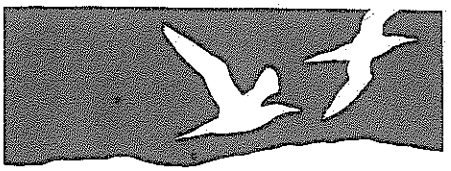

BTO Research Report No 75

THE ORNITHOLOGICAL IMPLICATIONS OF POWER LINE CONSTRUCTION ON TEESSIDE

A report from the British Trust for Ornithology

to Ove Arup and Partners

by

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EXECUTIVE SUMMARY

This study was commissioned by Ove Arup to:

1. report on the flight of birds across the study site on the north side of the Tees estuary, in order to find a favourable route for a power line, and
2. to assess the ornithological importance of the site.

The study site is on the north side of the Tees estuary. The principal ornithological interests on the estuary are its wintering populations of waders and wildfowl and the autumn passage of terns. Teesmouth is internationally important in winter for Knot and nationally important for Shelduck, Teal, Turnstone, Redshank, Knot, Sanderling and Purple Sandpiper.

Fieldwork was carried out between early December 1990 and mid-March 1991. A literature search was made of published and unpublished material. This produced information on the birds on the study site and adjacent areas, and also on bird/power line interactions.

Of the estuary's nationally important species, Shelduck and Teal were two of the site's most abundant birds. They also exhibited significant within season movements across the study site. 8 other species were classed as 'key species' ie the most mobile and/or abundant on the site. The distribution and movements of species are described in Section 3. The areas of greatest ornithological interest were identified as being in the central and eastern part of the site.

They were:

(i) Dorman's Pool for all of the key species, and the area of the site most used by Shelduck in winter.

(ii) Saltholme Pool, Saltholme Farm Pond, and adjacent pasture for Wigeon, Curlew, Lapwing and Golden Plover.

(iii) The Reclamation Pond for gull species.

The principal planes of movement of birds across the site were:

(i) NE-SW between Seal Sands or Dorman's Pool and the Saltholme water bodies.

(ii) W-E across Saltholme and Dorman's Pools, and the Reclamation Pond.

(iii) SE-NW between the River Tees and Dorman's Pool.

Section 5 firstly discusses the importance of the study site in the context of the adjacent areas in Teesmouth. A sizeable proportion of the Shelduck and Wigeon present on the estuary have been recorded on the study site. The pasture areas beside Saltholme and Dorman's Pools provide valuable winter feeding for Curlew, Lapwing and Golden Plover; the area is of local importance for these species.

Of the key species Teal, Curlew, Lapwing and Golden Plover were nationally the most susceptible to 'hitting wires'. To compare the vulnerability of different species to 'hitting wires' an index was calculated (Rose and Baillie 1989). Examples of the index for key and other species are Mute Swan 27.95; Teal 5.59; Kestrel 6.22; Wigeon 2.33; Curlew 6.55; Lapwing 7.55; Golden Plover 13.64; Robin 0.5. However, local factors, such as topography, habitat patterns and the

amount of movement at night appear to modify the vulnerability of some species.

The earthing wires and cables not carrying electric power were identified as being particularly hazardous to birds. A total of 89 birds were seen actively avoiding power lines on the study site. However, only 4 were seen flying between cables. The possible effect on the bird populations is discussed.

Both published guidelines and the data gathered in this study were used to identify areas which should be avoided for the route of the proposed power lines on the study site. These are over or between regularly used water bodies such as Dorman's Pool and the Reclamation Pond. Three possible routes were discussed. One which crossed the Saltholme Farm fields on the western side of the site was considered to cause the least interference to the birds. Mitigative measures in the construction of power lines were suggested.

1. GENERAL INTRODUCTION

Many species of birds use estuaries and the adjoining habitats throughout the year. Some are summer visitors which come to Britain to breed, such as the terns, others such as gulls breed and winter on estuaries. Large numbers of waders and wildfowl, which are the most characteristic of estuary birds, arrive in winter. They originate from breeding areas in North East Canada, Greenland, Iceland, northern Europe and the USSR so the protection of their wintering sites is an international responsibility.

The water bodies of main ornithological interest on the study site, namely Saltholme and Dorman's Pools and the Reclamation Pond are included in counts of birds in the BTO's Birds of Estuaries Enquiry (BoEE) for Teesmouth. Analysis of data from the BoEE for the 1985/86-1989/90 count years has shown that Teesmouth is internationally important for Knot in winter and Redshank in autumn. The estuary is nationally important for Shelduck, Teal, Turnstone, Redshank, Knot, Sanderling and Purple Sandpiper in winter (November-March), for Ringed Plover and Sanderling in spring (April-June) and for Redshank in autumn (July-October).

An estuary is judged to be of international importance if over 1% of the European population of a species uses that site, and of national importance if over 1% of the national

population uses the site. This was agreed by the nations present at the 'Ramsar' convention of 1979 (Moser 1987).

Six areas within the Tees Estuary are designated as Sites of Special Scientific Interest (SSSI's) (Fig 1.1) by the Nature Conservancy Council. Of these, five are of ornithological interest (NCC 1983).

The sites are:

1. Seal Sands, the largest area of intertidal mudflat on the estuary, holds important concentrations of Shelduck. Sizeable flocks of Mallard, Teal, Wigeon, Pochard, Goldeneye and Tufted Duck roost and feed on Seal Sands, particularly during cold weather. Knot and Redshank are, numerically, the most important species of wader on the site. Adjacent areas of reclaimed land, especially shallow lagoons are used as roost sites when the high tide covers the mudflat.

2. Cowpen Marsh is an area of saltmarsh with adjacent coastal grazing marshes and mudflats. Cowpen Marsh and Greatham Creek are important roosting and feeding areas for migrating wildfowl and waders which also feed on the intertidal flats of the Tees estuary. During the winter more than 1000 birds have regularly been seen. Peak counts of Wigeon (300), Teal (420), Curlew (520), Redshank (610), Lapwing (600), Golden

Plover (770) and Dunlin (320), have been recorded. The grazing marsh supports breeding Mallard, Teal, Moorhen, Coot, Redshank, Snipe, Lapwing, Reed Bunting and Yellow Wagtail.

3. Seaton Dunes and Common. The area provides important winter feeding and roost sites for waders, including Sanderling, Knot, Turnstone, Dunlin and Grey Plover. Up to half of the internationally important population of Sanderling on Teesmouth use the SSSI. Large numbers of Common, Arctic and Sandwich Terns frequent the area on migration.

4. Redcar Rocks. The rocks and sands when exposed at low tide are an important feeding ground for several species of wader, such as Knot, Turnstone and Sanderling especially during the winter.

5. South Gare and Coatham Sands. The site provides important winter feeding for Bar-tailed Godwit, Curlew, Redshank, Dunlin and Grey Plover and supports some 8% of the West European population of Sanderling. This SSSI is also used by Ringed Plover on migration, and approximately 2% of the West European population of Knot. The site holds the second largest breeding colony of Little Terns in the North of England.

Several different types of study on the effect of overhead lines on birds have been carried out. For instance, a detailed local survey at Dungeness, Kent, was based on the collection of corpses from beneath power lines (Scott, Roberts and Cadbury 1972). Similar work was done in the River Clyde Valley where power lines were running close to flooded fields and pasture (English 1991). On a national scale Rose and Baillie (1989) analysed data on ringed birds. In Norway, Bevanger and Thingstad (1988) reviewed the literature. The subject was studied from the viewpoint of birds being a problem to electricity companies in that they cause breaks in the power supply.

The objectives of this present study were:

1. To assess the ornithological importance of the site in the context of others in the vicinity.
2. To investigate the movements of birds across the study site (Fig 1.1), to enable a favourable route to be found for a proposed new power line.

2. METHODS

2.1 THE STUDY SITE

The study site is located on the north side of the River Tees Estuary, County Cleveland, the river mouth being approximately 1°9"W 54°38"N. Teesmouth is the most extensive estuarine mudflat on the east coast between Lindisfarne and the Humber (NCC 1983). In the Nineteenth Century 2,500ha of intertidal land existed. However, the area has since undergone substantial reclamation. The main intertidal area on the north side (Seal Sands) is now 140ha while Bran Sands, the only remaining sandflat on the south side is only 60ha (Evans 1979).

On the northern edge of the study site are three power lines running E-W. Near the southern and eastern edges of the site is the River Tees. A road running from Port Clarence towards Seaton Carew almost bisects the area (Figure 2.1.1).

Fig 2.1.1 shows the main habitat/land use types in each of the count areas while Fig 2.1.2 gives the names of the freshwater bodies which are used in the text of this report. Saltholme Pool was formed by subsidence over old brine workings. The part of the pool to the eastern side of the Seaton Carew Road has extensive vegetation cover. Dorman's Pool is part of the Saltholme complex and although

small, the surrounding meadow becomes extensively flooded in winter. The fields adjacent to Dorman's Pool, Saltholme Pool, Saltholme Farm Pond area and the field on its eastern border are permanent grazed pasture.

In the NW section of the study site are the Haverton Hole ponds. Pond A has been constructed recently and there is, as yet, little vegetation on its banks. Pond B appears to be under construction. In the long term there may be a whole series of ponds built between the Haverton Hole and Saltholme area which will form part of the international nature reserve (INCA pers comm).

2.2 DATA COLLECTION

A total of 19 days of fieldwork were carried out from early December 1990 to mid-March 1991. There were four days of reconnaissance during the second week of December to assess the number of species and individual birds present, to identify good vantage points from which to view them, to develop efficient field and recording methods, and in particular to find structures of different heights to aid estimates of the height at which birds were flying.

The remaining 15 visits to the study site were all at least two days apart (except for the last two when fog disrupted

the schedule). On these days continuous counting and logging of movements of birds was undertaken from dawn to dusk.

Counts

The whole area was covered on each visit and when daylight hours permitted the observations included high and low tide counts of the appropriate species. For each species the number, location, time and activity (eg roosting, feeding) were recorded; where necessary estimates were made of numbers of birds in a flock.

Movements

The direction of flight (8 points of the compass), height, species and number of birds were recorded, and if possible the reason for the movement was ascertained - the height of the flying birds was estimated either as below 7m or, if above this height, to the nearest 5m. In order to do this, local features such as power line suspension towers, trees, posts and street lamps were used as gauges. Counts of individuals were made as far as possible, but rapidly moving large flocks necessitated estimates of numbers.

The order in which the vantage points were visited was varied according to the state of the tide in relation to dawn and dusk times and was also adjusted to the behaviour

of the birds so that an estimate of the total number of birds using the site was obtained.

2.3 DATA ANALYSES

After each field visit all the information on counts and movements was transferred onto two sets of site maps and all the analyses were done from these.

Counts

1. The average number of birds in each count area/day (Fig 2.1.1) was calculated for each of the key species.

2. Estimates were made of the total number of all species using the site each day using data from both counts and movements, these are given in Appendix 1.

Movements

One bird flight made across the whole or part of a 1km grid (national grid) was taken as the unit of movement.

1. For each 1km square, the number of bird movements in the direction of each of the 8 points of the compass (N, NE, E, SE, etc) was calculated for the key species (see Section 3). Four height ranges were used, that

is <7m, 7-30m, >30-50m, and >50m. Birds taking off, landing, gaining or losing height were registered in each of the height categories through which they moved. The ranges 7-30m and >30-50m were combined in the diagrammatic presentation of the results so that individual birds flying within either of these were counted only once. The numbers and directions of birds flying at <7m and >50m are given in Appendix 2.

2. The percentage of movements caused by various factors, such as roosting or disturbance, were calculated for each of the key species (Appendix 3).

3. RESULTS: DISTRIBUTION AND MOVEMENTS OF WINTERING BIRDS

Key Species

The ten most numerous and/or mobile species were identified as Shelduck, Wigeon, Teal, Curlew, Lapwing, Golden Plover, Black-headed Gull, Common Gull, Herring Gull and Great Black-backed Gull.

Species accounts follow, outlining the main findings of this study.

3.1 SHELDUCK (*Tadorna tadorna*)

Britain and Ireland support about half of the total number of Shelduck in western Europe from late December to the middle of June. They are an important breeding and wintering area for this species (Prater 1981). Most of the British breeding birds migrate to moult in NW Germany. However, several thousand Shelduck moult on a few British estuaries eg The Wash or Bridgewater Bay. After moulting, Shelduck return to SE England in October and gradually spread northwards and westwards using a succession of estuaries such as Teesmouth as staging posts, to reach their eventual breeding ground several months later. Teesmouth is also used as a wintering area for juvenile Shelduck, eg from the Firth of Forth, which do not moult in their first year or migrate to Germany (Evans 1979).

In winter, Shelduck are found mainly on the coast, and the muddier estuaries such as those of eastern and southern England are favoured. They can occur at very high densities eg 4,000 on 140ha of Tees estuary mudflat (Evans 1986). Shelduck feed by sieving liquid mud to extract the small invertebrates such as snails, worms and crustacea. They scythe the mud at low tides or upend in shallow water as the tide rises or falls.

Distribution

The main areas used by Shelduck were Dorman's Pool and, to a much lesser extent, the Reclamation Pond (Fig 3.1.1). Dorman's Pool was used for both feeding and roosting, particularly on high Spring tides when there was a maximum of 241 birds.

Movements

74% of the attributed Shelduck movements were tidal. Most were in a NW-SE direction between Dorman's Pool and the direction of the River Tees (grids 4 and 8; Fig 3.1.2).

An area of exposed riverbank mud just SE of the study site (Fig 3.1.2) provides low tide feeding for both wildfowl and waders (R Ward pers comm). 110 Shelduck were observed there during one day in February, and the birds were seen to head NW in the direction of Dorman's Pool. When

Dorman's Pool and the Reclamation Pond were first frozen over in mid-January, birds flew from the river first to the former then to the latter and eventually east or northeast toward the Tees and Seal Sands.

There was also a substantial number of short W-E movements between Dorman's Pool and the Reclamation Pond (grid 4) and some longer W-E movements across the Reclamation Pond by birds moving to and from Dorman's Pool.

The Shelduck tended to gain height slowly when making these movements; they are relatively bulky birds. Power lines running in a NW-SE direction across girds 4 (western side) and 8 ie parallel to the birds' main flightline would thus provide the least obstruction.

3.2 WIGEON (Anas penelope)

Wigeon breed in an area extending from Ireland and Scotland eastward to the Pacific coast of the USSR. After breeding, birds migrate to Britain from Siberia, Iceland and Scandinavia. In winter, Wigeon are found around coasts and inland waters. They are distinct among ducks by being largely herbivorous and typically form tight flocks which spend a large part of the day grazing near to water.

Distribution

On most days several hundred Wigeon were present on the study site, but on two days in February, when the water bodies were frozen, none were seen. The highest estimates were 750 and 634 birds in January and March respectively.

Flocks of Wigeon used the Saltholme Farm Pond, Saltholme (western side) and Dorman's Pools (Fig 3.2.1). Only a few individuals were seen at the other water bodies and wet fields on the site.

Movements

The main observed routes of movement were NE-SW between Saltholme (western side) and Dorman's Pools and the Saltholme Farm Pond (Fig 3.2.2; grids 3, 4, 7 and 8). These were caused by disturbance, such as operations on the drainage ditches or movements of cattle between fields. Some movement was also seen between the study site and the directions of Seal Sands (SW-NE) and Greatham Creek (S-N at >50m; grid 4) where flocks have also been observed. Since the species was absent from the site on some field visits these movements are probably more common than observed and/or may occur at night.

The southward movement of Wigeon in grid 5 all occurred on one day when a flock was disturbed. When Wigeon are

disturbed they tend to gain height very quickly and similarly they 'drop' in to land - in many of the movements the birds reached a height of >50m so siting of power lines across the main path of movement may not pose as much of an obstruction as is at first apparent.

3.3 TEAL (Anas crecca)

Several thousand pairs of Teal breed in Britain. They breed mainly near moorland pools and burns, and also lowland marshes. Many British breeders remain in Britain for the winter.

35% of western Europe's 150,000 wintering Teal are estimated to occur in Britain. These include birds which breed in the USSR, Scandinavia and central Europe (Prater 1981).

Shallow water areas such as marshes and estuaries are favoured in winter where they eat small seeds and invertebrates.

Distribution

Teal were present at all the water bodies on the study site, but principally at Dorman's Pool where up to 166 individuals were seen (Fig 3.3.1). The highest number of Teal on the site was estimated to be 230 birds in early

January. Teal tend to move away from frozen water areas and as a result the numbers using the site fell during January but reached another peak of 178 in mid-March.

Movements

Teal were seen moving between the various ponds on the study site (Fig 3.3.2) particularly in a W-E direction between Dorman's Pool and the Reclamation Pond (grid 4) and a smaller number moved SE-NW between the ponds at Haverton Hole.

There was also a substantial movement (140 birds) observed in one day in a NE-SW direction between Seal Sands and Dorman's Pool (grid 4) and between Seal Sands and the Reclamation Pond (40 birds - grid 5).

Teal are susceptible to disturbance by Man, and in some areas they roost during the day, and fly to feeding sites at night.

Dorman's Pool, however, is clearly regarded as a 'safe' feeding site since 92% of the birds seen were taking food. Taking the study site as a whole, some 51% of the observed movements were attributed to disturbance.

3.4 CURLEW (Numenius arquata)

Curlew breed in an area extending from Britain though Scandinavia to eastern USSR. Birds breeding to the west of the Ural Mountains winter mainly in western Europe. Bird ringing has indicated that some Curlew breeding in Norway and Finland migrate to Teesmouth in the Autumn (Evans 1966).

In Britain they breed mainly on moors and upland pastures and move to winter on coastal mudflats and adjacent pasture where they feed on worms (eg ragworm on mudflats and earthworm on fields), crabs and molluscs. Feeding birds are usually well dispersed but they fly to communal roosts.

Distribution

The fields around the west side of Saltholme Pool, Saltholme Farm Pond and Dorman's Pool were most frequently used as roosting and feeding areas (Fig 3.4.1).

The peak high tide counts were of 257 roosting birds on Dorman's and 251 feeding at Saltholme Pool, while a total of over 300 birds were estimated to be using the site in late January. On a number of field visits, a substantial proportion of the Curlew using the site were present all day - at both high and low tide. A previous study of individually marked Curlew (Townshend 1981) demonstrated

that some birds remained on fields throughout the tidal cycle during the winter, except when feeding was made impossible by deep snow/frozen ground, while others almost always used Seal Sands at low water. Even when there was shallow snow cover the Curlew were observed feeding on the fields.

Movements

Many of the movements were very local and due to disturbance (27%), or were between roosting and feeding areas (47%) (Fig 3.4.2). Three main patterns of movement were identified:

(i) in a N-S direction between Saltholme Pool (mostly western side) and Saltholme Farm Pond (grid 7) and adjacent fields.

(ii) in a SW-NE direction between the Saltholme water bodies and Dorman's Pool (grids 4, 7 and 8).

(iii) in an E-W direction between Dorman's Pool and the fields adjacent to Saltholme (grids 3 and 4).

Tidal and other movements which occurred were:

(i) in a NE-SW line from Seal Sands direction towards Saltholme Farm Pond (grids 4 and 7).

(ii) in a W-E and NW-SE direction between Dorman's Pool and the River Tees (grids 4 and 8).

(iii) between the Saltholme water bodies and Greatham Creek (S-N grids 3 and 7) and the River Tees (NW-SE and SW-NE, grids 7 and 8).

3.5 LAPWING (*Vanellus vanellus*)

Lapwing breed across Europe and undergo a complex pattern of movement. In Britain those birds that breed in the uplands move south and west to occupy predominantly inland arable and grass fields. Particular fields are favoured from one year to the next probably because they provide a reliable source of invertebrate food. In severe weather, frozen ground prevents Lapwings from feeding and they move south and west or to local coastal areas. After a thaw they may move back but in prolonged freezing conditions Lapwing leave Britain for the rest of the winter.

Britain and Ireland are important wintering areas for Scandinavian Lapwings but birds also migrate to Britain from the low countries and central and eastern Europe and the USSR. The first migrants arrive in June coinciding with a western movement of British birds, but the main arrival of Lapwing into Britain is between October and December. From late January the migrants begin to leave and numbers drop rapidly through February and March.

Distribution

On the study site, the Lapwing count reached a peak of 3,500 birds in December and 2,000 were present in January. The frozen ground in mid-January reduced the numbers of birds using the site to approximately 750.

Lapwings used the site widely but the main concentrations were in the areas of Dorman's Pool and the west side of Saltholme Pool (Fig 3.5.1). The wet fields near to these pools were feeding sites while the waters' edges and islands were used for roosting.

Movements

A major cause of the movements of Lapwing (76%) was disturbance factors such as predators, people, or unusual vehicles moving along the Seaton Carew Road, eg JCB's with flashing lights. Hence the large number of 'circling' movements recorded for this species. A very small proportion of the total movement was attributed to the tidal cycle (5%) - most birds stayed on the site all day. Much of this tidal movement occurred on one day (21st December) when 1,332 Lapwings flew from the direction of the Tees to Dorman's Pool. This accounts for most of the S-N flight-line in grid 8 (Fig 3.5.2).

