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THE ORNITHOLOGICAL SIGNIFICANCE OF THE MOSTYN DOCKS AREA OF THE DEE ESTUARY TO WILDFOWL AND WADERS

by J.S. Kirby*

A report from the British Trust for Ornithology
to the Nature Conservancy Council and
the Royal Society for the Protection of Birds

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SUMMARY

1. The importance of the Mostyn Docks area, situated on the Welsh side of the Dee estuary, to wintering populations of wildfowl and waders was investigated in relation to a proposed expansion and development of the dock site.

2. The Dee estuary as a whole ranks amongst the top five estuaries in Britain for its wintering wildfowl and waders, and is designated by U.K. government as a site of international importance.

3. Analysis of 1981/82 to 1985/86 Birds of Estuaries Enquiry data shows that the estuary supports internationally important numbers of seven species of waders and three species of wildfowl through the winter months.

4. Appreciable proportions (13-45%) of the total estuary populations of four internationally important species (Shelduck, Oystercatcher, Curlew and Redshank) and Mallard are found within the study area, making the area of particular importance to these species.

5. Mostyn Bank represents the most important feeding area to these species and the majority roost in the vicinity of the Point of Ayr Colliery, although approximately half of the Redshanks roost within Mostyn Docks itself.

6. The area of direct land claim is relatively small (c.5 ha) and will affect an area which currently supports relatively few birds. During reclamation of this area, disturbance to adjacent areas should be kept to a minimum.

7. The construction of groynes however, may potentially have a much greater affect and may conceivably result in declines of the bird populations both within the study area itself and on the estuary as a whole.

INTRODUCTION

Each winter, the Dee estuary attracts many tens of thousands of migratory waders and wildfowl, ranking as one of the most important estuaries in the British Isles. Most of the estuary is scheduled as an SSSI and the site is listed as grade 1* in the Nature Conservation Review (Ratcliffe 1977). In addition, the estuary has been designated by U.K. government as a site of international importance under the Ramsar Convention and the European Commission Directive on the conservation of wild birds. The area is presently threatened by industrial and recreational developments which, if approved, would reduce the available habitat for birds, which in turn might reduce the numbers present.

Mostyn Docks lie on the Welsh side of the Dee estuary, approximately half way between Greenfield and the Point of Ayr (Figure 1). The docks accommodate ships of up to 2,000 tons on spring tides and transport maritime pine, wood pulp, aluminium, steel, scrap metal and sulphur to and from local industry (DECG report 1979). In February 1986, Mostyn Trading Company announced plans to expand the docks and create a new container handling terminal, thus removing 5.26 ha of existing mudflats. The Company also proposed to deepen the main channel to the docks to accommodate larger ships, and to protect the channel from strong tidal currents by the construction of groynes towards the mouth of the estuary (see Figure 1). Apart from the area of direct land claim, the construction of groynes could affect patterns of sedimentation over a much larger area, perhaps affecting the bird populations present. By May 1987, the Company had received planning permission for the docks expansion (affecting 3.2 ha of the SSSI) although the construction of groynes had not been given approval (S.J. Tyler, pers.comm.).

