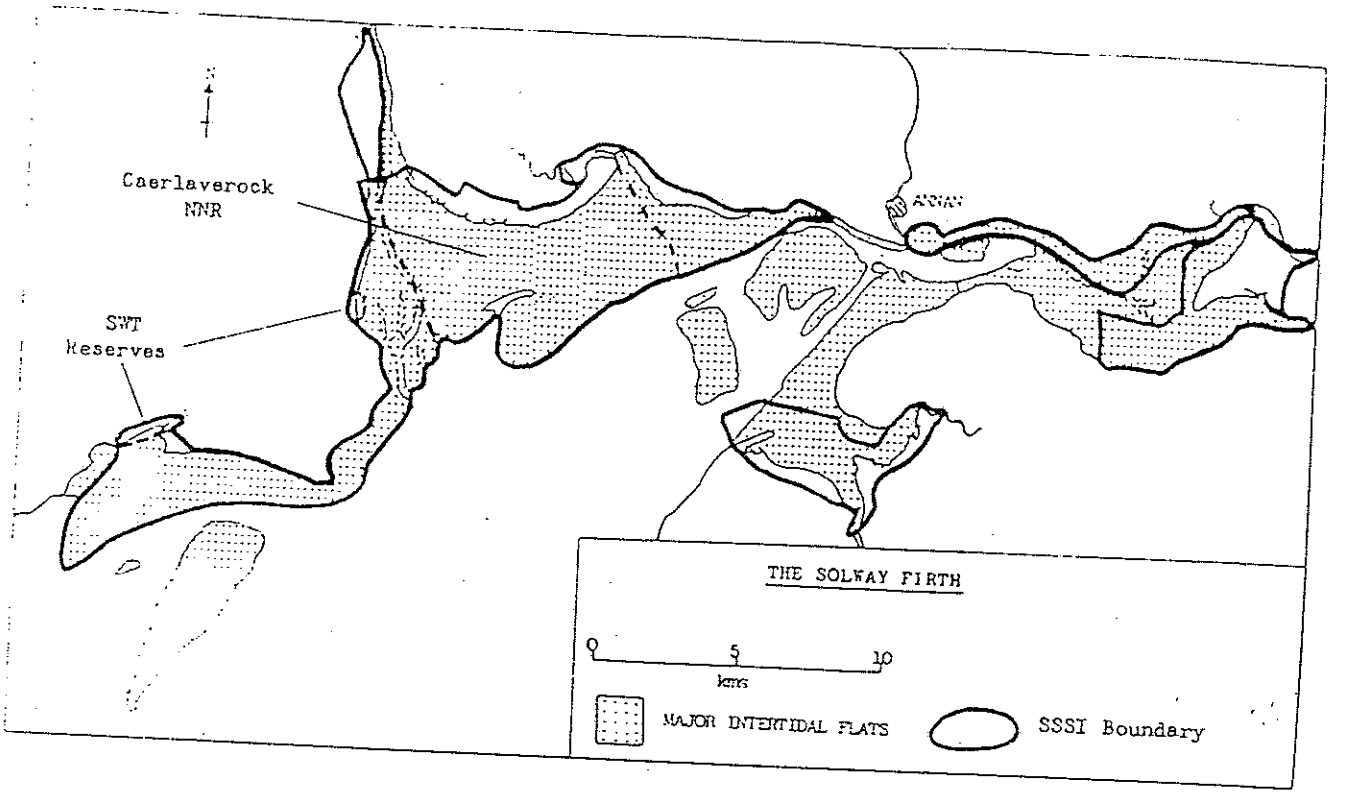


Figure 8.1 Current conservation status of the Inner Solway Firth. The entire area inland of a line joining Southerness Point to Grune Point is a Grade I NCR and a proposed Ramsar Site.

Potential threats

The annotations on Figure 8.2 indicate potential threats to birds on the Inner Solway.