The disturbance movements took place between all the main sites used. In particular they were:

(i) NE-SW between the Saltholme water bodies (grid 7);

(ii) SW-NE across the Seaton Carew Road between Dorman's and Saltholme Pools (grids 3, 4 and 7);

(iii) E-W between Saltholme and Dorman's Pools (grid 4).

3.6 GOLDEN PLOVER (Pluvialis apricaria)

Golden Plover breeding areas extend from Iceland to Central Siberia, but France, Britain and Ireland are the main wintering areas; the latter two holding some 200,000 - 300,000 birds. Migrants, many of which come from Iceland, arrive in Britain from October to December. In cold winters they move on to the south and southwest in search of food.

In Britain, Golden Plover breed on the moorland of the north and west and spend the winter on lowland agricultural land; permanent pasture is particularly favoured. Golden Plover also regularly feed and roost in the intertidal zone in northern England and Scotland.

They are very often in the company of Lapwings and Black-headed Gulls. Lapwings gather in fields where there are high concentrations of earthworms and Golden Plover use

them as indicators of good feeding sites. Although Black-headed Gulls steal worms from both species, they seem to benefit from the early warning of predators given by the gulls (Fuller 1986).

Distribution

The main areas used by Golden Plover were Dorman's Pool, the western side of Saltholme Pool and fields east and west of the Seaton Carew Road (Fig 3.6.1). This is a similar distribution to the main concentrations of Lapwing with which they always associated.

Large flocks, eg up to 754 in one area, were present at both high and low tide. The peak estimate of the total number of birds using the site was 800 in mid-December.

Movements

The principal cause of movements was disturbance (88%), the Golden Plover very often taking off with the Lapwing. These were:

(i) in a SW-NE direction between the Saltholme water bodies and adjacent fields and Dorman's Pool (Fig 3.6.2; grids 3, 4 and 7).

(ii) W-E direction between Dorman's Pool and the Reclamation Pond (grid 4).

(iii) E-W direction between fields either side of the Seaton Carew Road (grid 7).

There was also some movement from Dorman's Pool NE towards Seal Sands (grid 4). The birds were observed to fly over the existing power lines which run E-W along the northern edge of the study site.

Golden Plover and Lapwing take rapidly to the air when disturbed and the former climb quickly and fly at a high level (well above 50m) for several minutes. Thus the placement of power lines across these flight lines would not cause as much disruption as the diagram of movements suggests.

3.7 BLACK-HEADED GULL (Larus ridibundus)

The gulls are a ubiquitous and very successful group of birds which are abundant on British estuaries. They occur widely inland and on the coasts between estuaries and out at sea. Black-headed Gulls are distributed across Europe and Asia as far as the Pacific Ocean. Of an estimated 3 million wintering birds in Britain and Ireland, about two thirds are thought to be of continental origin (Flegg 1986). Many of these birds are from northern Europe and remain on the eastern side of the country (Mackinnon and Coulson 1987).

Although Black-headed Gulls are confined mainly to the north and east of central England in the breeding season, they are more widespread in winter. Most British breeders stay in this country in winter. These gregarious birds use a range of habitats, such as estuaries and coastal marshes, pasture, inland wetland, rubbish tips and urban parks.

Black-headed Gulls may feed on intertidal areas during the day. Roosting occurs on open water, either inland or on some estuaries eg. Teesmouth.

Distribution

Black-headed Gull was the most widespread and numerous gull on the site. The largest concentration was found at the Reclamation Pond and Dorman's Pool which they used, along with other gull species, for pre-roost bathing and for roosting (Fig 3.7.1). Peak counts in these two areas were 1,800 and 2,550 roosting birds respectively. Sizeable flocks (peak 353 birds) gathered at the flooded brassica field and much smaller groups at the Haverton Hole ponds. The fields adjacent to the Saltholme water bodies were also used extensively for feeding, loafing, roosting and preening. The peak number estimated using the study side was 3,550 in early January, but counts fluctuated according to whether the birds elected to roost on site.

Movements

Black-headed Gull movements were largely due (72%) to birds moving to or from their roost sites, and stopping to bathe in the freshwater at Dorman's Pool and the Reclamation Pond. There were a large number of eastward movements from these two water bodies (Fig 3.7.2; grids 4 and 5) indicating birds taking off from the site.

Other large roost movements included:

(i) leaving Saltholme Pool (western side) across grids 7 and 8 (SW-NE).

(ii) flight from Dorman's Pool towards Seal Sands (SW-NE) where the birds are known to gather (grid 4).

(iii) across grids 5 and 9 in a NW-SE direction.

The smaller number of birds flying around the Haverton Hole ponds and adjacent fields were largely undergoing disturbance movement (grids 1, 2 and 6) - Haverton Hole was not so well used as a roost/bathing site.

3.8 COMMON GULL (*Larus canus*)

Common Gulls breed mainly in Scotland and Ireland but in winter are much more widespread. An estimated 702,000 birds winter here, the majority of which come from the

breeding population of Scandinavia, Denmark and Germany while others arrive from Holland, USSR and Iceland (Vernon 1969).

Common Gulls breed by lochs on moors or on shingle, but in winter they are primarily found on inland farms, or on the coast. Often they will feed far inland and move to the coast at dusk to roost on estuaries or freshwater bodies.

Distribution

The Reclamation Pond and the flooded brassica field were the areas most favoured by Common Gull (Fig 3.8.1) and were used almost exclusively as roosting and preening sites. Dorman's Pool was used regularly, but was of less importance. The peak count of 1,243 roosting birds on the Reclamation Pond on one day (17th March) was exceptional and was presumed to be birds on passage. The next highest estimate was on the 15th March when 325 Common Gulls were roosting at the Reclamation Pond.

Movements

Most movements were associated with preening or roosting (67%). The main ones were:

(i) in an W-E direction in grid 4.

(ii) N-S in grids 4, 8 and 11 - this was mostly due to the dispersal of the largest flock described above.

Smaller scale movements were in a NE-SW direction in grid 4 and 8 and NW-SE in grid 8.

3.9 HERRING GULL (Larus argentatus)

Winter roost counts of Herring Gulls in 1983 gave an estimate of 275,000 birds in Britain.

A large proportion of the Herring Gulls wintering in the northeast of Britain come from the Scandinavian race (L. a. argentatus) (Coulson et al 1984))and some of these breeding birds also winter in the London area (Stanley et at 1981).

The breeding habitat is mainly coastal but in winter Herring Gulls also use inland areas. Their greatest concentrations are at centres of human population where they feed on edible waste, such as that on rubbish tips, fish quays, and food processing plants. They will also forage along the tide line of estuarine mudflats, but are less often found feeding on farmland invertebrates than Black-headed and Common Gulls.

Distribution

Herring Gulls were not numerous on site, the peak estimated total being 70. They were most commonly seen at Dorman's Pool, the Reclamation Pond and the flooded brassica field which they used for preening and roosting (Fig 3.9.1).

Movements

The only sizeable observed movements were in the W-E direction around Dorman's Pool and the Reclamation Pond (Fig 3.9.2; grids 4 and 5). A smaller movement in the SW-NE direction also occurred in grids 4 and 5 as birds moved towards Seal Sands. These movements were largely associated with roosting.

3.10 GREAT BLACK-BACKED GULL (Larus marinus)

British Great Black-backed Gulls are largely resident but in winter this population is augmented by Norwegian birds. These stay on the east side of the country - an area which holds virtually no Great Black-backed Gulls during the Summer.

In contrast with the other gulls, Great Black-backed do not breed in dense colonies. However, in winter, large concentrations form both inland and on the coast. Rubbish tips are patronised but most feed entirely at sea. The

number of birds seen on the coast fluctuates daily, presumably depending on the sea conditions.

Distribution

This species, like the Herring Gull was almost entirely confined to Dorman's Pool, the Reclamation Pond and the flooded brassica field which were used for preening and roosting (Fig 3.10.1). The highest estimate of the total number of birds using the site was 180 in early January.

Movements

Movements to/from roosts were again the primary cause of flights (89%). The greatest number of movements were in a W-E direction at Dorman's Pool and the Reclamation Pond (Fig 3.10.2; grids 4 and 5). A substantial number also occurred in the NE-SW direction - grids 3, 4 and 7. Fewer movements occurred in a NW-SE direction across grids 4 and 8.

Those birds moving NE from Dorman's Pool exhibited an interesting interaction with the power lines which run E-W along the northern boundary of the study site. They were seen taking off and flying in a NE direction as far as was necessary to gain enough height to get over the power lines. Once on the other side they changed course abruptly so that their flight direction was more northerly. This

phenomenon has also been reported for 275 KV lines (Kirby in litt). He has seen larger birds, such as gulls, invariably climb as they approach so as to fly over the lines.

3.11 OTHER SPECIES

This section summarises the field observations of the less abundant wintering birds. Where appropriate, additional information from the County of Cleveland Bird Reports (CCBR) 1985-89 is given. The species accounts are in the Voous order.

There were 23 species for which the total count did not exceed 10 on any one day. The details are given in Appendix 1.

With the exception of large water birds and birds of prey, which have a high chance of 'hitting wires' (Rose and Baillie 1989) these species will not be considered further.

Grey Heron (Ardea cinerea)

One or two birds were seen in the Saltholme water bodies (western) area. Their movements were low (<7m) and within these areas.

Swans

Mute Swan (Cygnus olor) were seen at Haverton Hole, Dorman's and Saltholme (eastern and western sides) and on the flooded brassica field.

Two groups of **Whooper Swan (Cygnus Cygnus)** used the study site during the winter. A family group (two adults and one juvenile) fed on the field by Saltholme Pool (eastern side). The other group consisted of two birds which were observed on the flooded brassica field, Saltholme Farm Pond, and Haverton Hole. No movements were observed but clearly these latter two birds were moving around the site. Small groups of Whooper Swans are regularly recorded using the various water bodies on the site (CCBR).

Bewick Swan (Cygnus columbianus bewickii) is also a regular visitor. Up to six have been recorded at Saltholme Pond in each of the last five winters (CCBR).

White-fronted Goose (Anser albifrons) are scarce winter visitors to the area but fifteen have been recorded at Saltholme Pool (CCBR).

Canada Goose (Branta canadensis). One bird was recorded flying over Dorman's Pool at a height of 30m. 27 were reported at Dorman's in 1987 (CCBR).

Mallard (Anas platyrhynchos). The main concentrations of up to 65 birds were at Haverton Hole, Dorman's and Saltholme Pool (eastern side). There was some movement of Mallard between (i) Dorman's Pool and the direction of Seal Sands (SW-NE plane) and (ii) Dorman's Pool and the River Tees (NW-SE). Over this sort of distance the birds gained height quite quickly and flew over any power lines across their route. More local movements, such as those between Dorman's Pool and the Reclamation Pond, and between the Saltholme water bodies were made at a lower height (15-40m).

Pintail (Anas acuta). Almost all of the small numbers of birds seen were at Dorman's Pool. The peak count was 16. No movements were observed.

Shoveler (Anas clypeata). Dorman's and Saltholme Pools were used almost exclusively; only a few occurred at Haverton Hole. The peak count was 36 birds. Movement was observed between the former two water bodies (W-E) and also N-S or E-W across Dorman's Pool. In the majority of movements (154), birds were flying between 7 and 50m. The study site, including Haverton Hole, has the highest reported count of the area in some years (CCBR).

Pochard (Aythya ferina) were mainly recorded at Haverton Hole and Saltholme Pool. The peak count was 24. No movements were observed.

Tufted Duck (Aythya fuligula). Up to 12 birds were seen mainly at Haverton Hole and Saltholme Pool. Movement was observed on one day only. This was at Haverton Hole where 3 birds flew SE-NW to a height of 45m.

Birds of Prey

Individual **Sparrowhawk (Accipter nisus), Kestrel (Falco tinnunculus)** (two birds), **Merlin (Falco columbarius)** and **Peregrine (Falco peregrinus)** were seen hunting across the site. Their rapid flight, with sudden changes in direction while chasing prey, make these birds vulnerable to power line collisions.

Partridges

Red-legged Partridge (Alectoris rufa) were seen near the Reclamation Pond and Saltholme Pool (eastern side). **Grey Partridge (Perdix perdix)** used the site more extensively. Peak counts were 8 and 15 respectively. The observed movements were very local and low (ie <7m).

The Rails

Moorhen (Gallinula chloropus). The greatest numbers of birds were seen at the Reclamation Pond. Of lesser importance were Saltholme and Dorman's Pools and Haverton Hole. The highest count was 25 birds. **Coot (Fulica atra)** used Saltholme Pool (peak count 29), Haverton Hole and Dorman's Pool. The highest count for the whole site was 51. A few **Water Rail (Rallus aquaticus)** have been reported

at all of the water bodies mentioned above and also at Hargreaves Quarry (CCBR). Local and low level (<7m) movements of Coot and Moorhen were seen. However, the Rails are known to move further at night. Fluctuations in the number of birds at the various water bodies suggests that birds were moving longer distances at night. Little is known about the height at which they fly, but at Dungeness they were often found dead below the power lines (Scott et al 1972).

Dunlin (Calidris alpina). Flocks of mainly roosting Dunlin used Saltholme Pool (western side) and the field to the south, and Dorman's Pool. The peak total count was 130 birds. Small flocks of Dunlin (up to 38 birds) were seen flying between Dorman's Pool and the River Tees (NW-SE) as the tide covered or uncovered their feeding area. On these flights the birds tended to reach a height of >50m. However, observed tidal movement between Dorman's Pool and the direction of Seal Sands (7 birds) was at <7m across the study site.

There were also more local movements W-E from Dorman's Pool to the Reclamation Pond and SW-NE between Saltholme and Dorman's Pool which were at 20-30m. Birds disturbed at Dorman's Pool gained height very rapidly and climbed above 50m. As in many cases of disturbance they later landed in the same area.

Ruff (Philomachus pugnax). Up to 15 birds were seen feeding mainly around Saltholme Pool (western side) and less frequently at Dorman's Pool. No movements were observed between these water bodies but could be inferred by examination of the count data.

Snipe (Gallinago gallinago) were mainly seen at Haverton Hole and Dorman's Pool. The highest count was 19 birds. Larger numbers of Snipe have been recorded at other times of year. 120 birds were present at Dorman's Pool in November 1985 and 45 at Saltholme Pool in August 1989. The few observed movements were all very local, eg between the Reclamation Pond and Dorman's Pool (E-W) and at Haverton Hole (SE-NW). Snipe can gain height very rapidly but some of these movements were entirely between 7 and 50m. Snipe are known to be active at night, but their flight height is not known.

Redshank (Tringa totanus). Up to 130 birds were seen on the study site. They were mostly feeding or roosting at high water in the Saltholme Pool (western side) and Dorman's Pool area and also on the flooded brassica field. Some birds apparently stayed on site all day. The major movements were between Dorman's Pool and the Reclamation Pond (W-E), The River Tees and Dorman's Pool/Hargreaves Quarry (SE-NW), and from the Saltholme Farm Pond area across the Seaton Carew road (W-E). All these flights went through the 7-50m height range.

Lesser Black-backed Gull (Larus fuscus). Although only up to 3 birds were seen on site during the fieldwork, in some years Dorman's Pool is a regular roost site during the summer (CCBR). In May 1987, 33 Lesser Black-backed Gulls were at the Reclamation Pond and 13 at Dorman's Pool.

Common Tern (Sterna hirundo) use the Tees estuary on passage during their autumn migration. In some years, there are large concentrations of birds on the study site. In 1985, for instance, there was an unusually large July peak of 2,500 Common Tern at Dorman's Pool and the Reclamation Pond. In 1988 1,500 Common and/or Arctic Terns gathered at Haverton Hole in August (CCBR).

Feral Pigeon (Columba livia). Up to 50 birds were seen on site. Very local movements were observed around Port Clarence.

Stock Dove (Columba oenas). Up to 33 birds were seen on the site. These were mainly in the field to the south of Saltholme Pool (western side). No major movements were observed.

Wood Pigeon (Columba palumbus). Up to 16 birds were seen mainly on the flooded brassica field. They were feeding there in the late winter. Few movements were observed.

Aerial Insect Eaters

The fast flying **Swift (Apus apus)**, **Swallow (Hirundo rustica)**, and **House Martin (Delichon Urbica)** have quite a high risk of 'hitting wires' (Rose and Baillie 1989). However, it is not known what proportion of these are due to collisions with low voltage domestic lines, as opposed to higher voltage transmission cables. The water bodies on the study site provide a good supply of insects for these birds eg May 1991 100 Swift were seen at Saltholme Pool. The well vegetated water margins also provide roost sites eg Hargreaves Quarry in September 1987 held 150 Swallow, and Haverton Hole in September 1985 had a maximum of 30 birds (CCBR).

Fieldfare (Turdus pilaris). Up to 110 birds were seen in the Dorman's and Saltholme Pool areas on 2 days in January. The only movements seen were very local and low (<7m).

Redwing (Turdus iliacus). 100 birds were reported roosting at Hargreave's Quarry (CCBR 1985)

Magpie (Pica). Single birds were seen on the fields across the study site and there were small groups at Hargreave's Quarry. The latter has been noted as a roost site, eg 30 birds in March 1987 (CCBR). The only observed movements were short flights at levels <50m.

Starling (Sturnus vulgaris). Their main feeding areas were the fields around Dorman's Pool and the Saltholme water bodies. There were some low level, <50m movements between these feeding areas. Roost movements were W-E from Dorman's and Saltholme Pools. There were also large flocks of birds moving to roost sites. W-E, NW-SE, or N-S over the Dorman's or Saltholme Pool areas, at a height >50m.

4 RESULTS: BREEDING BIRDS

The fieldwork did not extend far enough into the breeding season for there to have been much activity. However, Lapwing, Skylark and Shelduck all showed some breeding behaviour. Also a pair of Little Grebes had built a nest at Saltholme Pool by mid-March.

The breeding records therefore have been abstracted from the County of Cleveland Bird Reports 1985-89. Table 4.1 gives those species which have been confirmed as breeding in Cleveland and for which there is suitable breeding habitat on the study site.

The Cleveland Bird Reports (1988-89) also give specific records of birds breeding at named locations. This is not of course a comprehensive list. Those within or near the study area are summarised here.

Mute Swan (Cygnus olor) have bred or attempted to breed in all 5 years. They were at Hargreave's Quarry, Haverton Hole, Dorman's and Saltholme Pools.

Shelduck (Tadorna tadorna) are scarce breeders within the county. However, the SSSI's in the Seal Sands and Greatham Creek areas are used regularly. 108 young Shelduck were recorded in 1986 and 41 in 1989.

Red-legged Partridge (Alectoris rufa). In 1986, 1 pair bred in the Hargreave's Quarry/Dorman's Pool area.

Lapwing (Vanellus vanellus) are common breeders in Cleveland. A survey in 1986 reported 30 pairs nesting in the brine fields to the north of Dorman's Pool (Fig 1.1).

Ruff (Philomachus pugnax) are not recorded as breeding. However, the North Tees marshes and often specifically the Dorman's Pool/Saltholme area is used as an early spring display ground. The birds then disperse.

Whinchat (Saxicola rubetra). In 1986 Whinchat bred successfully in the Dorman's Pool/Reclamation Pond area.

Grasshopper Warbler (Locustella naevia). Reeling (territorial) birds were recorded in 1987. There were 2 at Hargreave's Quarry, 2 at Haverton Hole, and 1 on the Dorman's Pool area.

Sedge Warbler (Acrocephalus schoenobaenus). 2 pairs of territorial birds were present at Dorman's Pool in each of 3 years. Sedge Warblers were also recorded reeling at Haverton Hole (2 years), Hargreave's Quarry and Saltholme Pool.

5 DISCUSSION

5.1 The study site in context

The main ornithological features of Teesmouth are its wintering population of waders and wildfowl, and the autumn passage of terns (Davidson 1980). Many of the species which were observed during fieldwork are winter or passage visitors to this habitat, eg Golden Plover, Wigeon and Teal, and mainly breed outside Britain. Teesmouth is used for winter feeding or as a stop-over point in spring or autumn. The birds are present in much smaller numbers during the breeding season (May-July). One notable exception is the nationally important Shelduck population. There is a breeding population of this species on the estuary, concentrated on the Seal Sands and Greatham Creek areas. The lowest numbers of Shelduck are seen in autumn when the birds leave to moult.

The Tees estuary has undergone much industrial reclamation. There are now a series of Sites of Special Scientific Interest (Fig 1.1). Two sites on the north side of the Tees estuary, Seal Sands and Cowpen Marsh, were designated as SSSI's principally to protect their ornithological interest. Several species of waders and wildfowl are of international or national importance on the estuary.

The key species on the study site were chosen on the basis of their abundance and mobility. Of these species, Shelduck and Teal are of national importance. These categories of importance have been calculated from the peak counts of birds. Since birds are using the site on passage, there may be a considerable turnover of individuals. The figures, therefore, do not represent absolute numbers of birds using the estuary.

Data collected on the study site for the key species of waders and wildfowl are compared to Teesmouth as a whole in Table 5.1.

The average peak winter count (APWC) for the BoEE years 1985-1989 and the peak counts on the study site in the 1990-1991 winter are given.