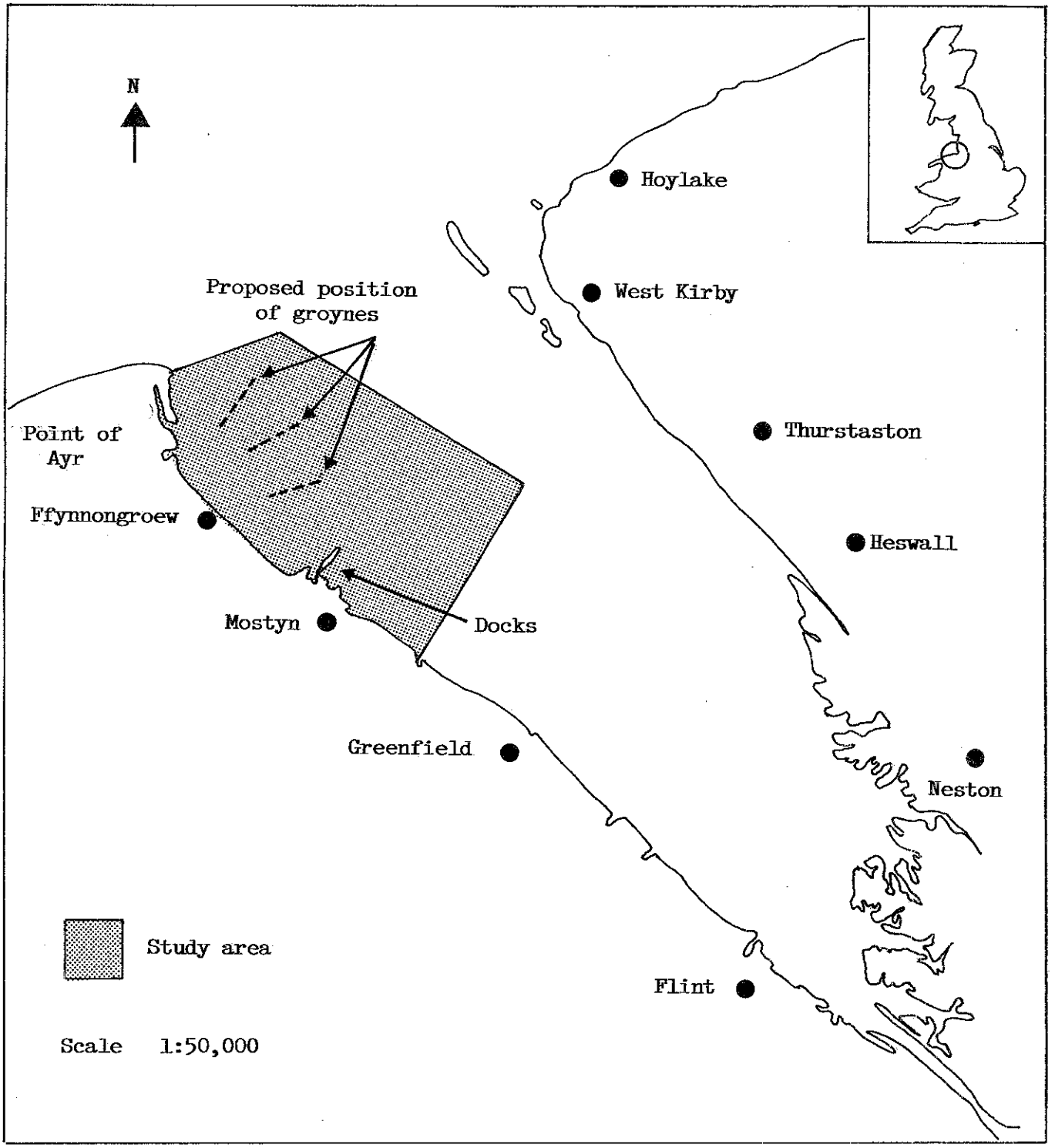


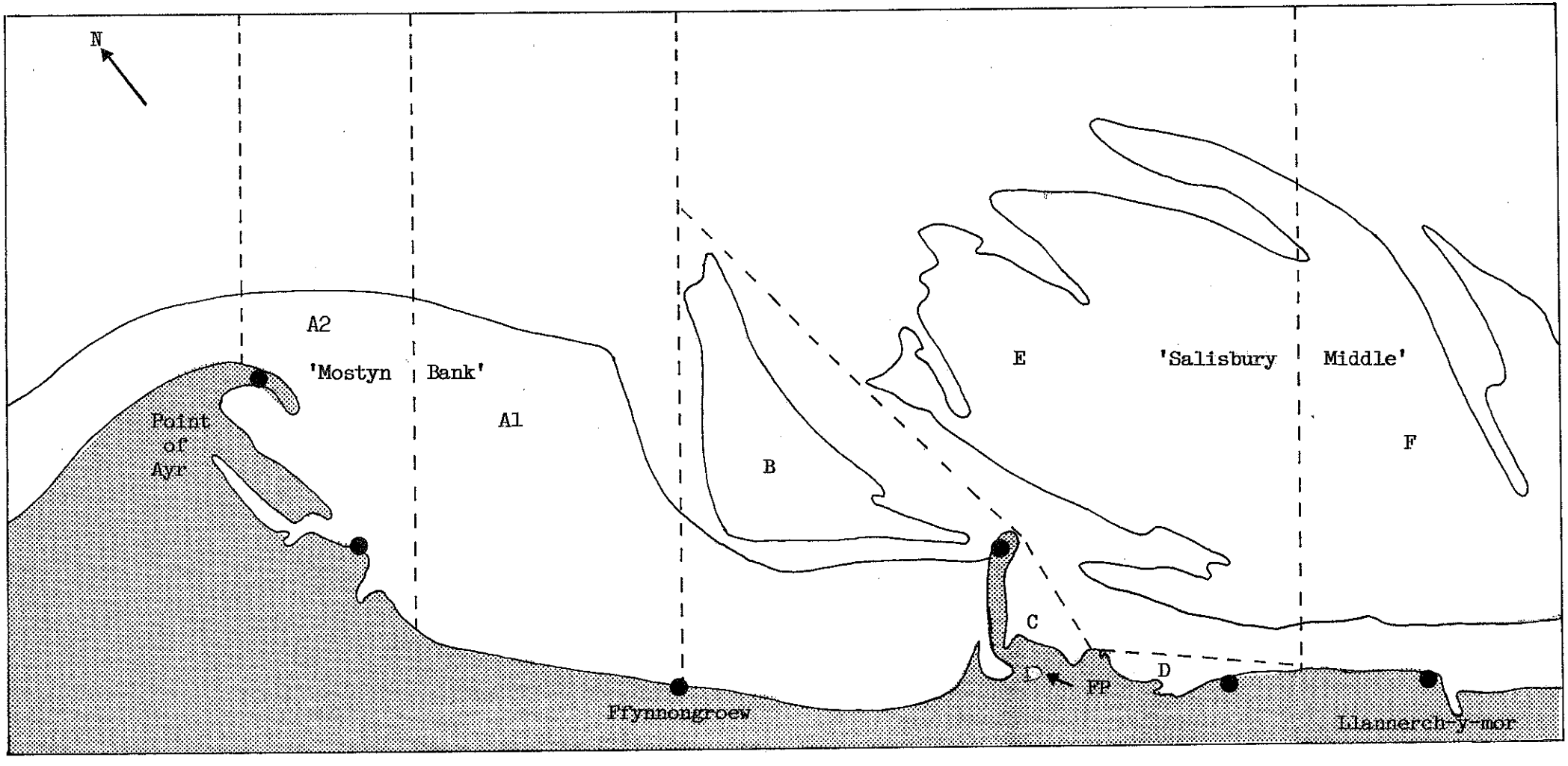
FIGURE 1. Map of Dee estuary showing the position of Mostyn Docks.

The aim of this study was to examine the ornithological significance of the study area in the light of the proposed developments. This involved identifying which species of wildfowl and waders were sufficiently abundant within the study area to warrant further consideration; the distribution of these species was then examined to identify the areas most utilised by them and in this way to see whether the proposed developments would be likely to affect the abundance of these species.

STUDY AREA

The study area (Figure 2) was approximately 1300 ha in area, encompassing the mudflats from Llannerch-y-mor (SJ.178795) north-westwards to the Point of Ayr (SJ.128852). This included the whole of 'Mostyn Bank', the majority of 'Salisbury Middle' and the flushing pool located within the docks.

The study area was divided into seven main sections (A1, A2, B-F), with the flushing pool being recorded separately. Sections A1, A2, C, D and the inner part of B are essentially muddy, whereas the outer part of section B and sections E and F are predominantly sandy. The sections vary considerably in size, approximate areas being as follows: section A1 (256 ha), section A2 (180 ha), section B (248 ha), section C (12 ha), section D (8 ha), section E (320 ha) and section F (280 ha). The flushing pool (FP) is small (2 ha) and very muddy.



KEY ● Observation points.

FIGURE 2. Map of the study area showing recording areas and positions of main observation points.

Field methods

The study area was visited at least once on 18 days between 10 December 1986 and 22 March 1987. Intensive observations, involving repeat counts throughout daylight hours, were conducted on 10-15 December, 19-21 January and 13-18 February (coinciding with the spring tides). In total, the study area was counted 53 times, with up to 5-7 counts per day during periods of intensive observations, although poor visiblity sometimes prevented observation of the more distant sections. Observations were made from suitable vantage points using 10 x 40 binoculars and a 15-45x magnification telescope. Details of weather, visibility and human disturbance were recorded.