Wildfowling occurs on most sections of the Inner Solway. On the north shore the main areas are Preston Merse, Carse Bay, Kirkconnel Merse, Caerlaverock and Priestside. On the south shore the Solway Wildfowling Association have leases on all the marshes. Geese are the main quarry species.

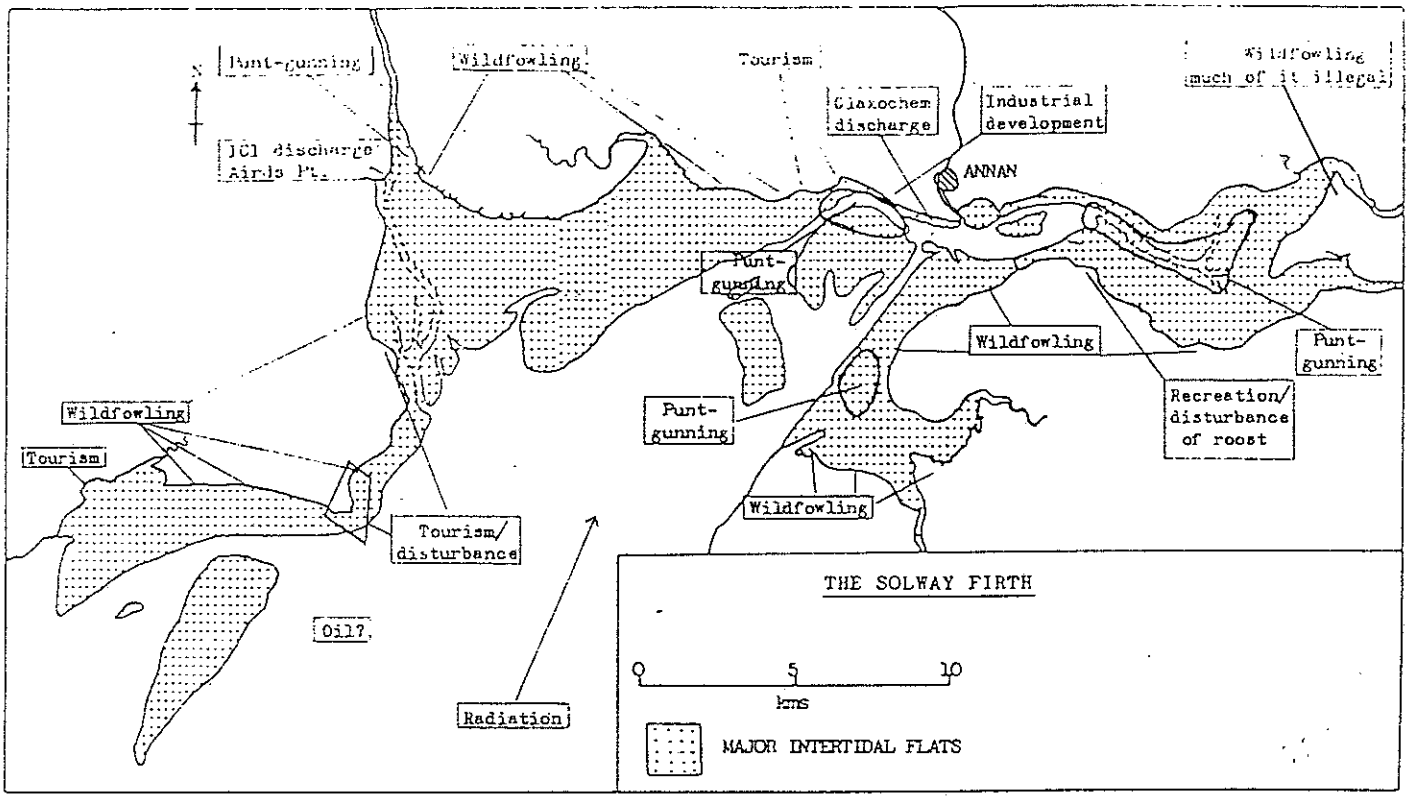


Figure 8.2 Potential threats to wintering bird populations on the Inner Solway.