The BoEE year runs from July in one year to June in the following year. The winter season is allocated as November to March. So the data cover the period November 1985 - March 1990. There is one count per month and the highest of these in each winter season is used to calculate the APWC.

The peak count for Shelduck on the study site is a relatively small proportion of the 5 year average on the estuary. However, the study site may assume greater importance at different times of the year. On the high

spring tide of 17th March, for instance, Dorman's Pool held a similar number of Shelduck to Seal Sands (R Ward pers comm).

The study site appears to hold a sizeable proportion of the Wigeon present on the estuary. The pasture around Saltholme and Dorman's Pools provides good grazing for these herbivorous birds. On many field visits the Wigeon flocks stayed in one location all day. The observed movements suggest that the flock of Wigeon on site also use other parts of the estuary.

The study site is of less importance for Teal. However, Dorman's Pool was used as a 'safe' feeding site by this species which is susceptible to disturbance by Man.

From mid-January to mid-February there was snow cover and the water bodies on the site were frozen. At this time the numbers of Teal, Lapwing, Golden Plover and Shelduck were reduced. The winter of 1990-91 was colder than that of the previous three years and so atypical when considering the five year average peak counts.

Curlew also feed inland and some birds were identified in this study and in Townshend (1981) as remaining on the fields all day. They were feeding there at both high and low water in preference to the mudflats such as Seal Sands. The pasture around Saltholme and Dorman's Pools is

particularly important in mid-winter and spring. At these times, there is a shortage of food in the estuarine mud due to low temperature and low prey density respectively.

The North Tees marshes, and the Dorman's Pool/Reclamation Pond area in particular, are described as holding the largest concentrations of Lapwing on the estuary in winter (CCBR 1985, '86 and '89). The study site also appears to be important for Golden Plover on the estuary. This might be expected because of the inland feeding habit of this species and also its association with Lapwing as described in 3.6.

Although the study site is not part of an SSSI, there is clearly some interchange of birds between it and the SSSI's. The Shelduck, for instance, continue to use Dorman's Pool and the Reclamation Pond as a high tide feeding and roosting site through the year (the Reclamation Pond is used more in the summer when Dorman's Pool is no longer flooded). Wigeon, Teal, Mallard, Curlew, Golden Plover and Redshank were all observed arriving from or going to Seal Sands. Wigeon and Curlew were seen moving towards Greatham Creek from the study site.

Records from bird observatories around the coast of Britain, show that migratory movements of Wigeon, Teal, Mallard, Tufted Duck and some waders eg Golden Plover occur at night (Martin 1990). On migration, Curlew, Lapwing and

Shelduck are more likely to move during the day. However, where the ducks and waders are using the intertidal mudflats for feeding it is the tide that determines the timing of their movements.

The birds also respond to such factors as food shortage and disturbance, ie they will feed at night if disturbed during the day. So some movements of the ducks and waders may have been more frequent than were recorded in the study.

5.2 The distribution of birds on the study site

Sections 3.1 - 3.11 detailed the distribution of each species.

The 'key' ornithological areas in terms of bird abundance on the site were Dorman's Pool, the Reclamation Pond, Saltholme Pool (western side) and Farm Pond, and the adjacent grazing land. The greatest diversity of species was recorded at Dorman's Pool. (Fig 5.2.1).

The Haverton Hole ponds were of lesser importance. However, it is INCA's intention to make a whole series of ponds between Haverton Hole and Saltholme Pool. This would provide more suitable habitat for waders and wildfowl on the western part of the site.

5.3 The major flight paths across the study site

Sections 3.1 - 3.11 give details of the movements of birds at the site mid-December to mid-March 1991. The major movements are summarised in Fig 5.3.

5.4 Which Species are the most vulnerable?

Rose & Baillie (1989) studied the incidence of ringed birds colliding fatally with overhead lines. A bird which is found dead and reported to the BTO is termed a ringing 'recovery'. Of the 132 species that have been recorded as "hitting wires" 87 have had over 100 recoveries.

In order to compare species a 'hit wire' index was calculated as:

$$\text{Hit wire index} = \frac{\text{hit wire recoveries} \times 100}{\text{birds found dead} + \text{hit wire recoveries}}$$

The 'hit wire' indices for the key species and other birds using the study site are given in Table 5.4. Unfortunately, the 'hit wire' description covers incidents with all types of lines - domestic low voltage as well as high voltage transmission. The proportion of recoveries for each species which are due to these different constructions is not known.

The highest mortality rates found by Rose and Baillie (1989) and other studies were amongst the large water

birds, particularly Mute Swan and Grey Heron, and the raptors (day flying birds of prey). The index for Shelduck is low but it may be that there are relatively few overhead wires close to their habitat.

In Norway, 23 threatened species of birds were found to hit wires frequently, eg Whooper Swan. Many of these species were within the groups of grebes, herons, waterfowl, hawks and falcons, gallinules, cranes and allies, shorebirds and gulls, owls, and some passerines (Bevanger and Thingstad 1988). However the magnitude of the mortality was not known.

As a group, waders, gulls, and terns, had an intermediate chance of mortality. However, Curlew and Lapwing had a moderate chance. These two wader species spend much time inland both in the winter and in the breeding season. Curlew for instance is predominantly coastal in winter but also feeds in fields near the coast. They are vulnerable when flying between these areas.

The 'hit wire' indices for landbirds are mostly low. They are rarely high flyers and tend to be small and manoeuvrable.

The aerial feeding birds such as Swift and Swallow are an exception. Their method of feeding by high speed chasing of prey makes them more likely to collide with wires. They

nest in buildings which may be near overhead wires (low power rather than high voltage National Grid lines) and gather on wires prior to migration.

The likelihood of a bird hitting a power line is related to a bird's size, manoeuvrability and the habitat which it uses. On a regional or local scale the habitat pattern, landscape features, and the nature of the surrounding area are probably of greatest influence.

The national figures presented in Table 5.4 may, therefore, show considerable regional variation. Dungeness, is known as a focal point for migrants, as they move along the coast by both day and night when they sometimes become grounded. Here the main power line casualties are gulls and nocturnal migrants such as Starlings and thrushes (Scott et al 1972). Table 5.4, however, suggests that landbirds are unlikely to hit wires.

The gull species that are most likely to hit wires at a national level are Black-headed and Common Gulls (Table 5.4). They spend more time inland than other gull species. In N E England, however, is was found that Black-headed, Herring, and Great Black-backed Gulls hit wires more frequently than elsewhere (Rose & Baillie 1989). Lesser Black-backed and Common Gulls show a similar pattern although the data available for these species is limited.

There is a concentration of reports of collisions by ringed Herring and Great Black-backed Gulls in the Tees and Tyne estuaries. Many Gulls in the area were caught and marked at rubbish tips during the 1970's and 1980's. This sample of ringed birds may be particularly likely to collide with overhead wires because of local factors such as the number of days of poor visibility, or of overhead wires across their flight lines.

5.5 Power line construction and causes of death

Birds may either be killed on power lines by electrocution or by striking the cables. Large birds, such as Swans, are particularly at risk of electrocution since their wing span can bridge two wires as they fly between pylons.

The single earthing wire at the top of each pylon was identified as the most likely cause of death at Dungeness, Kent. To the human eye it is less visible than the other cables (Scott et al 1972). Both Shelduck and Starling have been seen to fly above the conductors only to hit the earthing wire at Dungeness. Birds have also been recorded hitting the earthing wire at Teesmouth (Teesmouth Bird Club in litt cited Scott et al 1972).

There is some evidence that birds respond to the electric field around the conductor (H Dickinson in litt cited Scott et al 1972) and Kirby (in litt). Observations suggest that

birds will fly between live conductors up to 66 KV. At 132 KV any small birds will fly between, and at 275 KV and above no bird will approach the lines (Kirby in litt). Larger birds experience a greater voltage difference between their extremities. They will have less tolerance of the wires.

The strongest evidence that birds can detect high voltage transmission was an incident when there was a break in the power line. A drifting oil rig brought down 275 KV lines which ran across the lower Tees. The wires on the approaches to the break were dead for many months and gulls, amongst other species, were killed. These power lines consisted of two circuits with a single earthing wire across the top of the towers. Even when only one circuit was active (before the lines were brought down) bird collisions were very unusual.

5.6 Bird/power line interactions seen on the study site.

During the course of the fieldwork records were kept of the behaviour of birds as they approached existing power transmission lines which run E-W along the northern edge of the study site. The observations are listed here:

(i) Gulls

On 2 days, (17th and 21st December) a total of 65 Great Black-backed Gulls steadily gained enough height to enable

them to fly over the 'wires'. They took off from Dorman's Pool in a north-easterly direction and once they had negotiated the wires changed to a more northerly course.

On 17th March 10 Common, 5 Black-headed, and 8 Herring Gulls took off from the Reclamation Pond. They circled before they gained enough height to fly over the wires in the direction of Seal Sands.

On 14th January the movement of 2 Great Black-backed Gulls flying north from Haverton Hole took them between some power lines.

Gulls were also seen apparently using power lines as an aid to navigation. On 14th January 27 Black-headed and 1 Common Gull followed the transmission lines southeast and then east from the Haverton Hole area towards Dorman's Pool.

(ii) Teal

On 17th December a Teal behaved similarly to the Great Black-backed Gulls on that day (see (i) Gulls above).

(iii) Mute Swan

On 14th January 2 Mute Swans flew at a height of approximately 45m through the wires. They were moving from the Saltholme Pool direction towards Seal Sands.

5.7 The effect of collisions with power lines on the bird populations

In order to assess what effect collisions with power lines will have on bird populations two factors need to be considered (i) the amount of mortality that is caused by the power lines, and (ii) the status of the populations that are subject to this mortality.

(i) Bird populations are able to remain stable in spite of mortality from artificial causes such as hunting. The birds compensate for the losses by, for instance, increasing their production of young. Only a certain level of mortality can, however, be sustained. Beyond that the population will start to go into decline.

(ii) If a population is already declining it will have little ability to compensate for mortality. Lapwing and Curlew are the only two of the key species which have shown any form of population decline. Although breeding Lapwing numbers have gone down nationally, in northerly sheep rearing areas the population has increased. No national data are available on changes in numbers of wintering Lapwings. However, the number of Curlew wintering on British estuaries has declined slightly since the early 1970's (Rose and Baillie 1989).

Rose and Baillie (1989) conclude that overhead lines are unlikely to threaten bird populations. Their report states that they still cause a considerable number of bird deaths, and may have severe effects on local populations. Consequently, the siting of new power transmission lines should take into account local factors and, ideally, the route of minimum interference should be chosen where possible.

5.8 Recommendations for the siting of power lines

Particular hazards to birds are overhead lines built near estuaries, between bodies of water, and in river valleys (Scott et al 1972). This is because they may cross the flight lines of water birds (eg waders, wildfowl) between their feeding and roosting sites. A high incidence of casualties of such birds was reported in the Teesmouth area in 1963 and '64. Recent work in the River Clyde Valley showed that power lines running close to flooded fields were causing casualties of Mute and Whooper Swans in particular. The lines were sited across a regularly used flight path between water bodies (English 1991).

There have been a number of recommendations to minimise the hazard to birds from power lines (Bevanger and Thingstad 1988; Scott et al 1972). Lines should be run parallel to, rather than across, the regularly used flight paths of birds. The areas to avoid are:

(i) Those where the topography leads to the low passage of birds.

(ii) Key areas for birds.

(iii) Vegetation.

(iv) Important wetland areas used for roosting, breeding, and feeding by waterbirds.

(v) Local feeding passages.

Based on this information, it is recommended that some areas on the study site are avoided in the construction of power lines:

(i) water bodies such as Dorman's Pool, the Reclamation Pond or Saltholme Pool. In these areas birds are frequently taking off or landing.

(ii) the piece of land between Dorman's Pool and the Reclamation Pond. This is higher than both water bodies and many birds fly over it at a low level. They have been observed during the day and heard at night.

With this is mind three potential power line routes are shown in Fig 5.8 and each route is discussed here.

Route 1

This route would avoid all the major concentrations of birds. However it cuts across the flight path of Shelduck and Curlew between the River Tees and Dorman's Pool or the Reclamation Pond (SE-NW) and (E-W) Fig 5.3. These are regular tidal movements between feeding and roosting sites. In the case of Shelduck they probably go on through much of

the year and at night. For both species, but particularly Shelduck, movements tend to be mainly at a height of <50m. Shelduck are of national importance on the Tees estuary. On a national scale the likelihood of Shelduck 'hitting wires' is low. However, there would have been a low ringing recovery rate if there are currently relatively few power lines close to their habitat.

A power line on this route would also cut across the large movement of Gulls, Starlings, and possibly Terns (see section 3.11). Gulls and Terns use Dorman's Pool and the Reclamation Pond as a roosting and/or pre-roost bathing site.

Route 2

This route does not interfere with the flight lines of the Shelduck as it runs approximately parallel to them. However some Lapwing, and Curlew cross the railway line within the critical height range of 7-50m. Wigeon and Golden Plover also take this flight path but tend to fly higher in this section.

The wet meadows around Saltholme and Dorman's Pools are of local importance for Lapwing and Curlew. Neither of these species is of national importance on the estuary. They are present in greatest numbers during the winter. Both Curlew and Lapwing have a moderate chance of 'hitting wires'.

Route 2 would also cross the routes of Black-headed Gulls heading NE from Saltholme Pool (Fig 3.7.2).

Route 3

This route would not enter much of the area most favoured by the birds. Some flights (mostly caused by disturbance) of Lapwing, Curlew and Black-headed Gulls on the field adjacent to Saltholme Farm Pond, would cross the power lines.

However, during the next few years, INCA may build a series of ponds between Haverton Hole and Saltholme Pool. This would attract more birds into the western part of the site.

In conclusion, Route 1 avoids the areas most heavily used by birds, but it cuts across the flights of Shelduck and Curlew. The former is of national importance on the estuary and makes frequent movements between the study site and the River Tees. Route 2 crosses the paths of Lapwing and Curlew. These two species are most abundant on the site during the winter.

Currently, Route 3 would be of least interference to the movement of birds. However, it is INCA's intention to build a series of ponds in the area where Route 3 runs in a northerly direction. It is therefore suggested that there be liaison with INCA.

5.9 Mitigative Measures.

Birds are most abundant on the study site in winter although there is also a considerable spring and autumn passage of birds. In winter visibility tends to be poorer, and there may be more movement during the hours of darkness. It is, therefore, recommended that construction of power lines is not done in winter.

Kirby (in litt) suggested that birds are at greatest risk during the construction phase. When no current is running through the wires, birds are unable to detect the conductors at night or in poor weather conditions.

The earthing wire was advocated as being a greater hazard than the conductors by Scott et al (1972). To decrease the chances of birds hitting earthing wires, these should be marked. Coils of plastic or phosphorescent material could be used. The latter gave effective protection for Whooper Swans (Bevanger and Thingstad 1988). However the effectiveness of these markers is reduced in poor visibility or at night. Large raptor silhouettes were thought to be the most reliable in bad light. Bevanger and Thingstad (1988) also describe equipment which causes special problems. These are:

(i) insulators mounted at the top of crossarms

(ii) transformers in pole-mounted arrangements

(iii) steel crossarms

They recommend:

(i) more hanging insulators are used

(ii) the crossarms are made of non conductive material

(iii) insulation of crossarms which are made of conductive material

(iv) isolating coatings on the steel crossarms

(v) mounting of "bird protection" on spark gaps

(vi) ground wire gapping

(vii) insulation of the conducting wires of pole-mounted transformers or their enclosure in covered buildings.

All or any of these mitigative measures could be adopted on the study site as appropriate.

ACKNOWLEDGEMENTS

The study was carried out under contract from Ove Arup to whom our thanks are offered. My thanks go to Paul Johnson of Ove Arup for advising on the early plans for the report, Dr Rowena Langston and Dr Nigel Clark for their discussion and comments on the fieldwork and the report, Ray Waters for extraction of Teesmouth data, and my other colleagues at the BTO. I am very grateful to Sophie Foulger for typing the manuscript and her help, and that of Liz Murray in the production of the diagrams.

I would like to thank Durham University for their hospitality while on fieldwork and for the use of their library, and Robin Ward and Matthew Parsons for their counts of birds.

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Table 4.1 Species which have bred in Cleveland 1985-1989 and for which there is suitable breeding habitat on the study site.

SPECIES
Little Grebe
Mute Swan
Canada Goose
Shelduck
Mallard
Shoveler
Pochard
Tufted Duck
Red-legged Partridge
Grey Partridge
Water Rail
Moorhen
Coot
Ringed Plover
Lapwing
Quail
Snipe
Curlew
Common Tern
Feral Pigeon
Woodpigeon
Cuckoo
Skylark
House Martin
Tree Pipit
Meadow Pipit
Yellow Wagtail
Pied Wagtail
Wren
Dunnock
Robin
Blackbird
Song Thrush
Mistle Thrush
Grasshopper Warbler
Sedge Warbler
Reed Warbler
Lesser Whitethroat
Whitethroat
Black Redstart
Blue Tit
Great Tit
Magpie
Rook
Carrion Crow
Starling
House Sparrow
Chaffinch
Greenfinch
Linnet
Yellowhammer
Reed Bunting
Corn Bunting

Table 5.1 The Teesmouth average peak winter counts 1985-1990 and the study site peak counts

Species	APWC (Teesmouth 1985-90)	Peak count on study site 1990-91
Shelduck	1381	230 (4th Jan)
Wigeon	1233	750 (4th Jan)
Teal	1261	230 (4th Jan)
Curlew	576	321 (25th Jan)
Lapwing	4411	3500 (21st Dec)
Golden Plover	503	800 (17th Dec)

NB. Hartlepool Bay was included for the first time in the 1988-89 year.

Table 5.4 'Hit Wire' indices for the key species and others using the study site.

SPECIES	'HIT WIRE' INDEX
Grey Heron	10.93
Mute Swan	27.95
Shelduck K	1.2*
Wigeon K	2.33*
Teal K	5.59
Mallard	4.88
Tufted Duck	7.02
Kestrel	6.22
Moorhen	2.34
Coot	7.02
Golden Plover K	13.64*
Lapwing K	7.55
Curlew K	6.55
Black-headed Gull K	5.22
Common Gull K	4.36
Herring Gull K	2.91
Great Black-backed Gull	2.46
Swallow	4.82
Robin	0.50
Song Thrush	1.86

* Between 1 and 9 ringing recoveries attributable to overhead lines.

K Key species

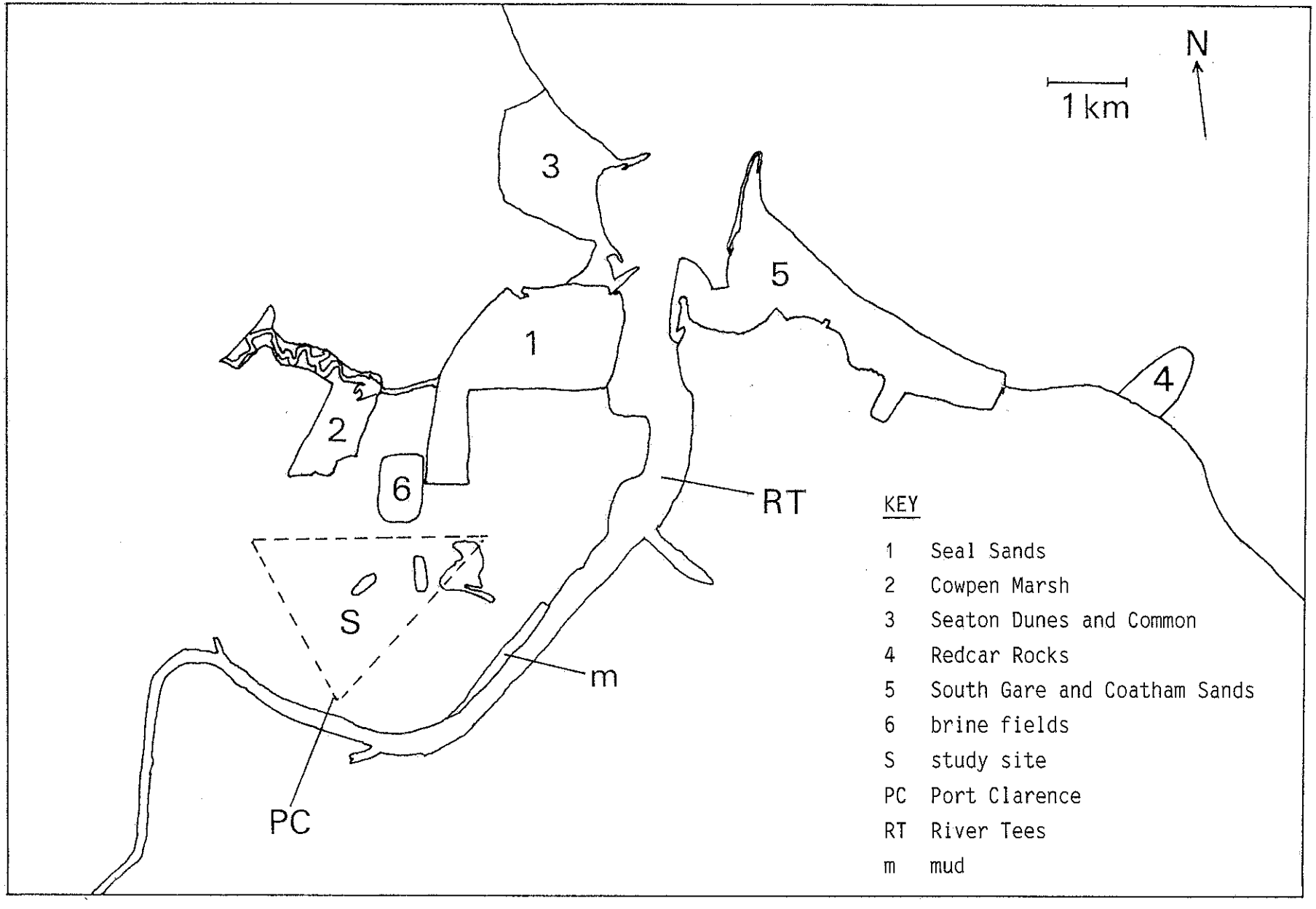


Figure 1.1 Map of Teesside showing the study site and other areas of ornithological interest.