Sections of the study area were counted consecutively, and the numbers, positions and activity of each species were recorded. The time at which each count was started and finished was noted, as well as an estimate of the proportion of each section uncovered by the tide and hence available to feeding birds. Counts were conducted at all stages of the tide, although relatively few were done during the high water period. Any movements of birds between sections, or to or from the study area were recorded, as were congregations of roosting birds.

Analysis

Analyses concerning the ornithological significance of the entire Dee estuary are based on information collected by the Birds of Estuaries Enquiry (BoEE), Britain's national monitoring scheme for estuarine birds, for the winters of 1981/82 to 1985/86. BoEE counters conduct

simultaneous high water roost counts, on pre-selected dates in the middle of each month, of the numbers of wildfowl and waders present. Counts are then summed to give a total count for each estuary. Further details of BoEE methods are given by Prater (1981).

The criteria most widely used to assess the importance of a particular site, and that used in these analyses, are that a wetland is considered internationally important if it regularly supports 1% of the individuals in a population of one species or sub-species of waterfowl (Smart 1976, Spagnesi 1982). Similarly, a wetland in Britain is considered nationally important if it regularly holds at least 1% of the estimated British wintering population of one species or sub-species of waterfowl (Prater 1981). In addition, a site regularly holding more than 10,000 wildfowl or 20,000 waders qualifies as internationally important by virtue of absolute numbers. Appendix 1 gives the appropriate qualifying levels for wildfowl and waders for both cateregories of importance. Scientific names of all species mentioned in the text are given in Appendix 5.

Median and peak counts were used to indicate the importance of the study area to the various bird species. Thus, a median count of 100 birds indicates that on half of the visits to the study area, one would expect to count more than 100 birds. Where the counts of a particular species were erratic, resulting in a wide degree of variability, this is discussed. Section A2 could not be counted as frequently as the other sections due to access difficulties but counts from this section were needed for inclusion in analyses concerning the significance of the whole study area to waders and wildfowl. Thus, the data collected from A2 were used to calculate a correction factor reflecting the proportion of each species normally present in this section. This was used to give estimates of total

numbers on the whole study area. The median number of individuals of each species present in the study area during the feeding period (ie. non high tide periods, see below) was then expressed as a percentage of the total estuary population, derived from monthly BoEE counts. Both the BoEE monthly counts and those made in this study are subject to a number of inaccuracies, such as the possibility of not locating all the birds present, the inaccuracies of counting large numbers of birds and the inherent dynamics of estuary bird populations (influenced by the weather, height of tide, disturbance, daily movements etc.). Sources of error in shorebird counts are discussed by Prater (1979), Kersten et al (1981) and Rappoldt et al 1985, who show that such counts only estimate (with errors of up to 37%) the true numbers of birds present. These limitations must be taken into account in the interpretation of results presented.

For the analyses, the tidal cycle was divided into 'high' (1 hour either side of high tide), 'falling' (1-4 hours post-high tide), 'rising' (1-4 hours pre-high tide) and 'low' tide periods (from 4 hours post to 4 hours pre high tide). These divisions reflect the availability of the mudflats to feeding birds, such that they are completely unavailable during the high tide period, completely exposed during the low tide period, and uncovering or covering on the falling and rising tide respectively (Figure 3). Of the 53 counts obtained, 7 were made during the high tide period, 11 on the falling tide, 13 on the rising tide, and 22 during the low tide period. This allowed examination of the use made of the study area by birds at different states of tide.