Punt-gunning for dabbling ducks is occurring commercially on sections 6 and 7, with perhaps 3 boats working the area regularly during the winter. The impact is not known, although disturbance levels are high. Less intensive punt-gunning occurs 'for pleasure' at the mouth of Moricambe Bay and in the Nith Estuary.

Tourism is unlikely to develop extensively on the Inner Solway except at Southerness where considerable developments are already established. Further westward expansion of the holiday camp may jeopardise the very important Gillfoot Bay roost.

Industrial developments are found only at Annan Waterfoot where further expansion may occur. There are outflows at this site and at Airds Point on the Nith.

8.3 Future work

This report attempts to summarise the available information on estuary birds of the Inner Solway, and has highlighted many of the gaps in our knowledge of birds in this area. I shall briefly discuss the major gaps, such that these may be given priority either in future contract work, or by the active local amateur counting and ringing groups.

Autumn populations

Little information is available on the timing or size of the autumn migration of waders through the Inner Solway. Much information could be collected from a run of coordinated BoEE counts over the whole area during this period. (At present, only the south shore is counted). Far more information would result from an integration of catching and counting, similar to the project carried out in the springs of 1983 and 1984. This should have the following aims:

- to assess the origins of the birds using the area.
- to measure population turnover and hence assess the size of the populations visiting the area.
- to assess whether the Inner Solway is an important moulting area for waders, and for which species.

The limited data available suggest that the following species may occur in important numbers at this time of year: Oystercatcher, Ringed Plover, Grey Plover, Turnstone, Curlew, Bar-tailed Godwit, Redshank, Dunlin (schinzii race).

Use of individual areas

The extensive approach adopted for this survey has provided a baseline for assessing the relative importance of individual sections of the Inner Solway for estuary birds. This is adequate at the present time, but in the event of any major threat to any section, more intensive data would be required to assess bird utilisation and potential impact.

Effects of wildfowling

Little information is available on the effects of wildfowlers on the bird populations of this heavily shot area. An urgent priority would be to assess the intensity and effects of punt-gunning on bird distributions and numbers.

It is strongly recommended that the BoEE counting programme be continued for the foreseeable future, at least during the midwinter months (Dec - Feb), to provide up-to-date information on the long-term trends. It is also urged that the ringing activities of the North Solway Ringing Group be continued to maintain samples of ringed birds. This would be particularly valuable during the spring period. Further suggested areas for future ringing activities are described above.

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10. APPENDICES

10.1 APPENDIX 1 Assessment of conservation importance

Objective measures of the conservation importance of different areas are required to identify priority sites for the protection of particular species. For wetlands, the following criteria have been internationally recommended (IWRB 1980):

Criteria and Qualifying Levels for International and National Importance

A wetland is considered Internationally Important if it:

(a) REGULARLY supports either 10,000 ducks, geese and swans; or 10,000 coots; or 20,000 waders.

(b) REGULARLY supports 1% of the individuals in a population of one species or subspecies of waterfowl.

(c) REGULARLY supports 1% of the breeding pairs in a population of one species or subspecies of waterfowl.

A wetland in Britain is considered Nationally Important if it regularly holds at least 1% of the estimated wintering population of one species of subspecies of waterfowl (Prater 1981, Salmon 1981).

Table A.1 gives the qualifying levels among wildfowl and waders for both categories of importance. Note that "regularly", as used in the criteria, means that the average maximum for the FIVE most recent seasons available exceed the appropriate qualifying level.

There are two limitations to these criteria which must be considered in the analyses:

1. They do not account satisfactorily for migration staging posts, where the number of birds present on a single day may be low, but because of turnover the total number of birds using the site over the migration period may be very large.