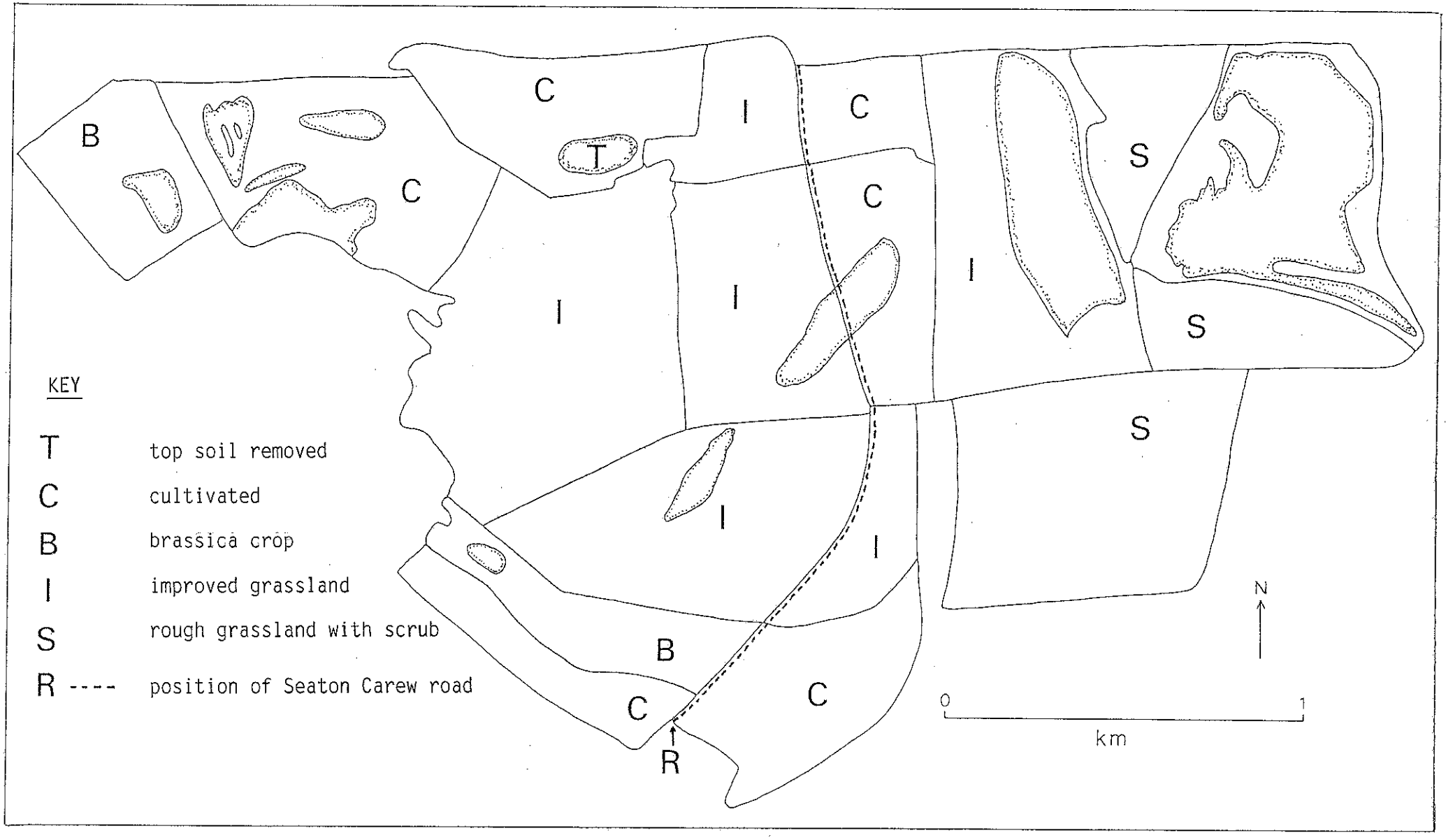


Figure 2.1.1 Map of study site showing main habitat/land use in each count area.

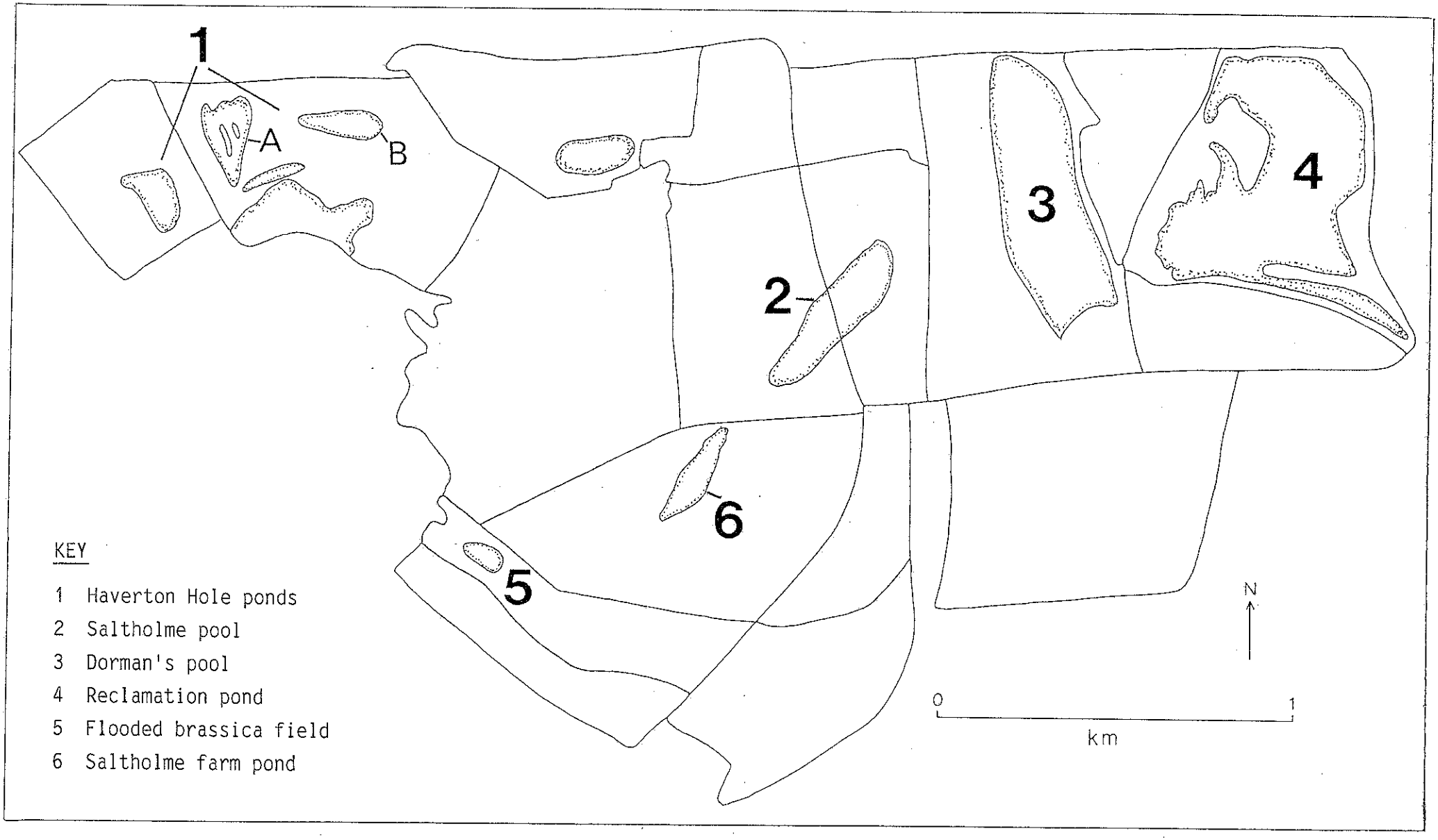


Figure 2.1.2 Map of study site showing location of water bodies

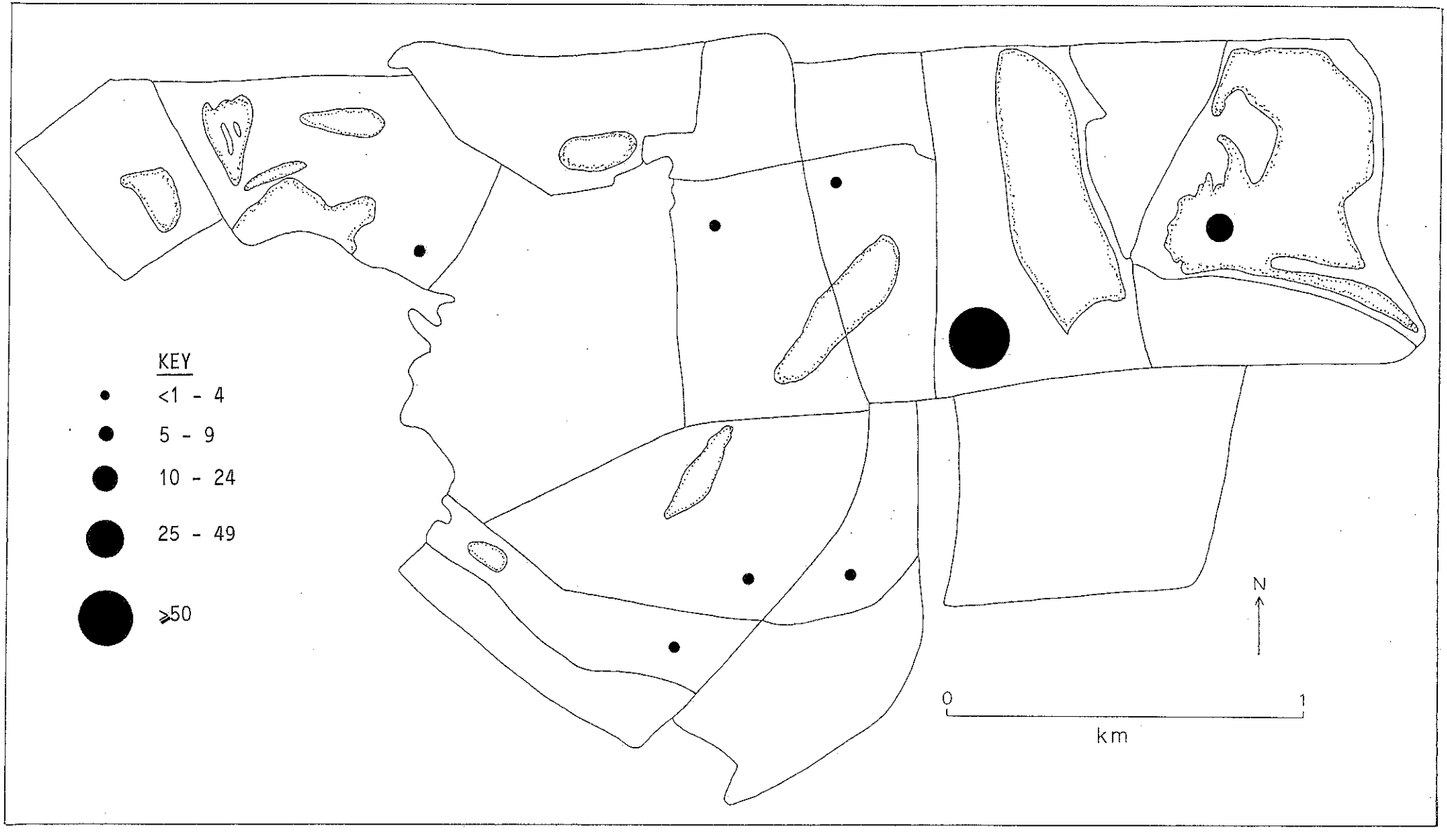


Figure 3.1.1 The average number of Shelduck seen in each count area per day between mid-December 1990 & mid-March 1991.

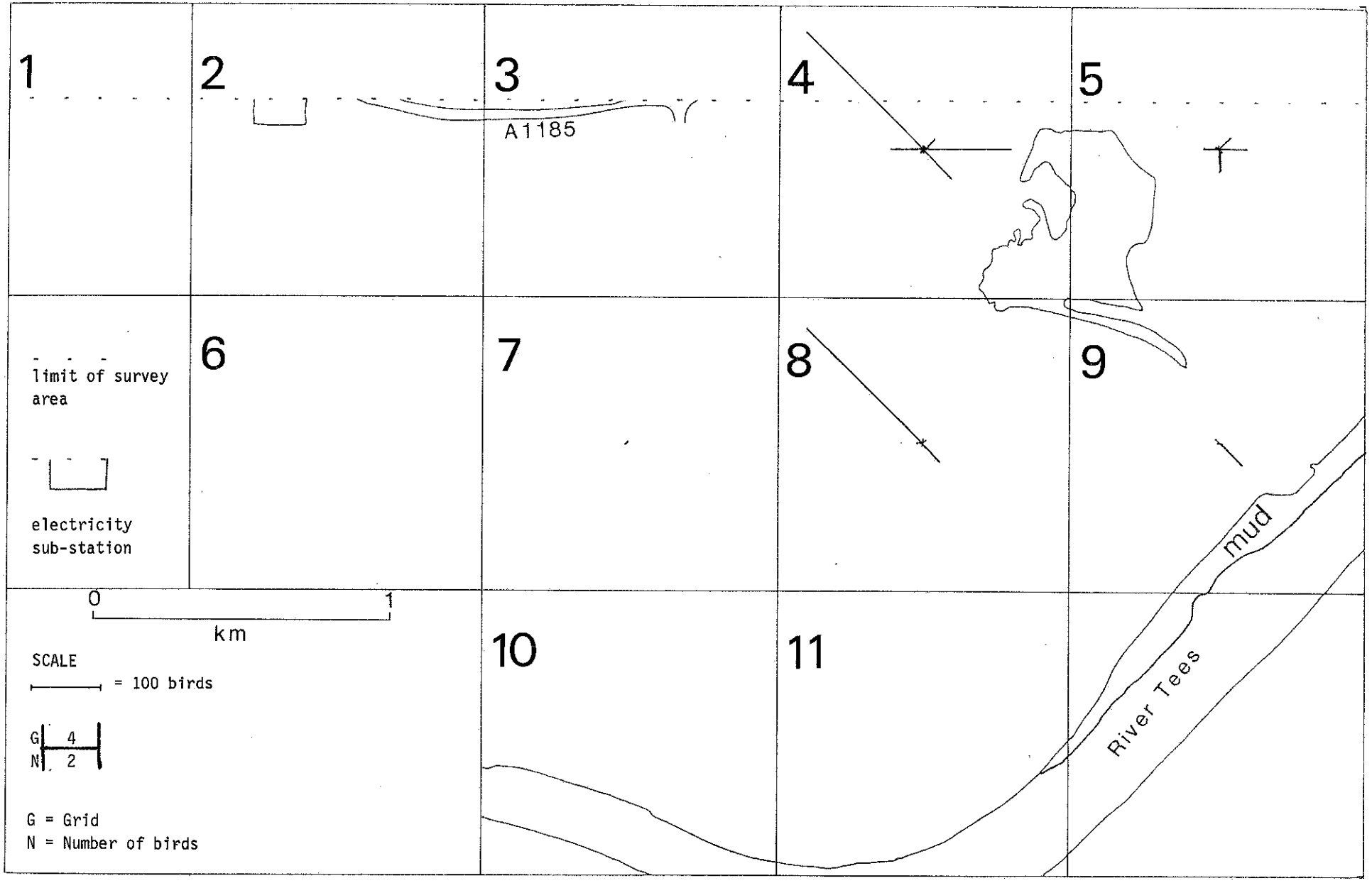


Figure 3.1.2 The total number of Shelduck flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

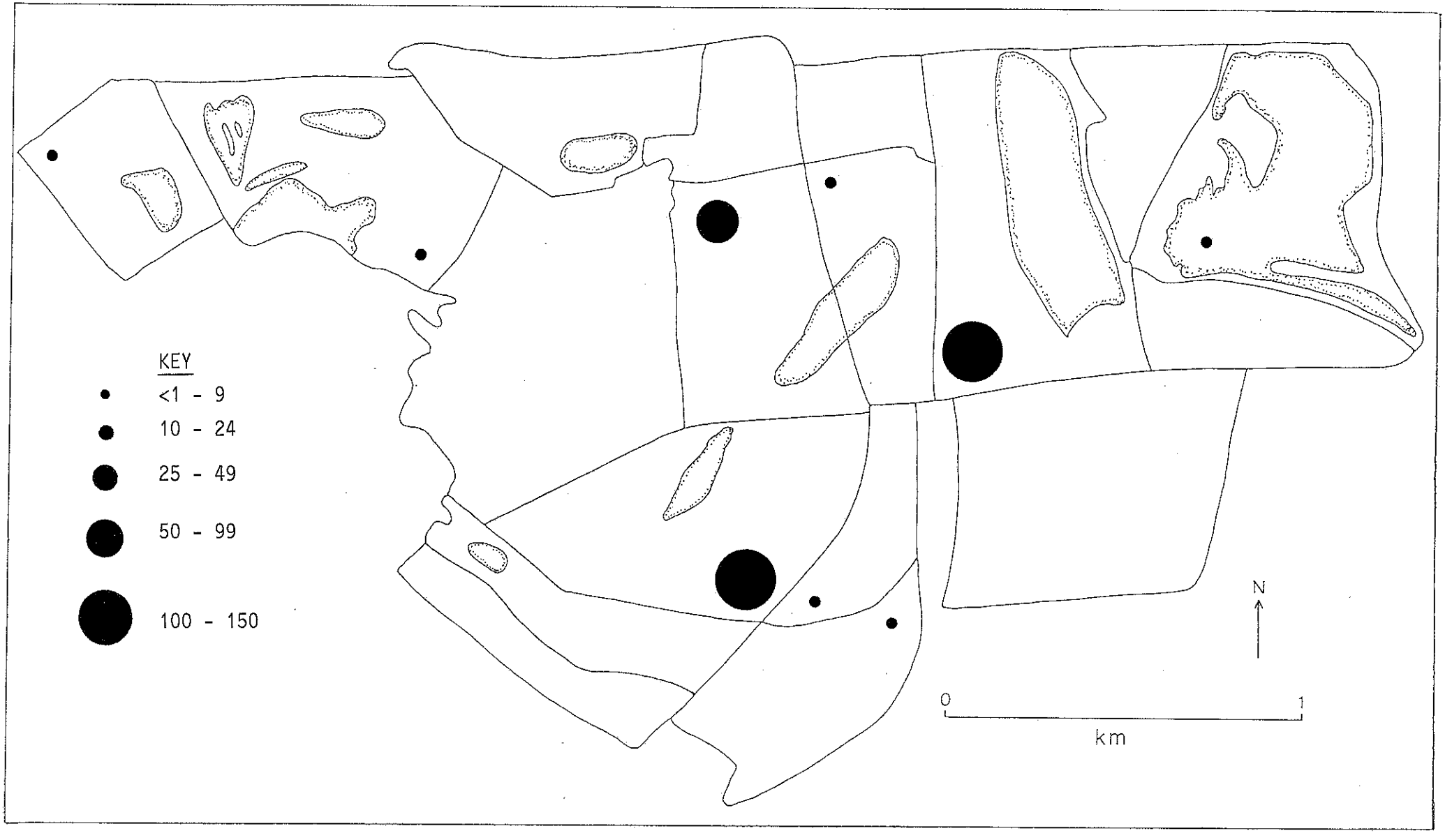


Figure 3.2.1 The average number of Wigeon seen in each count area per day between mid-December 1990 & mid-March 1991.