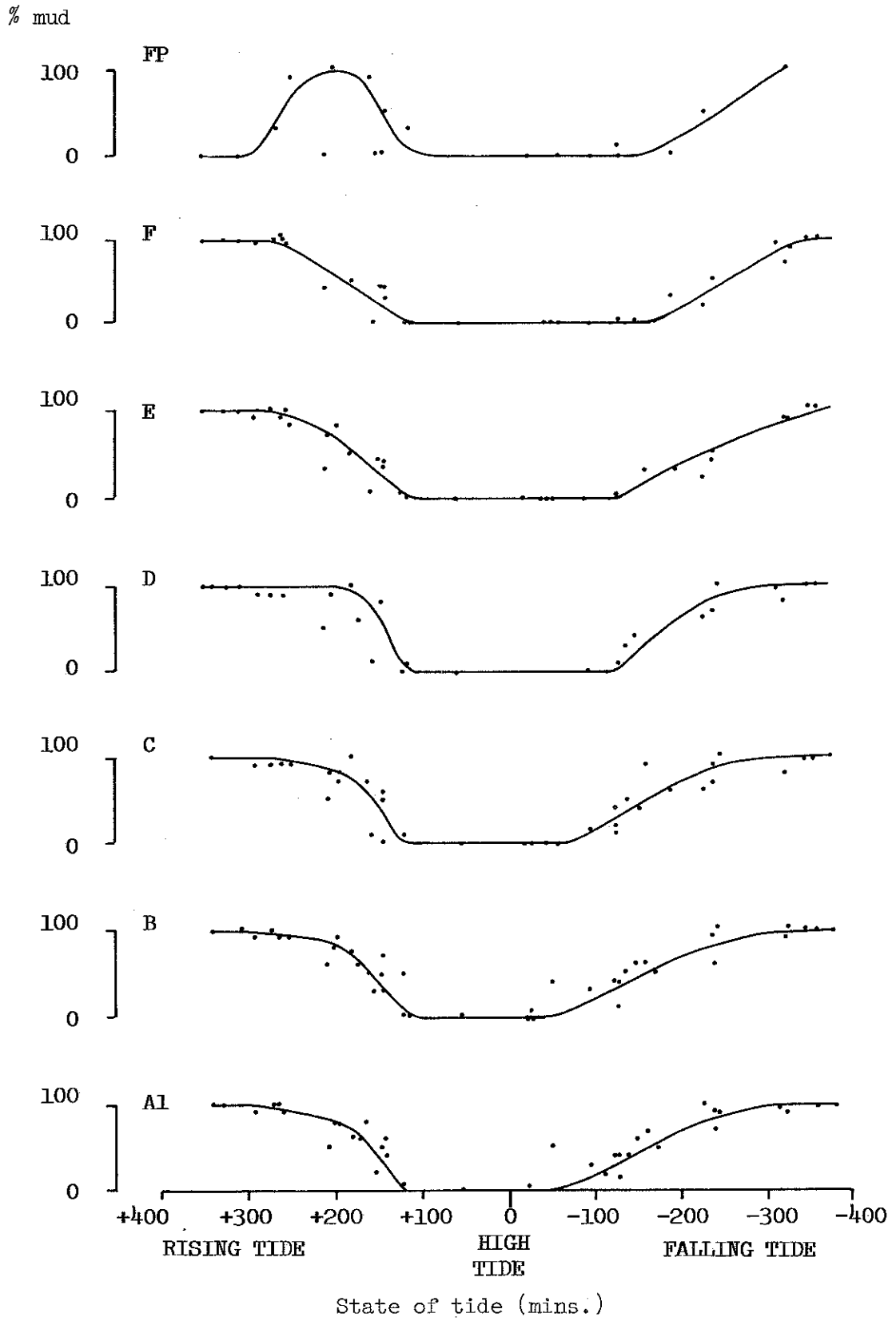


FIGURE 3. The pattern of tidal coverage of each section of the study area.

A. The importance of the Dee estuary to wildfowl and waders

The Dee is internationally important in terms of the total numbers of waders it supports (Table 1), with average all-year and winter peak counts of c. 94,000 and 83,000 birds respectively. Only the Wash, Morecambe Bay and, in some years, the Ribble regularly support more waders; the former are considerably larger and hence the density of birds on the Dee is relatively high in comparison with these sites. The Dee is also internationally important in terms of the absolute numbers of wildfowl present, with an average all-year peak of 18,846 over the period 1981/82 to 1985/86 (D. Salmon, in litt.).

Table 1. Principal sites for waders in Britain (based on 1981/82 to 1985/86 BoEE counts).