2. The level of significance of a "site" will clearly depend on how the "site" is defined. Thus, a small section of shore may not be significant, whereas when added to an adjacent section it may become so. It is thus important to identify a "site" using selection criteria relevant to bird distribution, behaviour and movement (ie the north and south shores of the Inner Solway must clearly be recognised as one site because of the regular movements of birds across the estuary).

Table A.1 Qualifying levels for national and international importance

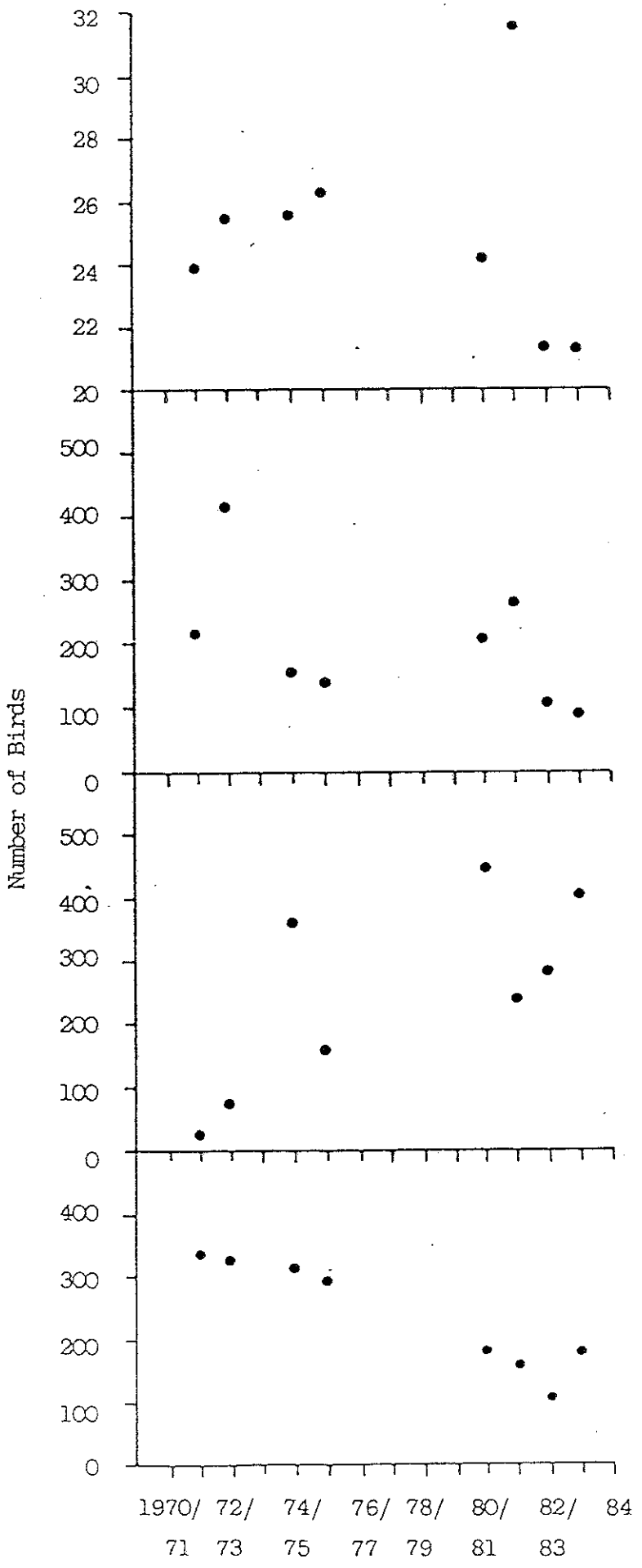
	National (Gt. Britain only)	International (North/west European pop.)
Mute Swan	180	1,200
Bewick's Swan	50	120
Whooper Swan	50 *	100
Pink-footed Goose: Iceland/ Greenland pop.	900	900
Greylag Goose: Iceland pop.	900	900
Barnacle Goose: Svalbard pop.	80	100 *
Shelduck	750	1,250
Wigeon	2,000	5,000
Teal	1,000	2,000
Mallard	4,000	10,000 +
Pintail	250	750
Shoveler	90	1,000
Scaup	50	1,500
Goldeneye	150	2,000
Red-breasted Merganser	100	400
Oystercatcher	3,000	7,500
Ringed Plover	120 (Passage: 300)	1,000
Golden Plover	2,000	10,000
Grey Plover	100	800
Lapwing	5,000	20,000 +
Knot	2,500	3,500
Sanderling: Passage	300	500
Winter	100	150
Purple Sandpiper	180	?
Dunlin	5,500 (Passage: 2,000)	20,000 +
Bar-tailed Godwit	450	5,500
Curlew	1,000	3,000
Redshank	1,000 (Passage: 1,200)	2,000
Turnstone	250	500