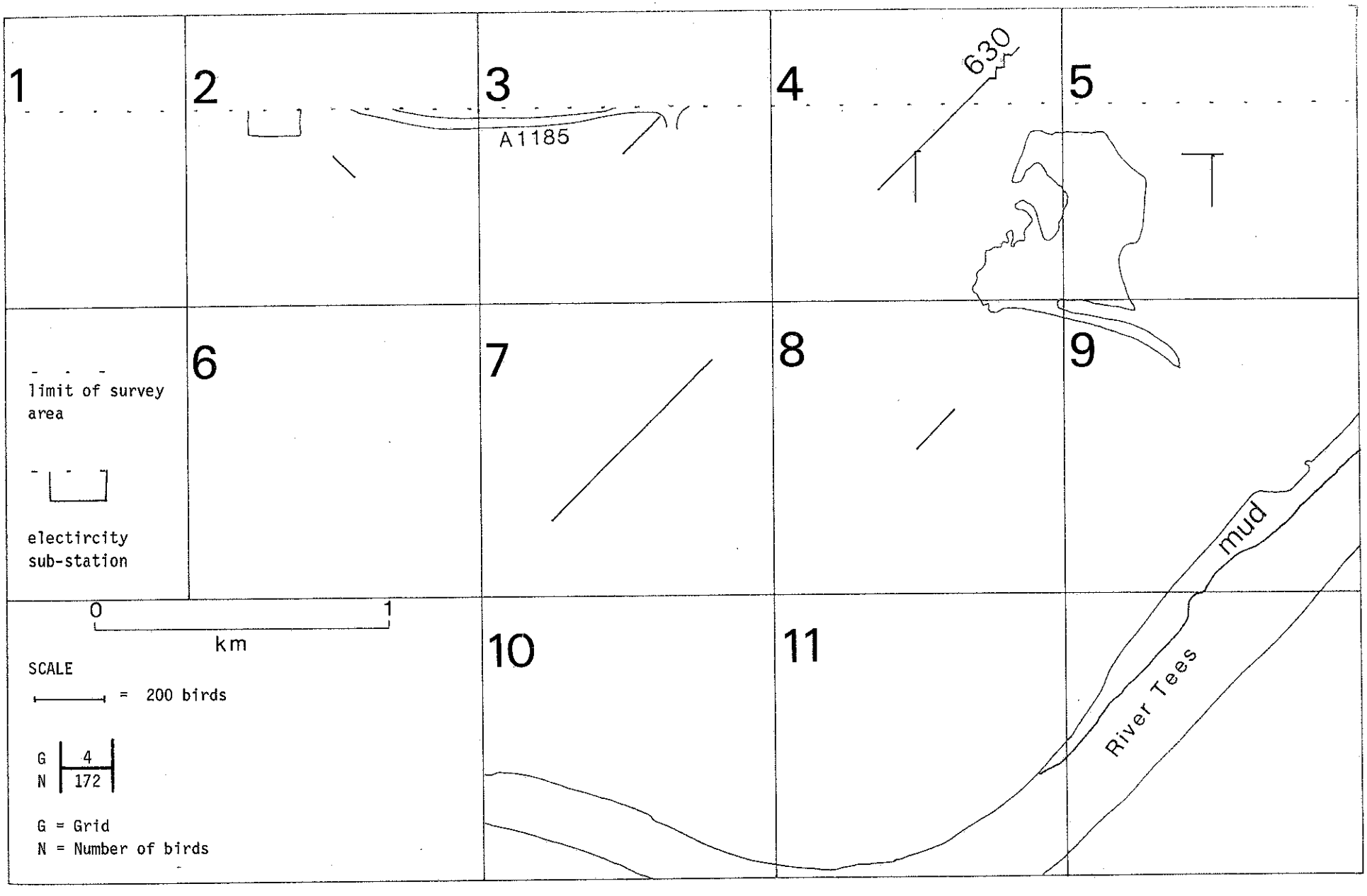


Figure 3.2.2 The total number of Wigeon flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

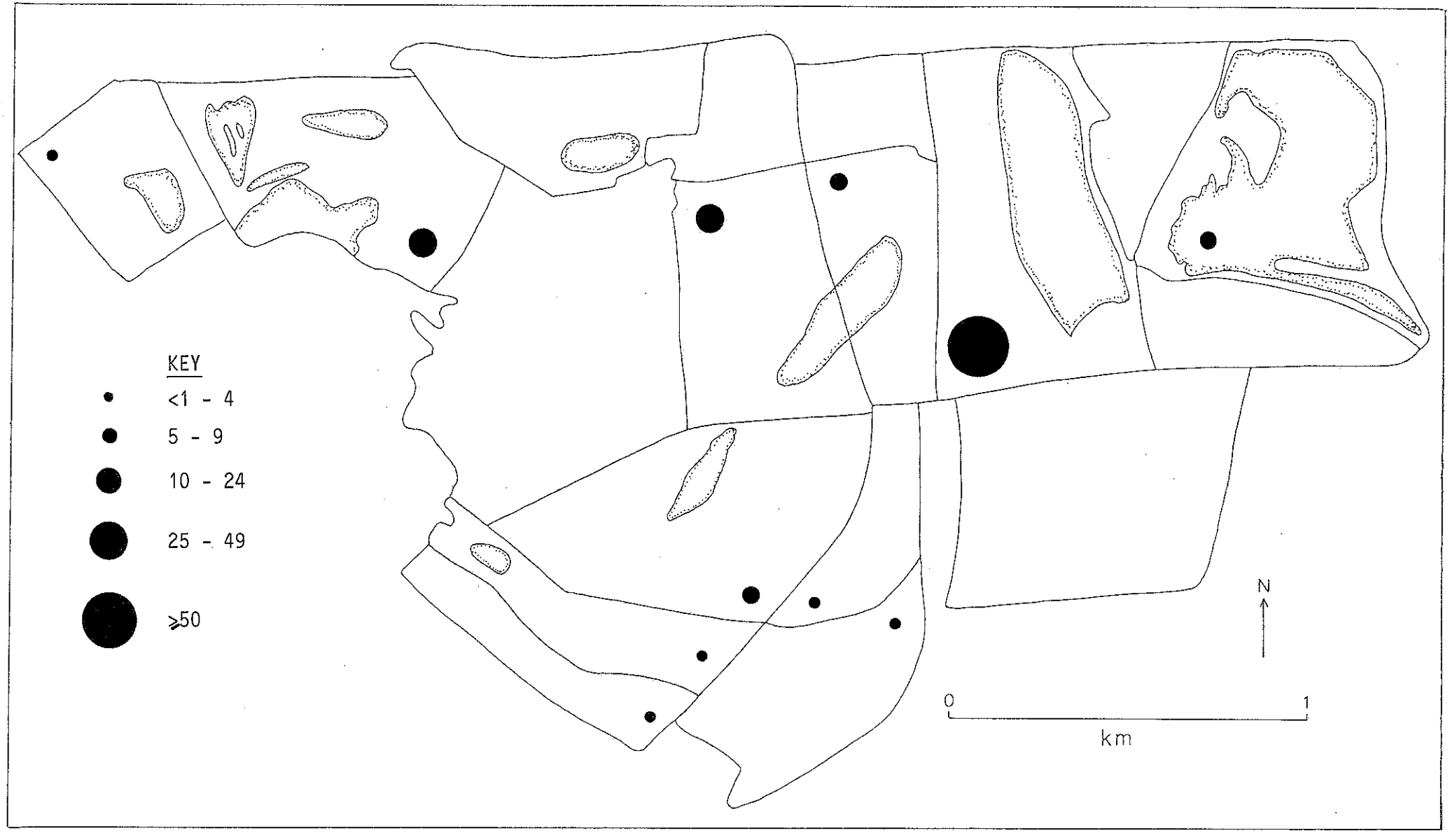


Figure 3.3.1 The average number of Teal seen in each count area per day between mid-December 1990 & mid-March 1991.

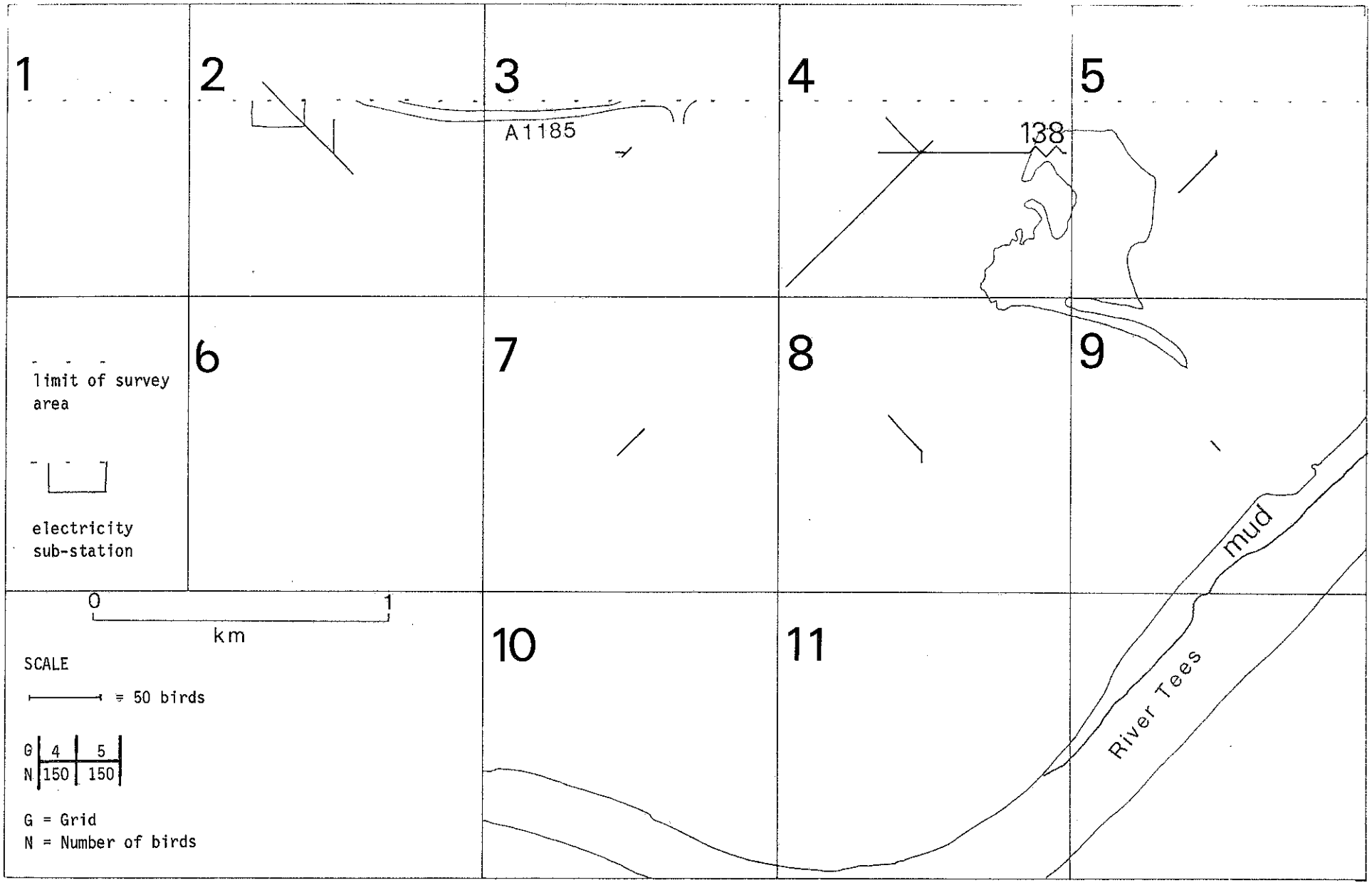


Figure 3.3.2 The total number of Teal flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

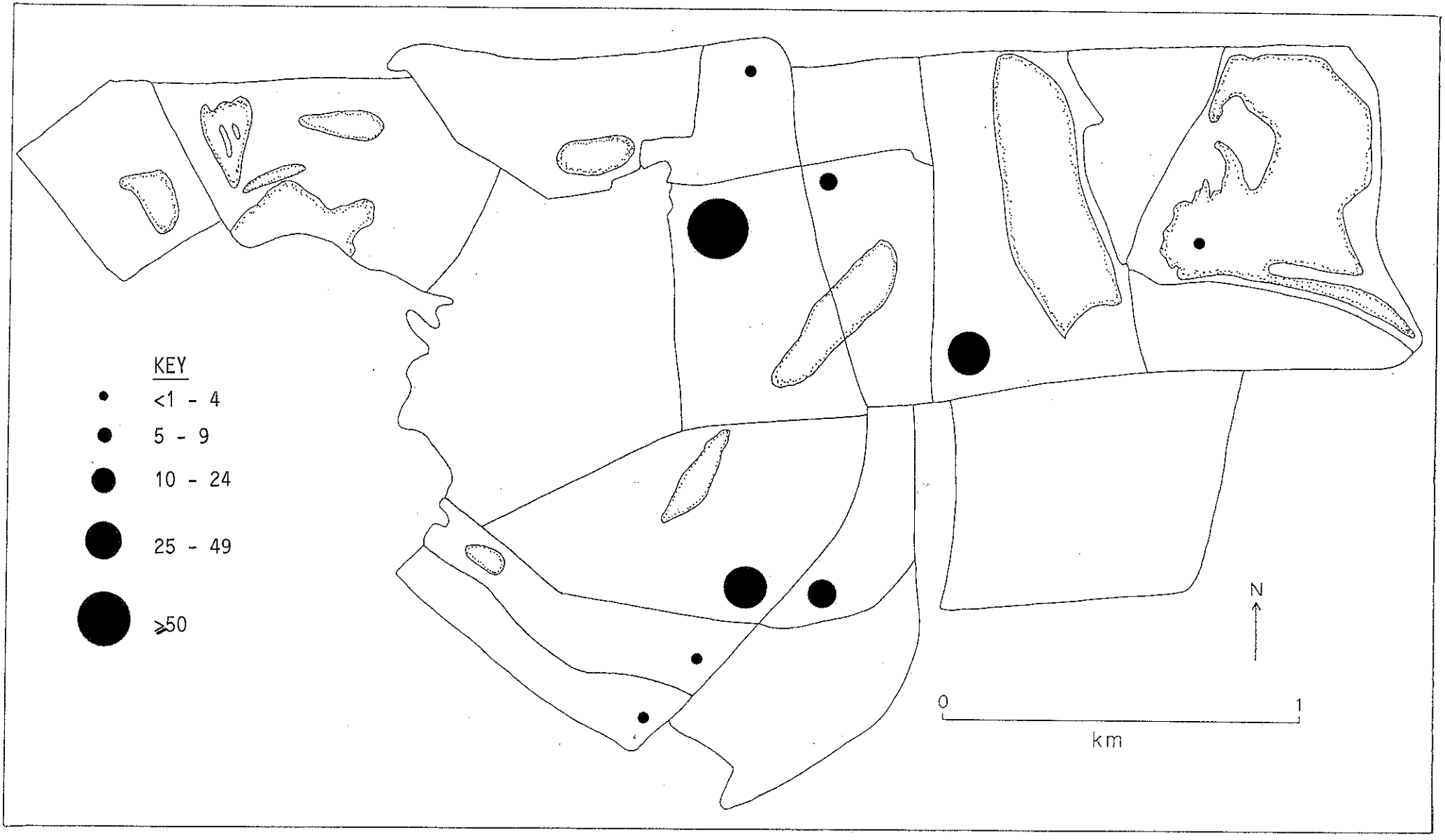


Figure 3.4.1 The average number of Curlew seen in each count area per day between mid-December 1990 & mid-March 1991.

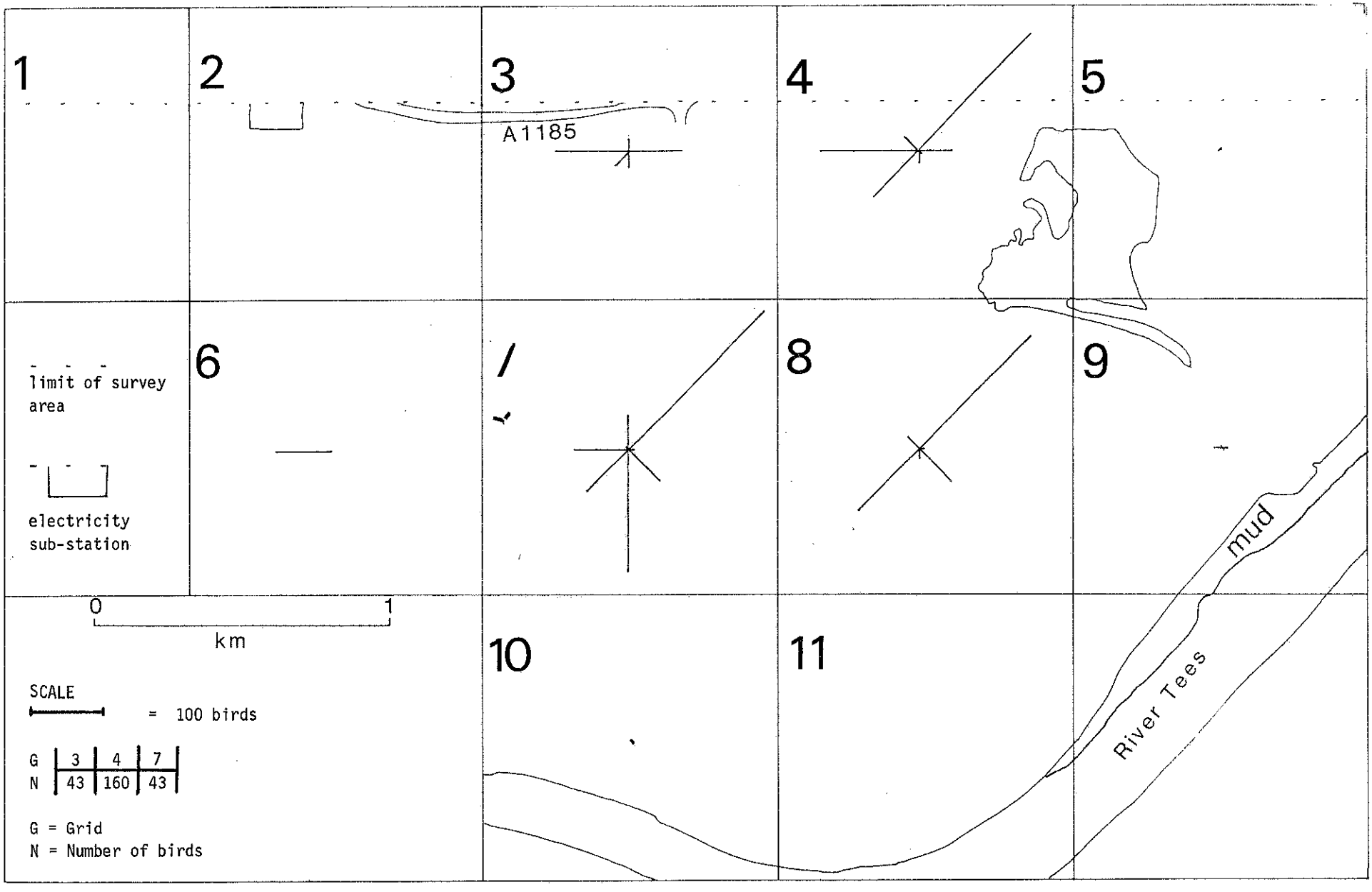


Figure 3.4.2 The total number of Curlew flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