Sites	Winter peak					
	1981/82	82/83	83/84	84/85	85/86	Mean
Wash	119,708	179,993	121,437	135,176	214,633	154,189
Morecambe Bay	-	104,943	128,179	148,645	145,348	131,779
Ribble	65,917	70,794	53,994	54,994	72,731	63,686
Dee	99,891	91,070	82,724	62,678	77,267	82,726
Humber	83,502	47,734	70,637	77,433	83,460	72,553
	All-year peak					
Wash	165,655	179,993	121,437	173,389	224,574	173,010
Morecambe Bay	-	105,330	159,893	177,025	155,591	149,460
Ribble	92,366	118,393	132,262	138,927	100,582	116,506
Dee	111,745	93,759	86,764	79,314	98,866	94,090
Humber	87,609	48,320	90,607	78,422	92,610	79,514

Of the species present, the Dee supports internationally important numbers of seven species of waders and three species of wildfowl (Table 2): Oystercatcher, Grey Plover, Curlew, Black-tailed Godwit, Redshank, Knot, Sanderling, Teal, Pintail and Shelduck. In addition, the estuary is of national importance for a further two species of wader: Bar-tailed Godwit and Dunlin. Hence the estuary as a whole is of outstanding ornithological significance.

The December, January and February BoEE counts for 1981/82 to 1986/87 are given in Appendix 2a-c. Counts during 1986/87 were similar to those in previous years for many species. However, relatively few Oystercatchers were present in December, and Pintail were at very low levels. Conversely, high numbers of Grey Plovers, Turnstones, Redshanks and Mallards were present, whilst Lapwings, Curlews and Redshanks showed evidence of a cold weather exodus during January. At the same time, Wigeon numbers increased dramatically.

Table 2. The national and international significance of the Dee estuary to waders and wildfowl (based on 1981/82 to 1985/86 BoEE data).

	Average peak winter count (Nov-March)	% of British population	% of European population
Oystercatcher	33,659	12.0	4.5
Grey Plover	1,593	7.6	2.0
Curlew	2,873	3.2	1.0
Black-t-Godwit	775	15.5	1.9
Bar-t-Godwit	825	1.4	0.2
Redshank	3,695	4.9	1.9
Spotted Redshank	6	3.0	<<0.1
Knot	22,679	10.3	6.5
Dunlin	17,242	4.0	0.9
Sanderling	311	2.2	2.1
Teal	3,498	3.5	1.8
Pintail	6,762	27.0	9.0
Shelduck	5,112	6.8	4.1

B. Numbers of wildfowl and waders within the study area

Numbers of each species present in the study area, during the feeding (ie. non high tide) period, in December, January and February are given in Table 3. There was considerable variability in counts, both within and between months, which can be attributed largely to daily and seasonal movements of birds into and out of the study area.

Wildfowl

Only two species of wildfowl, Mallard and Shelduck, occurred in sufficient numbers in the study area to merit attention (Table 3). In general, Shelduck numbers were highest in December and declined to lower levels in January and February. Numbers in the study area represented 7-15% of the total estuary population, although at certain times much higher numbers were present. For example, the count of 722 in February represented 33% of the total Dee population. Hence the area is of particular importance to this species. Counts of Mallard peaked at 560 during December, although numbers dropped during the cold weather of January and remained relatively low throughout February; the study area contained 3-13% of the total Dee population.

Waders

Oystercatcher, Curlew and Redshank were by far the most abundant waders present in the study area (Table 3). Numbers of Oystercatchers fluctuated widely between counts, but there was no evidence of a cold weather exodus from the study area. On average, 16-20% of the total Dee Oystercatcher population occurred in the

Table 3. The numbers of birds present within the study area in December to February compared with the estuary as a whole (median values are based on corrected figures).

Species	December			January			February		
	Median	(range)	% of Dee	Median	(range)	% of Dee	Median	(range)	% of Dee
Mallard	291	(165-560)	5.5	133	(50-333)	3.1	174	(99-347)	13.0
Shelduck	466	(102-568)	15.2	236	(72-548)	7.5	268	(125-722)	12.4
Wigeon	0	(0-10)	0.0	0	(0-20)	0.0	0	(0-4)	0.0
Pintail	0	(0-1)	0.0	0		0.0	0	(0-15)	0.0
Red-b-Merganser	0	(0-4)	0.0	2	(0-6)	(40.0)	0	(0-6)	0.0
Oyster-catcher	1880	(935-4553)	16.6	3342	(1742-7869)	16.1	4967	(1188-7228)	20.2
Lapwing	0	(0-1500)	0.0	0		0.0	0	(0-153)	0.0
Ringed Plover	1	(0-14)	1.8	2	(0-9)	-	0	(0-4)	0.0
Turnstone	0	(0-10)	0.0	0	(0-10)	0.0	0	(0-25)	0.0
Curlew	871	(271-1196)	24.8	335	(158-1141)	29.1	1004	(396-1440)	45.4
Black-t-Godwit	0	(0-2)	0.0	0		0.0	0		0.0
Bar-t-Godwit	0	(0-1)	0.0	0	(0-2)	0.0	0	(0-1)	0.0
Redshank	819	(444-1582)	13.8	793	(676-1248)	21.5	1026	(161-1624)	16.0
Knot	0	(0-21)	0.0	205	(0-1410)	1.7	2	(0-20)	0.0
Dunlin	148	(3-500)	1.4	0	(0-2014)	0.0	70	(2-396)	0.9