(* minimum permissible: represents over 1%
+ maximum permissible: represents under 1%
- British population too small for meaningful figure to be obtained)

10.2 APPENDIX 2 Long-term trends in Solway Wader Populations

Long-term trends in the size of the populations of waders wintering on the Inner Solway were examined from data collected for the BoEE. In Figure A.2 I have plotted out the peak midwinter counts (December, January or February) for each year in which counts have been made. The patterns were then examined using linear regression, and the slope tested from a hypothetical zero slope, using Students' 't' test.

FIGURE A2



OYSTERCATCHER

$r = -0.17$

slope = -119.24

$t_6 = -0.43$

n.s.

RINGED PLOVER

$r = -0.51$

slope = -11.34

$t_6 = -1.45$

n.s.

GREY PLOVER

$r = 0.73$

slope = 23.65

$t_6 = 2.58$

$0.02 < P < 0.05$

TURNSTONE

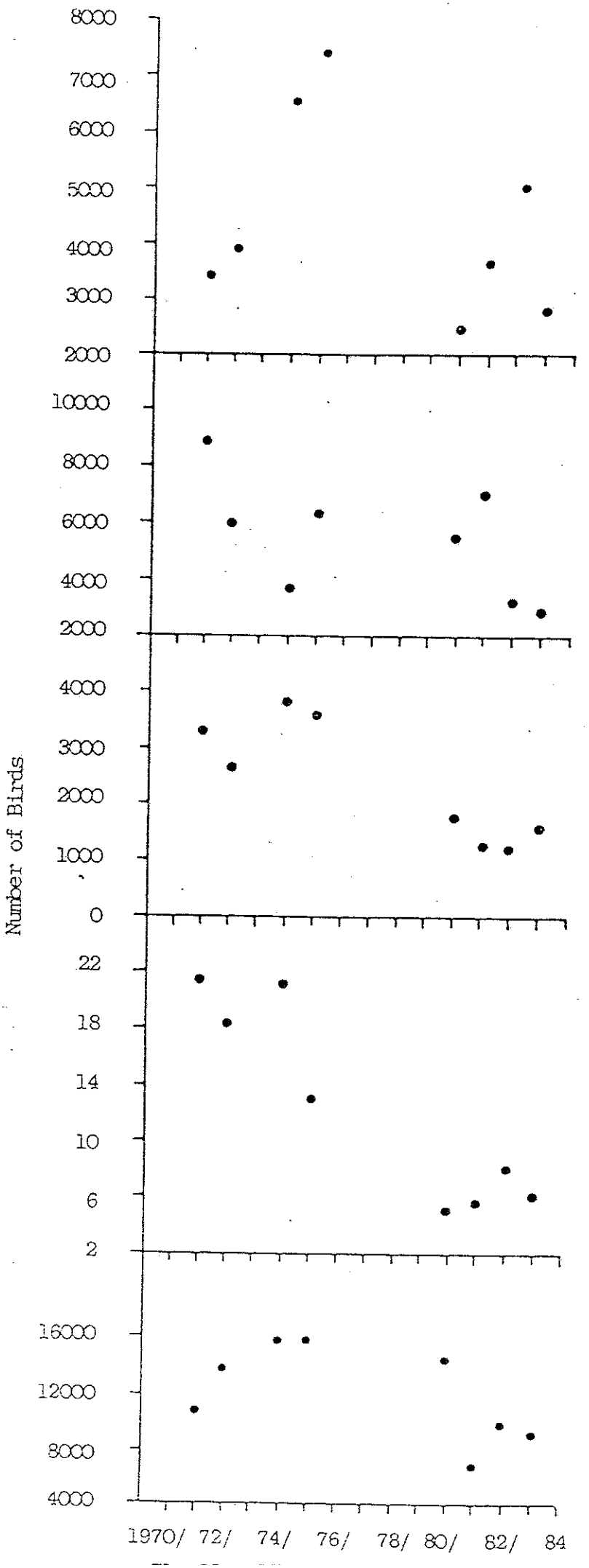
$r = -0.95$

slope = -18.00

$t_6 = -7.11$

$P \ll 0.001$

FIGURE A2 (cont'd)



CURLEW

$r = -0.33$

slope = -120.2

$t_6 = -0.84$

n.s.

BAR-TAILED GODWIT

$r = -0.577$

slope = -25.41

$t_6 = -1.73$

n.s.

REDSHANK

$r = -0.83$

slope = -185.38

$t_6 = -3.62$

$0.01 < P < 0.02$

KNOT

$r = -0.92$

slope = -1372.50

$t_6 = -5.92$

$0.01 < P < 0.01$

DUNLIN

$r = -0.55$

slope = -383.38

$t_6 = -1.60$

n.s.

	SECTION							
	1	2	3	4	5	6	7	8