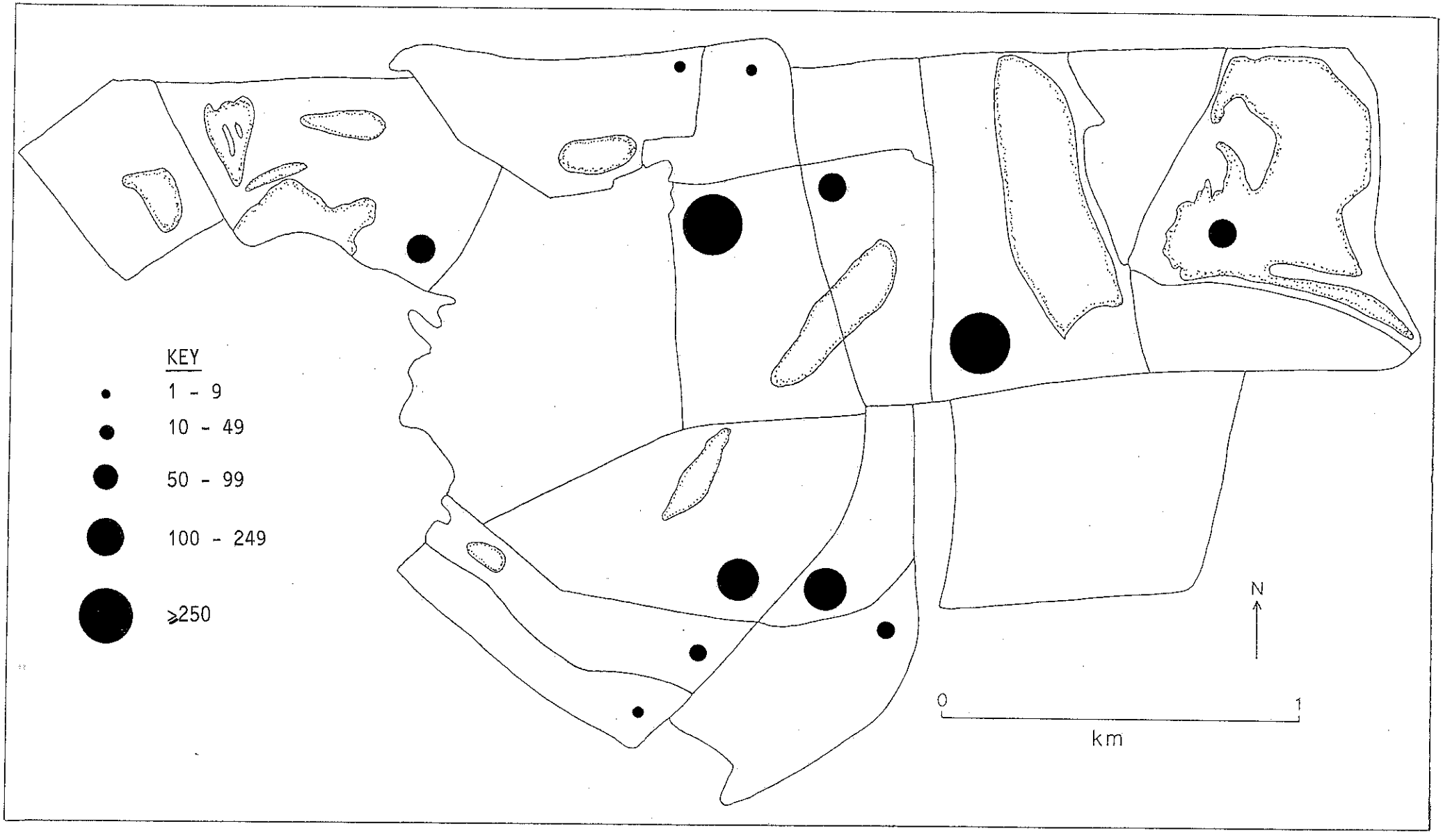
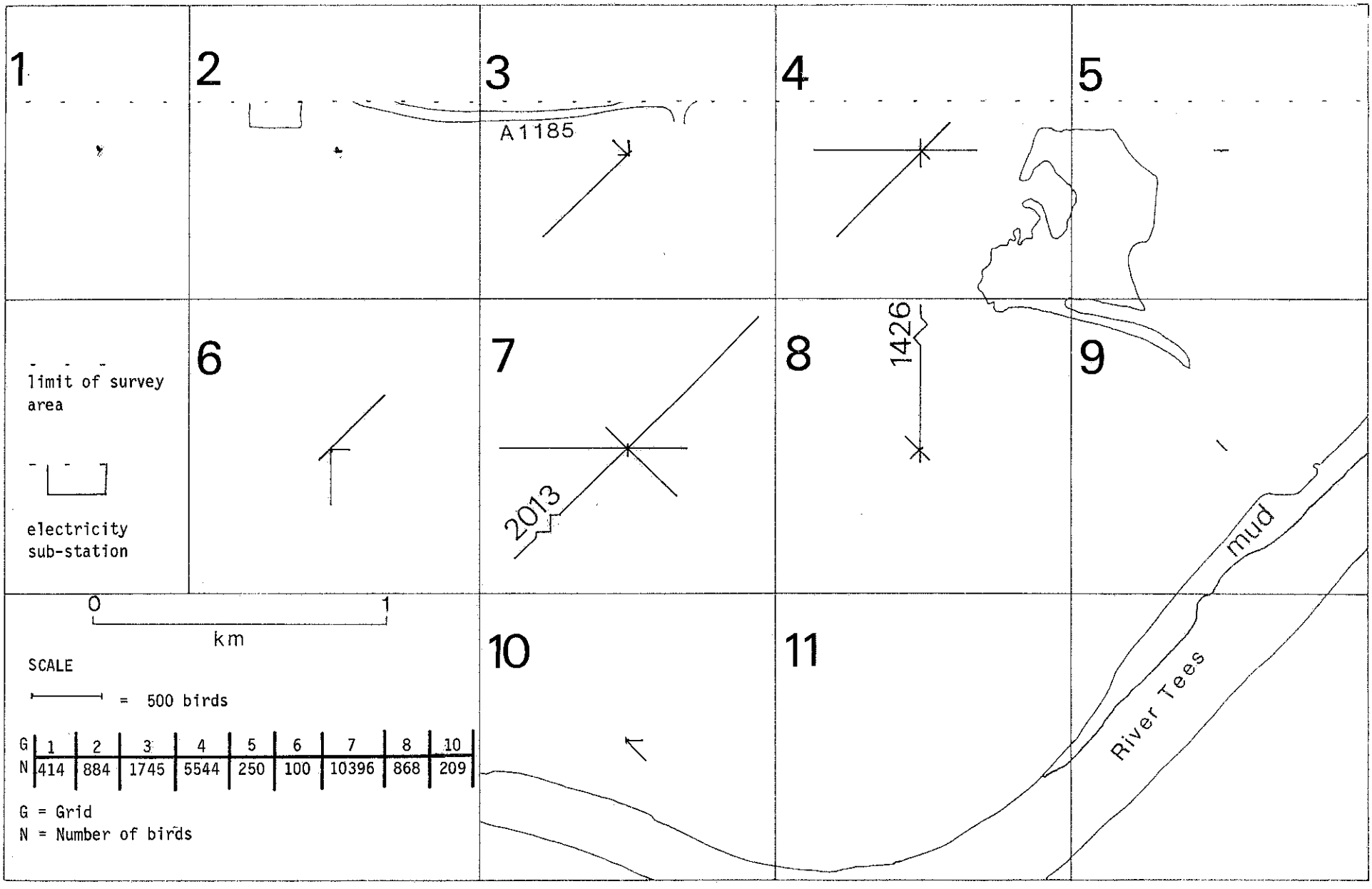


Figure 3.5.1 The average number of Lapwing seen in each count area per day between mid-December 1990 & mid-March 1991.



G	1	2	3	4	5	6	7	8	10
N	414	884	1745	5544	250	100	10396	868	209

Figure 3.5.2 The total number of Lapwing flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

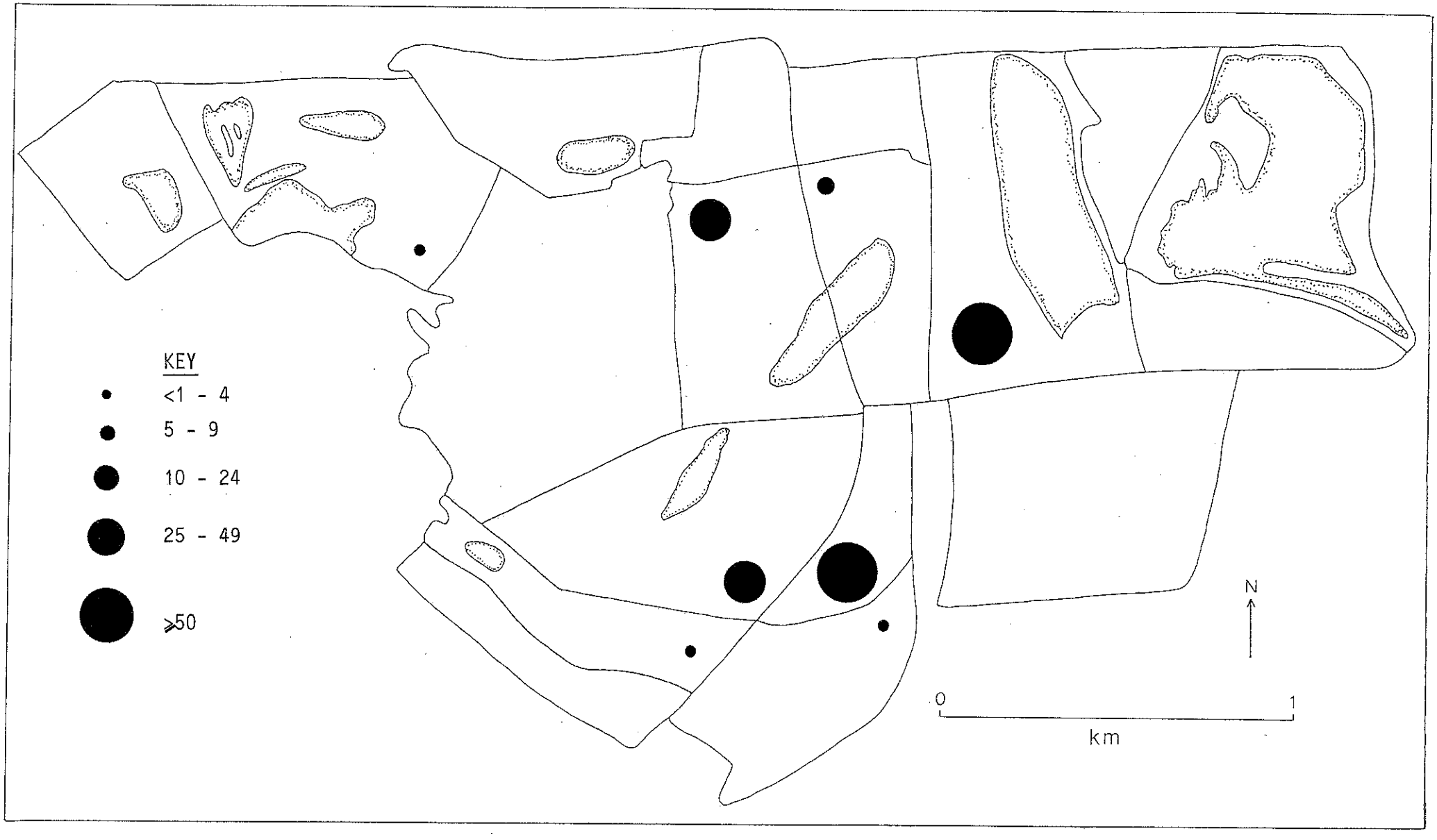


Figure 3.6.1 The average number of Golden Plover seen in each count area per day between mid-December 1990 & mid-March 1991.

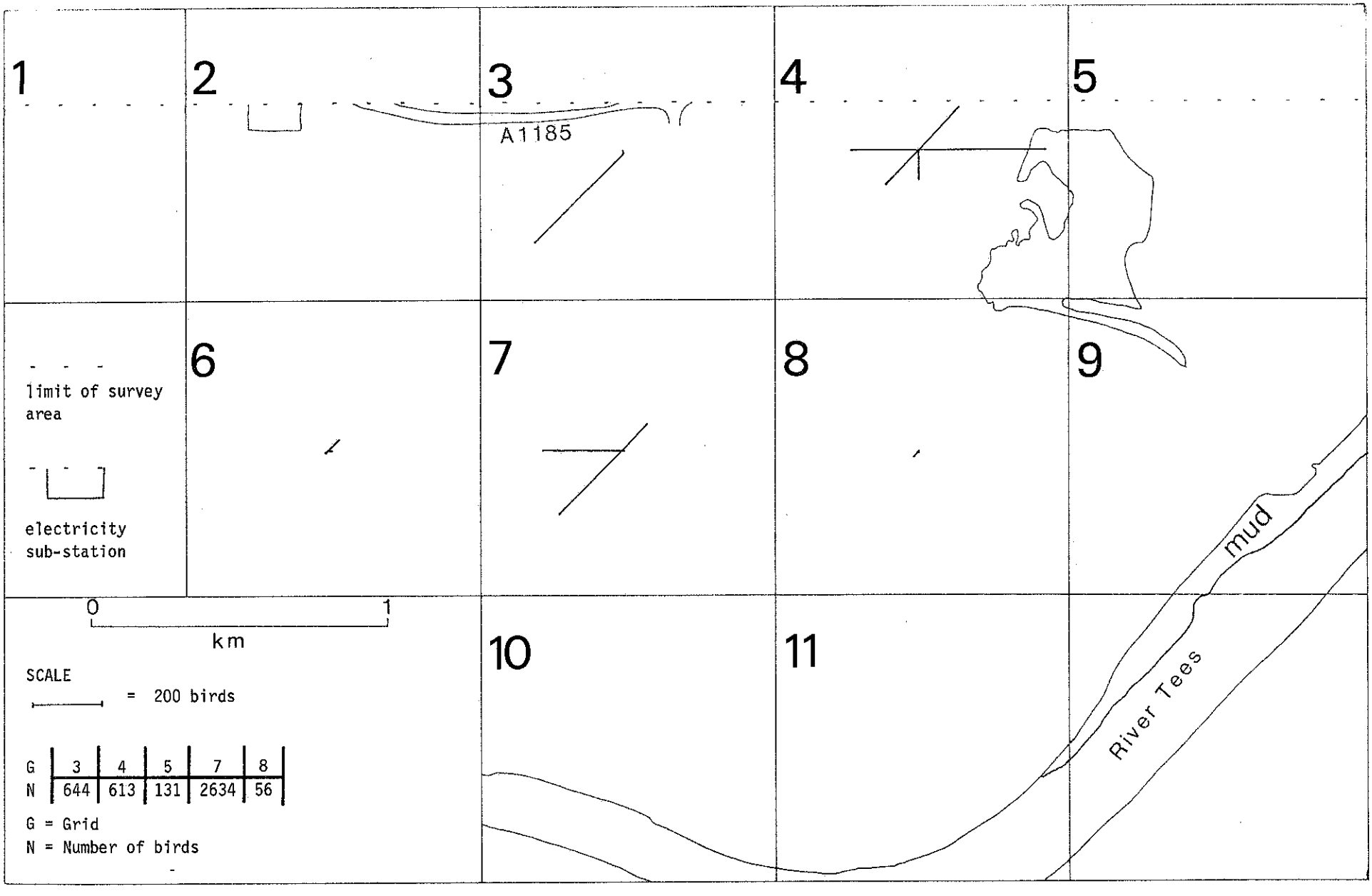


Figure 3.6.2 The total number of Golden Plover flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

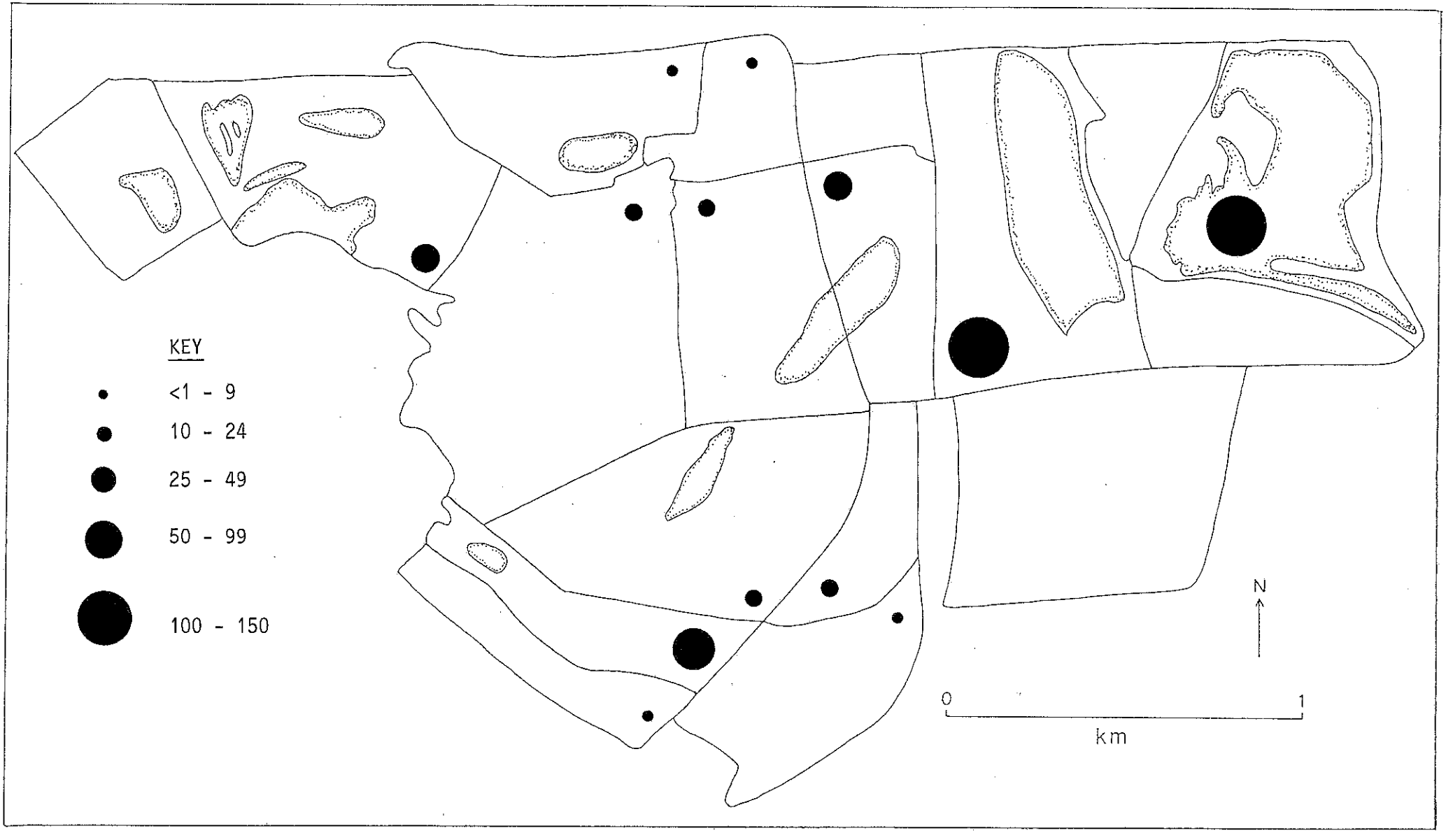


Figure 3.7.1 The average number of Black-headed Gull seen in each count area per day between mid-December 1990 & mid-March 1991.

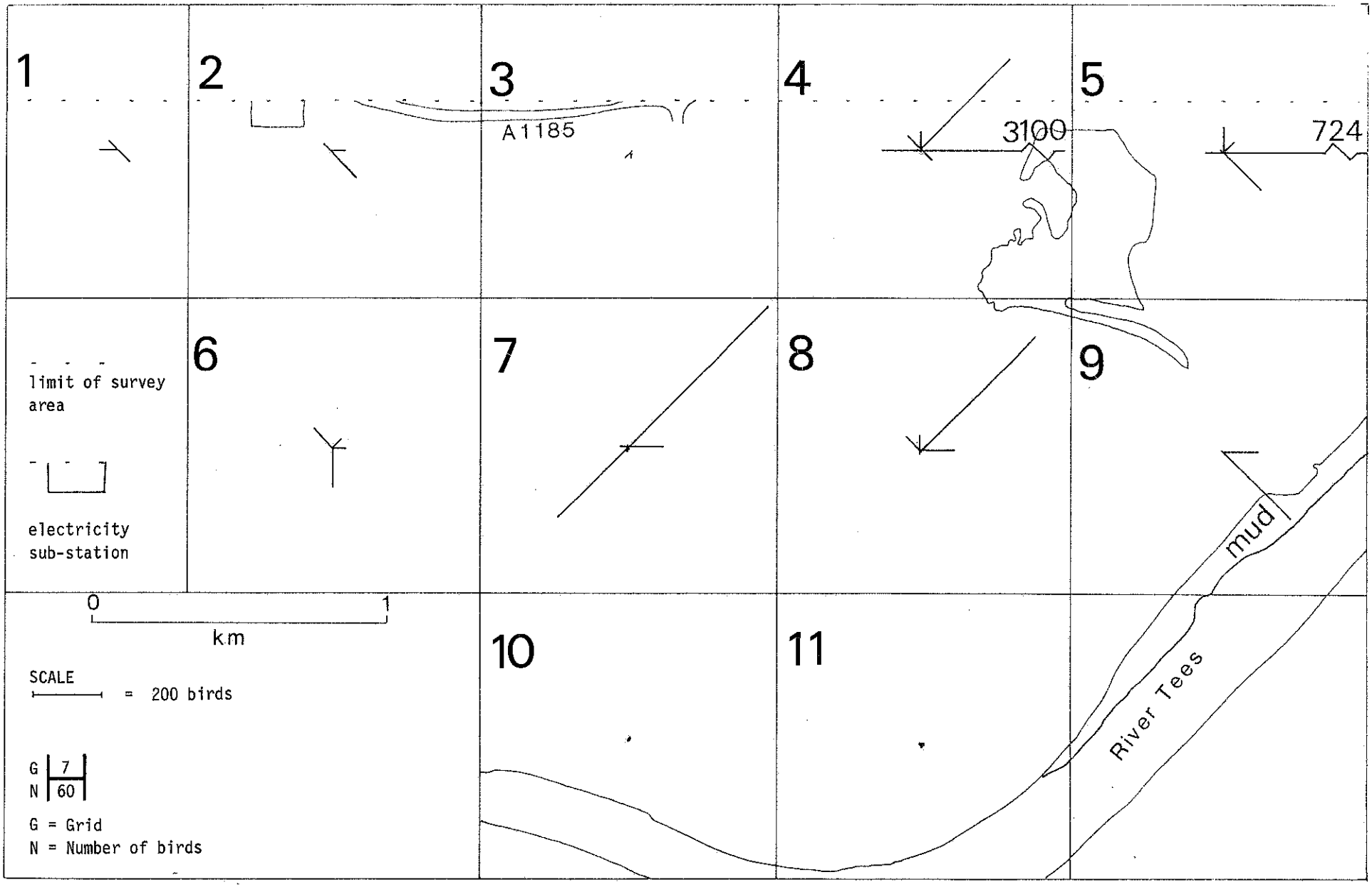


Figure 3.7.2 The total number of Black-headed Gull flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

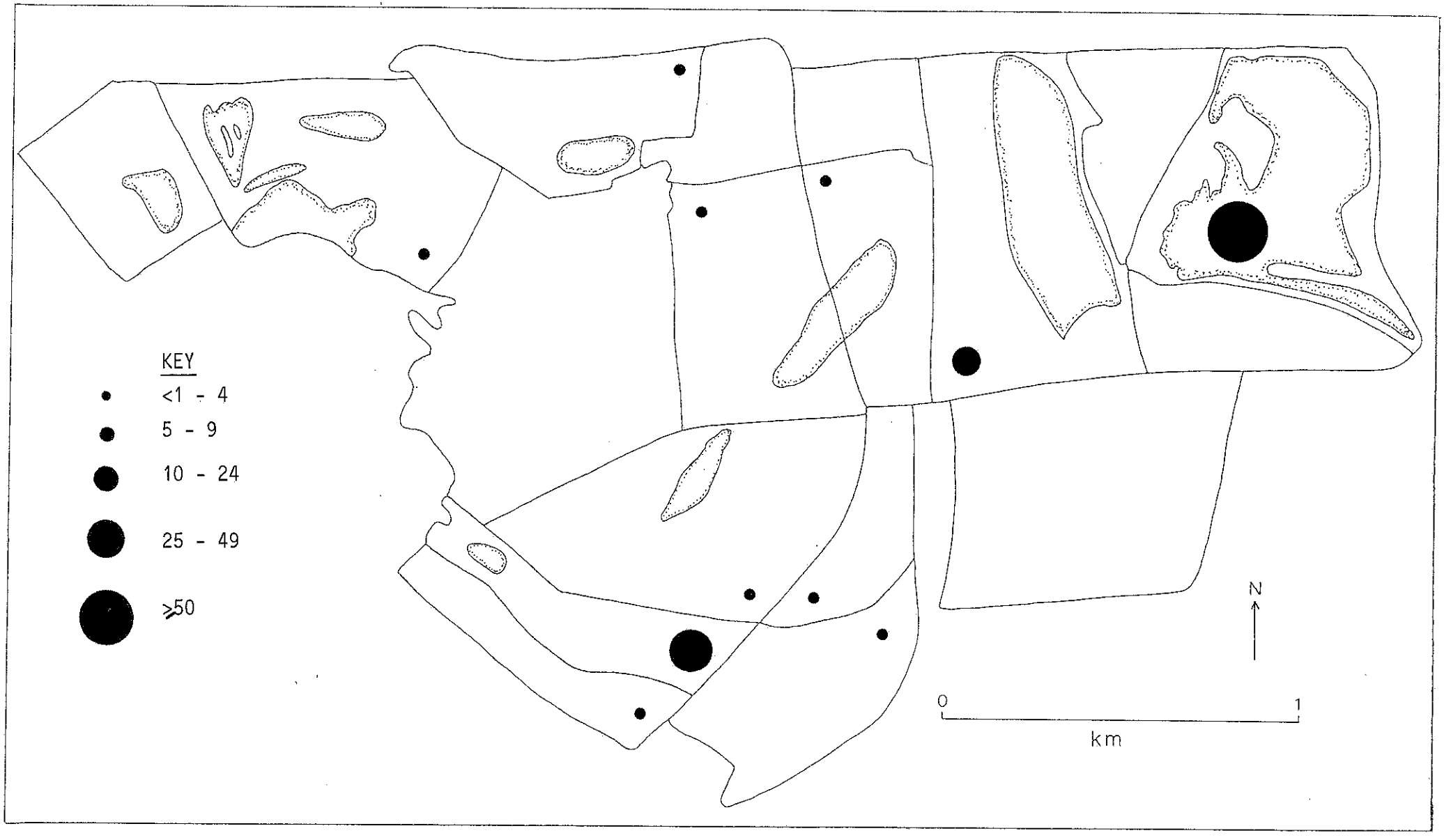


Figure 3.8.1 The average number of Common Gull seen in each count area per day between mid-December 1990 & mid-March 1991.

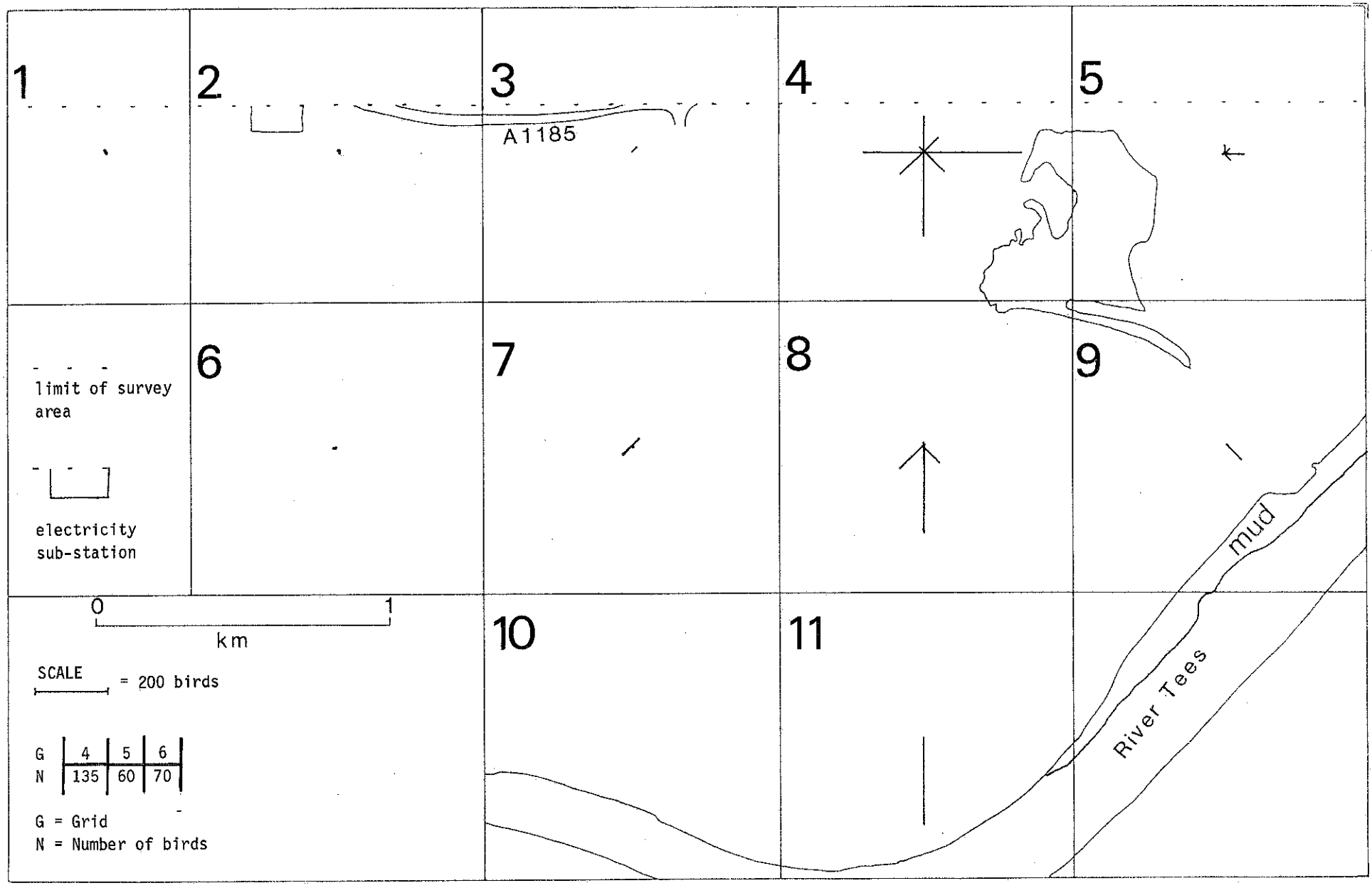


Figure 3.8.2 The total number of Common Gull flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

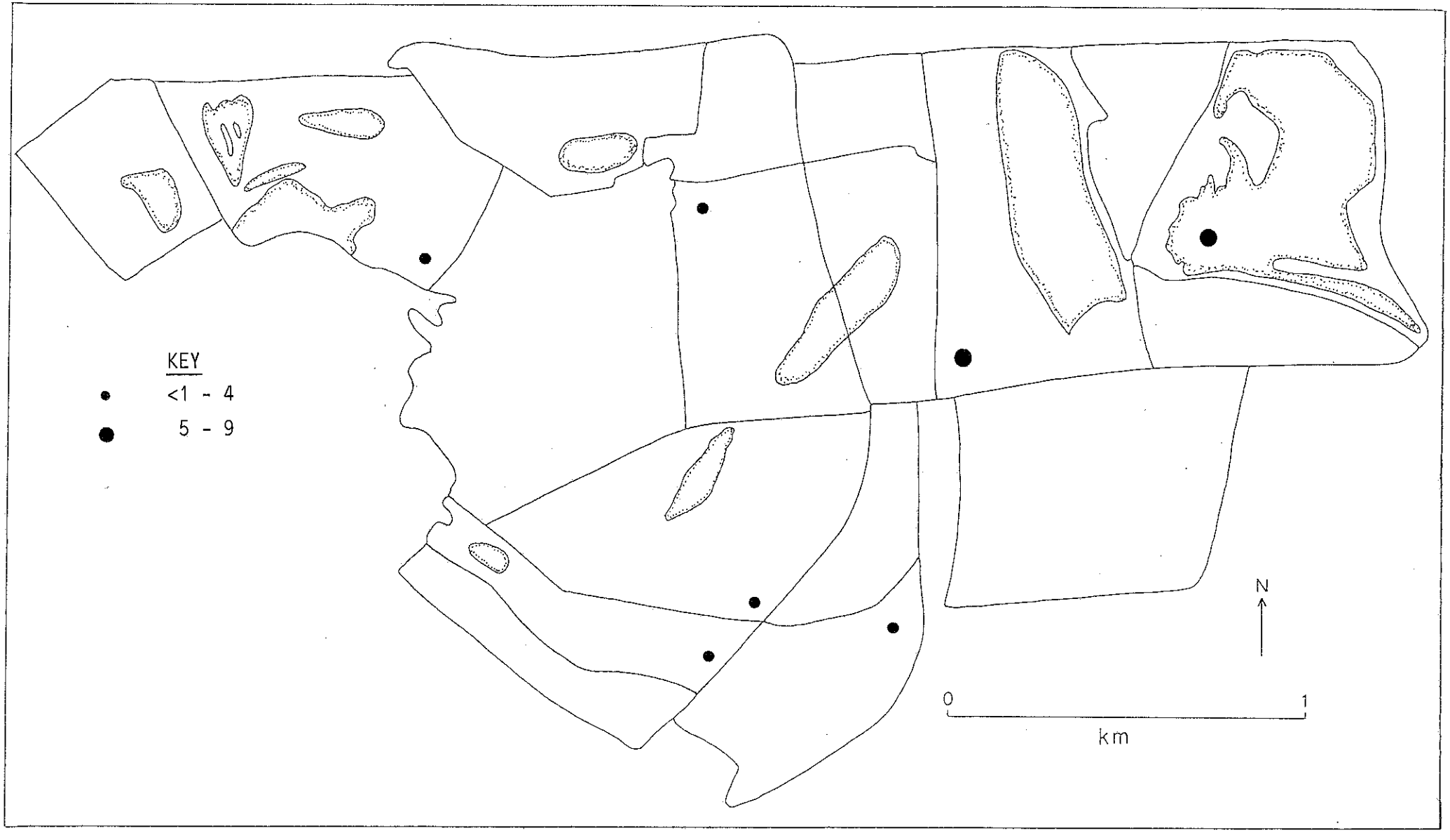


Figure 3.9.1 The average number of Herring Gull seen in each count area per day between mid-December 1990 & mid-March 1991.

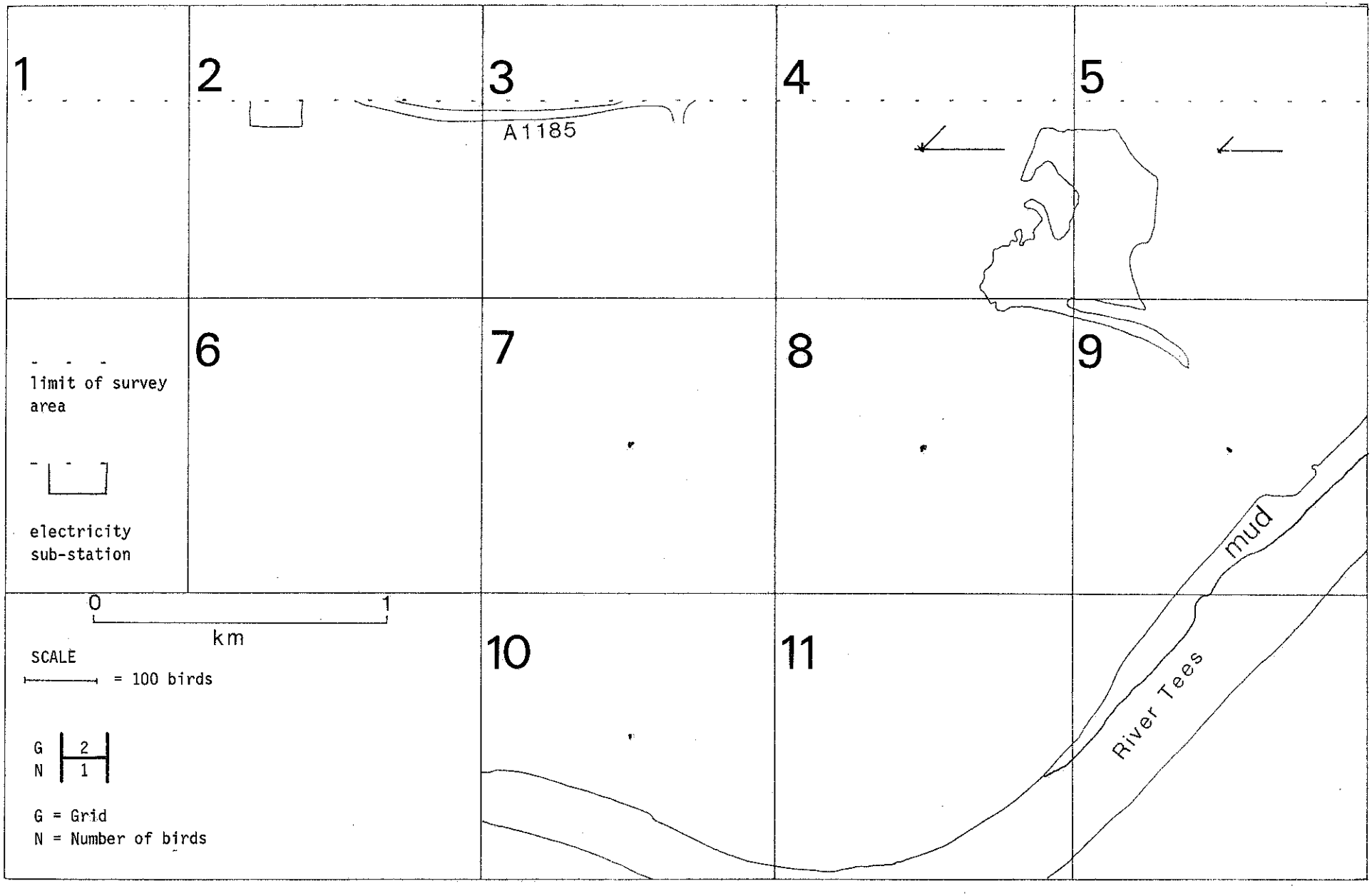


Figure 3.9.2 The total number of Herring Gull flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

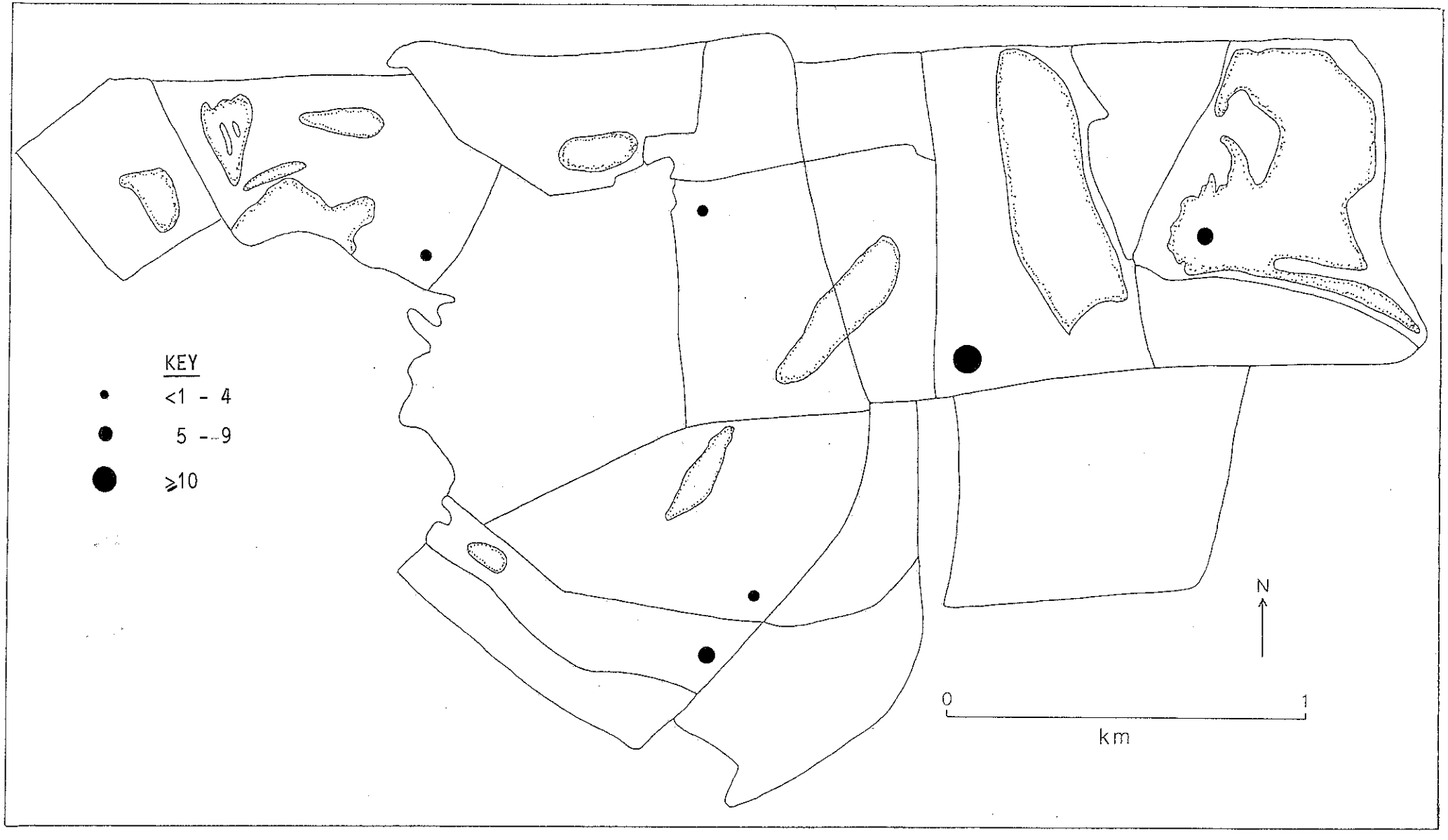


Figure 3.10.1 The average number of Great Black-backed Gull seen in each count area per day between mid-December 1990 & mid-March 1991.