Oystercatcher	19.9 (4)	6.9 (5)	21.6 (1)	20.6 (2)	4.5 (6)	2.3 (7)	2.1 (8)	20.5 (
Ringed Plover	20.6 (3)	22.0 (1)	0.1 (8)	20.9 (2)	10.1 (4)	1.6 (6)	0.2 (7)	4.7 (
Grey Plover	27.6 (3)	3.8 (4)	0.3 (7)	29.5 (1)	2.6 (5)	0.6 (6)	0 (8)	28.2 (
Turnstone	43.6 (1)	18.3 (3)	0 (8)	19.8 (2)	2.9 (6)	3.2 (4)	0.3 (7)	3.1 (
Curlew	4.2 (6)	2.3 (8)	11.6 (3)	6.9 (5)	10.3 (4)	2.6 (7)	18.3 (2)	25.6 (
Bar-tailed Godwit	68.9 (1)	0 (8)	0.5 (6)	7.9 (2)	2.2 (4)	0.4 (7)	0.9 (5)	7.5 (
Redshank	3.6 (7)	15.9 (2)	3.5 (8)	14.3 (3)	18.9 (1)	13.4 (4)	11.6 (5)	11.1 (
Knot	11.3 (3)	0.9 (6)	0.4 (7)	46.9 (1)	3.2 (4)	0.1 (8)	2.1 (5)	22.0 (
Dunlin	11.5 (3)	4.9 (7)	10.1 (4)	23.7 (2)	9.7 (5)	3.1 (8)	5.4 (6)	25.8 (
Shelduck	9.5 (5)	2.2 (7)	10.5 (4)	14.3 (3)	1.5 (8)	14.4 (2)	16.9 (1)	5.5 (
OVERALL RANK	3	5	7	1	4	8	6	2

Table A3 Percentage of the total Solway population of waders and Shelduck counted in each of the low water feeding areas of the Inner Solway. See text for methods, and Figure 5.1 for section map. The figures in parentheses are the rank values, '1' indicating the most important section for the species and '8' the least important.

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S. Shore: R. Armstrong, D. Barrow, H. Brown, M. Carrier, W. Dalzell, M. Easton, J. Hamer, R. Hancock, G. Hill, J. Mohammed, E. Rhone, J Ryden, T. Savage, M. Tulloch.

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