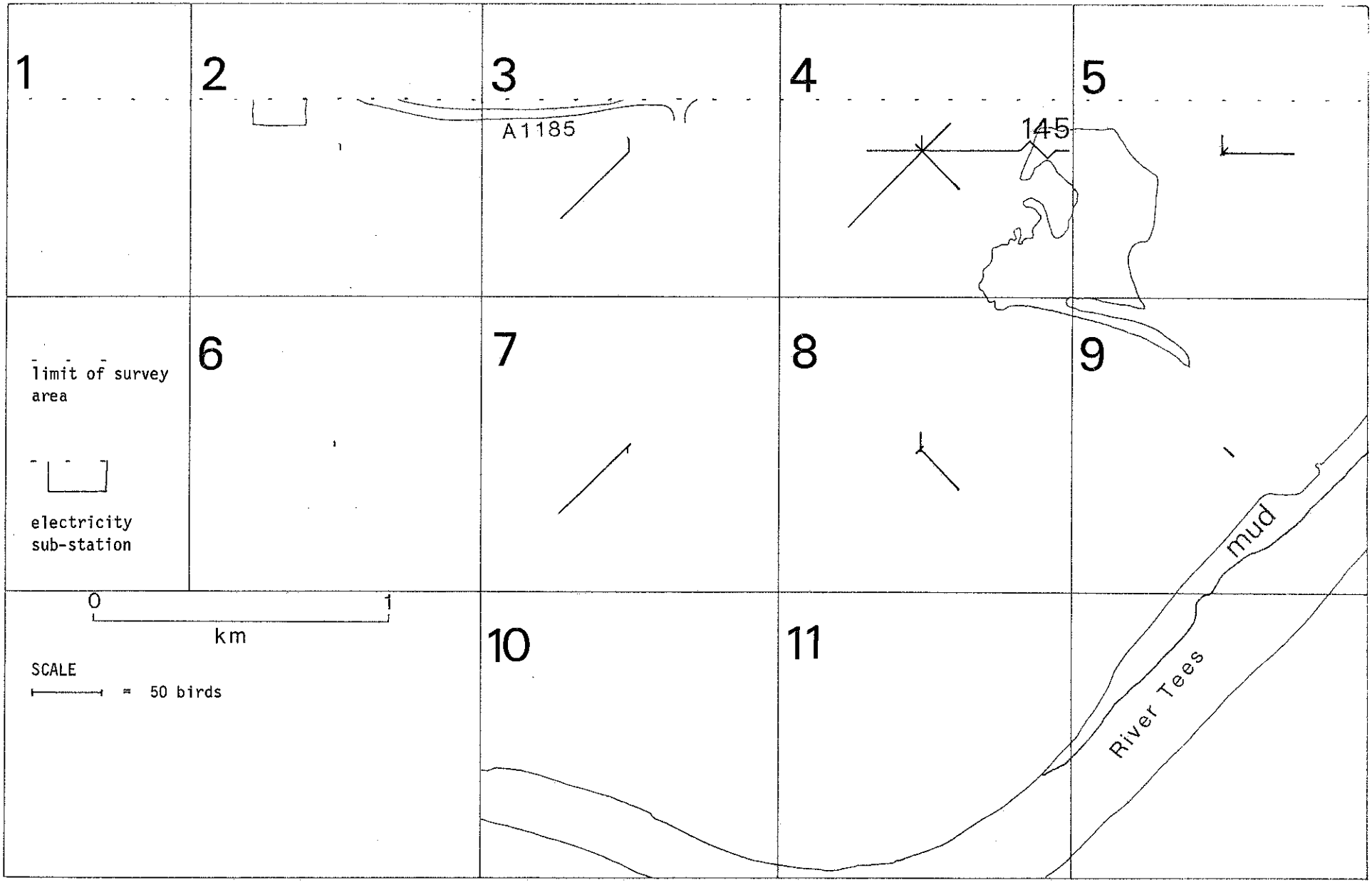


Figure 3.10.2 The total number of Great Black-backed Gull flights made in each direction at a height of 7m to 50m across the study site between mid-December 1990 and mid-March 1991.

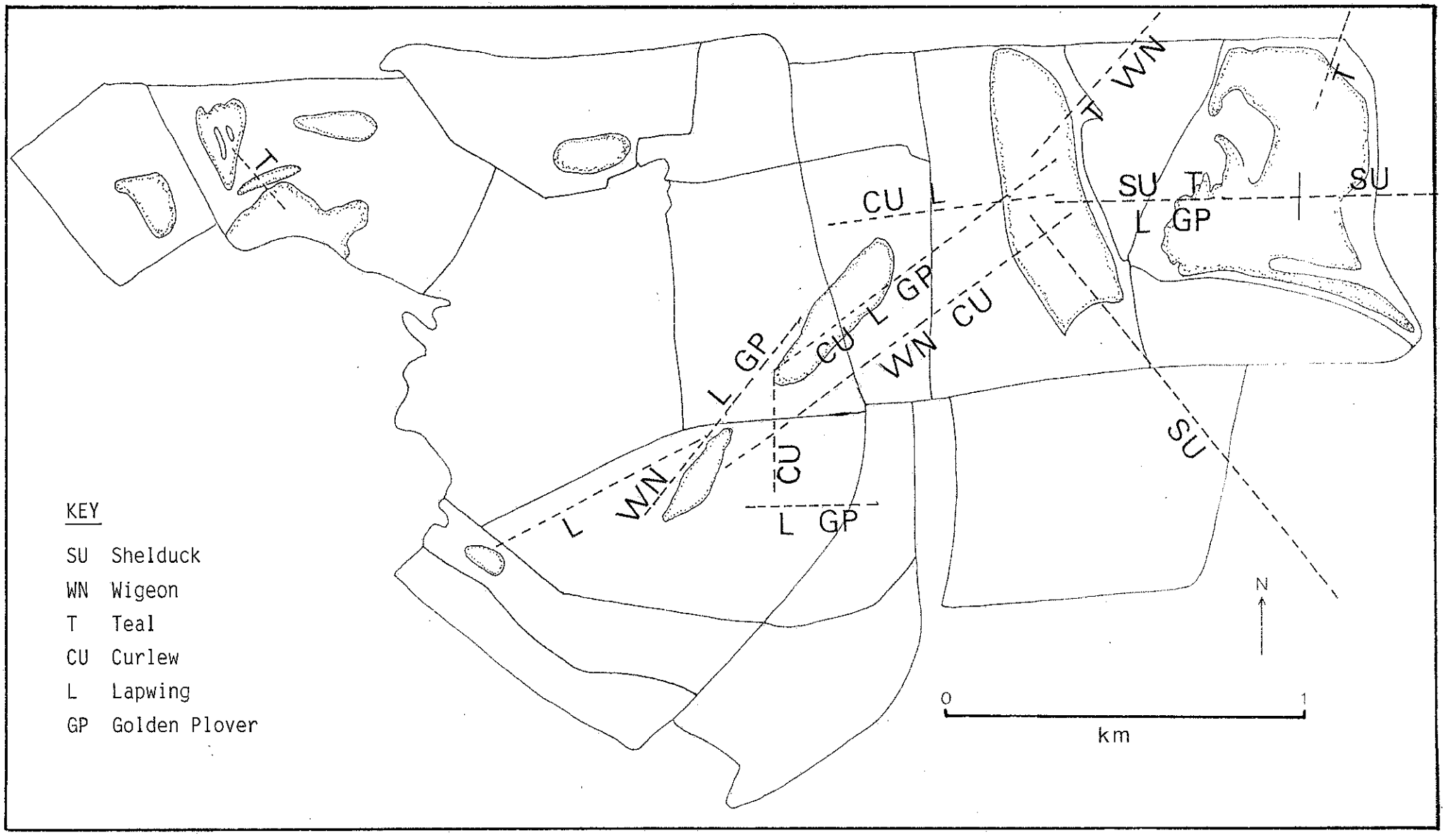


Figure 5.3 Summary of the major flight paths of the wader and wildfowl key species, mid-December 1990 to mid-March 1991.

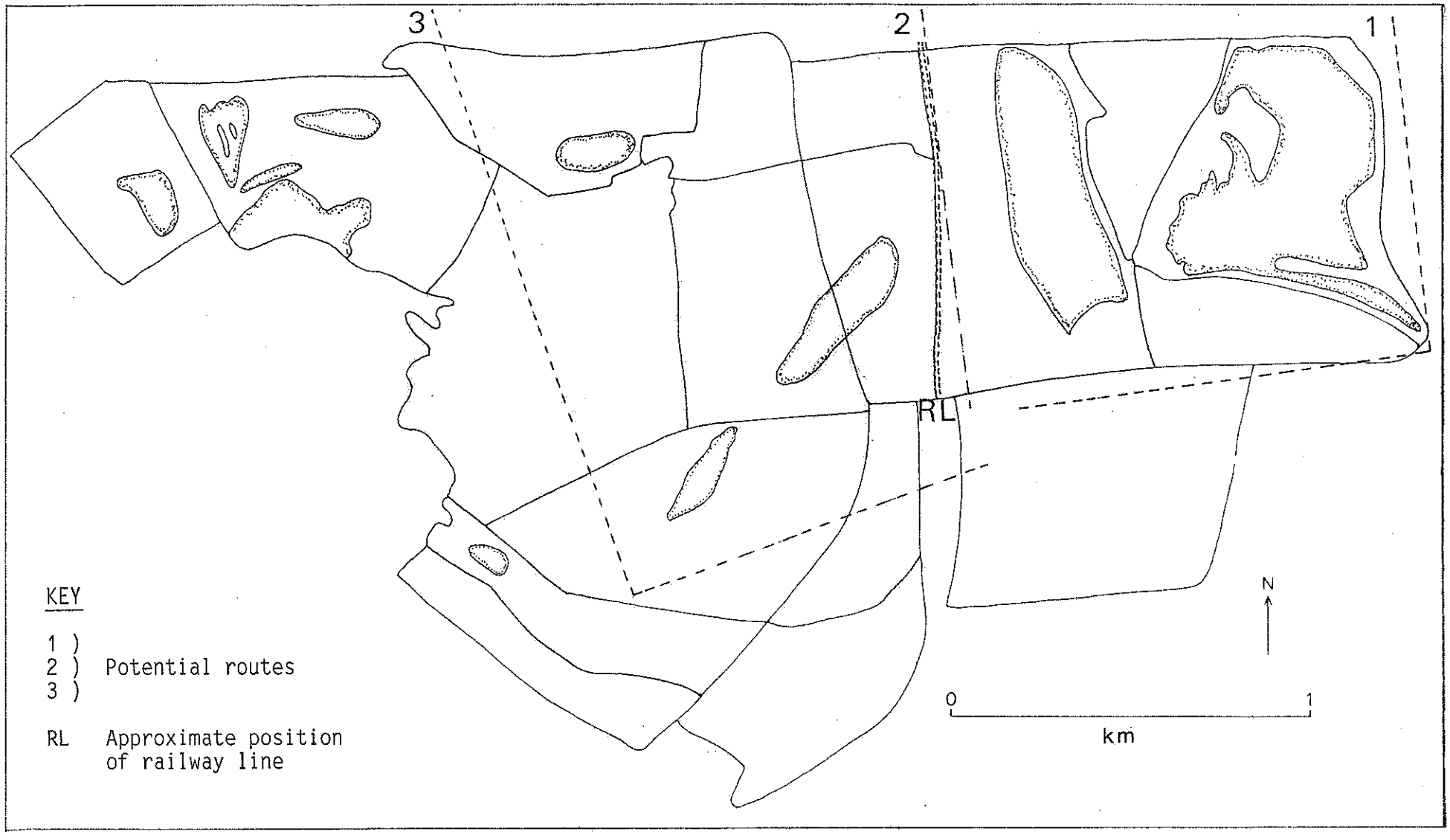


Figure 5.8 Three potential routes for the proposed power transmission lines.

APPENDIX 1

The total number of birds using the study site during each day of fieldwork (mid-December 1990 and mid-March 1991).

	14.12	17.12	21.12	4.1	11.1	14.1	25.1	28.1	15.2	18.2	21.2	25.2	12.3	15.3	17.3
Key Species															
Shelduck	12	180		24	240	31	36	69	18	107	67	41	87	107	133
Wigeon	310	320	340	750	500	200	400	260			500	525	634	100	98
Teal	130	80	150	230	40	25	35	60	62	71	90	140	113	100	178
Curlew	100	70	115	145	230	33	321	164	11	43	85	77	182	251	233
Lapwing	3000	2750	3500	60	2000	750	600	400	81	240	900	800	300	130	220
Golden Plover	400	800	550	50	12	50	204	5		1	31	52	30	44	1
Black-headed Gull	600	220	1700	3550	150	236	138	270	860	550	2200	400	310	330	44
Common Gull	12	6	30	11	30	11	42	30	47	50	35	75	300	325	1287
Herring Gull	4	10	70	2	50	1	5	38	3	12	30	3	15	9	48
Great Black-backed Gull	3	30	110	180	75	1	1	84		3	33		2	1	6
Other Species															
Little Grebe						2				1	1	1	3	4	2
Heron	1									1			2	1	
Mute Swan			1			8	2	2	5		2	1	4	2	5
Whooper Swan				2	2		2		2	2	2	2	3	3	3
Canada Goose													1		
Ruddy Shelduck				1	1	1									
Mallard	50	45	42	36	30	9	26	49	54	65	18	7	34	32	49

APPENDIX 1

The total number of birds using the study site during each day of fieldwork (mid-December 1990 and mid-March 1991).

Other Species (Cont)	14.12	17.12	21.12	4.1	11.1	14.1	25.1	28.1	15.2	18.2	21.2	25.2	12.3	15.3	17.3
Pintail	1		2		1		1	2			16	7	6	1	3
Shoveler	35	7	25		14	25	14	3	6	20	14	20	36	26	34
Pochard			2		3		7	1	2	1	3	4	24	9	6
Tufted Duck								5	4	4	12	3	13	6	10
Scaup											1				
Sparrowhawk			1				1								
Kestrel	1			1	1	1	2	1	2	1	1	1	1	1	1
Merlin												1			
Peregrine							1								
Red-legged Partridge				8		4									
Grey Partridge	15	6	5					4	9	6			2	1	2
Moorhen	13	23	23		7	8	16	25	18	19	23	9	4	2	4
Coot	4	4	2		5	27	26	30	19	38	46	44	39	51	49
Ringed Plover												3	3	3	3
Knot													1		
Dunlin	88	15	45		37	130	56	25	4	97	109	76	28	38	32
Ruff	3	4	3	2	9	8	15	9			9	7	10	10	10
Snipe	19	6				10	1			2				5	2
Redshank	11	4	30	4	80	38	8	33	3	55	87	96	130	100	75

APPENDIX 1

The total number of birds using the study site during each day of fieldwork (mid-December 1990 and mid-March 1991).

Other Species (Cont)	14.12	17.12	21.12	4.1	11.1	14.1	25.1	28.1	15.2	18.2	21.2	25.2	12.3	15.3	17.3
Lesser Black-backed Gull											1			3	3
Feral Pigeon				8	19	20	50	19			22			9	18
Stock Dove	19	18	20	2	5	1			10	7			33		7
Woodpigeon												3	10	10	16
Skylark				5	4	5		5			1	1	4	3	8
Meadow Pipit					1										
Pied Wagtail						1					1				
Wren							1			1					
Robin						1									
Blackbird	1	1	1			1		1					1		
Fieldfare					110	30									
Blue Tit				2		1	3								
Magpie		2	5	11	3	2	2	3	1	4	5		2	2	3
Carrion Crow	1	1		3	6	3	2	2	2	8	3	4	1	2	1
Starling	550	200	1000	200	550	538	340	80	120	130	200	180	650	100	100
Greenfinch						2									
Goldfinch				3		24	4	21	15		1				
Linnet			2												
Reed Bunting									1						

APPENDIX 2

The numbers and directions of flight of the key species flying at <7m and >50m (mid-December 1990 - mid-March 1991)

	SHELDUCK				WIGEON					
	Grid				Grid					
Direction	4	5	8	9	2	3	4	5	7	8
N <7	5									
N >50							200			
NE <7	10						480		365	
NE >50		26				725	820		920	295
E <7	78	17					13			
E >50	31	31					211	8		
SE <7	57	2						3		
SE >50	10	1	40	66	90			3		
S <7	2	1								
S >50										
SW <7	5						10		300	
SW >50							255		245	245
W <7	63	18	9				100	120		
W >50	17	14		9			120			
NW <7	199	2	8							
NW >50			60	38						
CIRCLING <7							172			
CIRCLING >50							170			

APPENDIX 2

The numbers and directions of flight of the key species flying at <7m and >50m (mid-December 1990 - mid-March 1991)

TEAL

Direction		Grid 2	3	4	5	6	7	8
N	<7	25		12	7			
	>50	25		1	1			
NE	<7			11			21	
	>50		5	11		32	16	42
E	<7			138				
	>50	20		35	6			
SE	<7	20						
	>50	20					32	
S	<7			3			8	
	>50							
SW	<7			160	40		7	
	>50		7	140			2	
W	<7		7	183	1			
	>50		7	56				
NW	<7	75		37				
	>50	75						
CIRCLING	<7							
	>50							

CURLEW

Direction		Grid 3	4	5	6	7	8	9	10
N	<7	17				32			
	>50								
NE	<7		225	1		281			
	>50		4			1	1		
E	<7	80	13				8		
	>50								
SE	<7		25			65	38		4
	>50	1	3	1		5	68	66	
S	<7		15			153	1		
	>50		6			13	14		
SW	<7		26	5		51	42		2
	>50		10			52	64		11
W	<7	100	148		80	80			
	>50	100	102				2	2	
NW	<7		24			2			
	>50					2	24	22	
CIRCLING	<7	43	130			43			
	>50		60			60			

APPENDIX 2

The numbers and directions of flight of the key species flying at <7m and >50m (mid-December 1990 - mid-March 1991)

LAPWING

	Grid										
Direction	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
N <7			98	90			19	2018		17	
N >50							18	1406		17	1332
NE <7			12	264		510	1279				
NE >50			14	389		245	1203	135			
E <7	10			410	50	155	510			110	
E >50				83		130	145			150	150
SE <7				94		10	500	8		150	
SE >50							189	133		160	39
S <7			30	119		400	28			16	
S >50						400	64	101		22	
SW <7			653	661		120	1832				
SW >50			20	360			1001	361			
W <7			70	721	72		900	5			
W >50				443	128		700	100			
NW <7	60	60	150	20			210	153			
NW >50	60							20	20		
CIRCLING <7	414	884	1745	6060	250	100	10396	412		209	
CIRCLING >50	250	720	120	5459	839	100	5626	792		309	

APPENDIX 2

The numbers and directions of flight of the key species flying at <7m and >50m (mid-December 1990 - mid-March 1991)

	GOLDEN PLOVER							COMMON GULL							
	Grid							Grid							
Direction	3	4	5	6	7	8	10	2	3	4	5	6	7	8	9
N <7	10														
N >50															
NE <7		176		49	80					32	7		7		
NE >50		201		25	134	60			1	13	11		27	6	
E <7		380		8						178	35	1	1		
E >50		230			8				33	275	200		7		1
SE <7								6		38	10				2
SE >50		25	25							17	9			19	19
S <7		90								255					
S >50		80			80										
SW <7	370	80		12	245					72	72		33		
SW >50	80	168			88	88				3			11	75	
W <7		200			235	11				176	65				
W >50		200			200					84	3				
NW <7										18					
NW >50	20									16				16	16
CIRCLING <7	644	604	130		2634	47				135	60	70			
CIRCLING >50	4	626	157		1425	74	40			135					

APPENDIX 2

The numbers and directions of flight of the key species flying at <7m and >50m (mid-December 1990 - mid-March 1991)

BLACK-HEADED GULL

	Grid									
Direction	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
N <7			16	43	80		5	11		
>50		1			80			43		
NE <7				22	5	40	716	3		
>50		10	145	221	64	11	363	199	1	
E <7		24		2986	180	26	108	90	60	
>50	27	43	170	1899	1620		32	109	36	
SE <7		82		99	300	7				7
>50	10	12		113	54			60	37	
S <7				8		112	13	1		
>50			4	1		102	4	2		
SW <7							288			
>50			72	75	2		162	3		
W <7		2		90	19		5			
>50				15	1					
NW <7		1		55	1	55				
>50				4		55	2	43	2	
CIRCLING <7							52			
>50				1						

APPENDIX 2

The numbers and directions of flight of the key species flying at <7m and >50m (mid-December 1990 - mid-March 1991)

GREAT BLACK-BACKED GULL

Direction		Grid 3	4	5	7	8	9	10
N	<7		11	12				
	>50			12		10		
NE	<7		29		2			
	>50	1	70	9		2		
E	<7		145	13				
	>50	3	114	11			1	
SE	<7		38	1		1		
	>50			1		32	33	
S	<7		1		4			
	>50							6
SW	<7		74					
	>50							
W	<7		42					
	>50				1	1	1	
NW	<7		6	5				
	>50							
CIRCLING	<7							
	>50							

HERRING GULL

Direction		Grid 2	3	4	5	7	8	9	10
N	<7			2					
	>50			2			2		
NE	<7			48	9		1		
	>50		5	42	57	6	6	5	2
E	<7			105	9				
	>50		4	88	66	2	3	3	
SE	<7			5	1				
	>50		2	5			3	2	
S	<7					1			
	>50		1			1			
SW	<7			4	1				
	>50		5	4	1	33	1		
W	<7			12	4				
	>50					3	3	3	
NW	<7				7				
	>50			5			5	5	
CIRCLING	<7	1							
	>50								

APPENDIX 3

The causes of movements in all directions and across all grids of birds recorded flying at between 7m and 50m, mid-December 1990 to mid-March 1991.

SPECIES	Total no of movements	% of movements caused by each factor							
		Roost	Disturbance by predator	Other Disturb.	Tidal	To preen	To feed	Territorial	Other
Shelduck	1016	19		4	74		<1		2
Wigeon	2423	<1		99			<1		<1
Teal	913	<1	18	51	4		11	<1	15
Curlew	2328	47	6	27	8	<1			12
Lapwing	32839	4	9	76	5		<1	<1	6
Golden Plover	6156	3	2	88	1				6
Black-headed Gull	7616	72	2	20	<1	<1	<1		6
Common Gull	2207	62	<1	19	4	5	4		6
Herring Gull	333	90	<1	2	3	2	1		2
Great Black-backed Gull	639	89		9		<1			1