study area, although the January maximum of 7,869 and February maximum of 7,228 represented 38% and 29%, respectively, of the estuary population during those months.

Numbers of Curlews present within the study area also fluctuated greatly between counts (Table 3). Curlews frequently flew inland from the study area to feed in coastal fields, and the relative profitability of field- versus shore-feeding influenced the numbers of birds present within the study area. Numbers within the study area tended to be high during December and February, with some evidence of an exodus during the cold weather in January, a phenomenon also detected by the monthly BoEE counts (see Appendix 2). The Curlew population present in the study area represented 25-45% of that present on the estuary as a whole, though the peak count in February (1,440) comprised as much as 65% of the Curlews recorded by the BoEE in that month.

Redshanks were most abundant in the study area in February, with somewhat lower numbers occurring in December and January (Table 3). They were sometimes difficult to count due to their habit of feeding in gullies; this may have contributed to the variability of the counts. The numbers present accounted for an average of 14-22% of the estuary population, with the December peak (1,582) and February peak (1,624) constituting 27% and 25%, respectively, of the total population.

The remaining species of waders recorded in the study area occurred in relatively small numbers (Table 3). Ringed Plover and Turnstone were recorded regularly; Dunlin and Knot sporadically, although sometimes in fairly large flocks. The maximum counts of Dunlin (2,014) and Knot (1,410), both in January, represented 16% and 12%

of the total estuary count for these species in that month.

To conclude, Mallard, Shelduck, Oystercatcher, Curlew and Redshank are sufficiently numerous in the study area to warrant more detailed consideration. All but Mallard are of international importance.

Table 4. Numbers of the main species recorded in section A2.

	Date of count and state of tide							
Species	4 Jan	10 Jan	7 Feb	13 Feb	17 Feb	17 Feb	18 Feb	22 Feb
	L	L	R	F	R	H	H	L
Mallard	-	-	31	20	65	110	64	0
Shelduck	-	82	357	130	100	350	154	71
Oystercatcher	-	-	1500	0	2000	5000	4000	16
Curlew	106	101	416	80	50	1000	1000	9
Redshank	700	515	1200	600	500	550	550	514

* L = low tide, R = rising tide, F = falling tide, H = high tide.

C. Distribution of key wildfowl and wader species within the study area

High tide roosts

Observations of movements suggested that the great majority of birds feeding in the study area also roosted there. Few, apart from a small proportion of Curlews, were seen to leave the study area to roost elsewhere.

The position of the main high tide roost varied with the height of the tide, weather conditions and disturbance. On lower tides, birds sometimes congregated off Ffynnongroew, but more often gathered in section A2 (see Figure 2). This area, adjacent to the Point of Ayr colliery, is relatively undisturbed and contains suitable roost sites for the majority of species (Figures 4-7). Table 4 shows that large numbers of birds were present there during the high tide period. For example, during the high tide period of 17 and 18 February, A2 held c. 60% of all Mallards, 85% of Shelducks, 98% of Oystercatchers and Curlews, and 50% of the Redshanks recorded in the study area. In addition, small numbers of Mallards and Shelducks remained scattered over the study area during the high tide period. Mallards also favoured the area of Spartina marsh near the footbridge at Ffynnongroew.

The majority of Oystercatchers roosted adjacent to the colliery and often on the shingle spit at the Point of Ayr. In addition, small numbers regularly roosted in section D (Figure 5). Almost all Curlew roosted alongside the Oystercatchers, particularly on the marsh between the colliery and the Point of Ayr (Figure 6); some left the

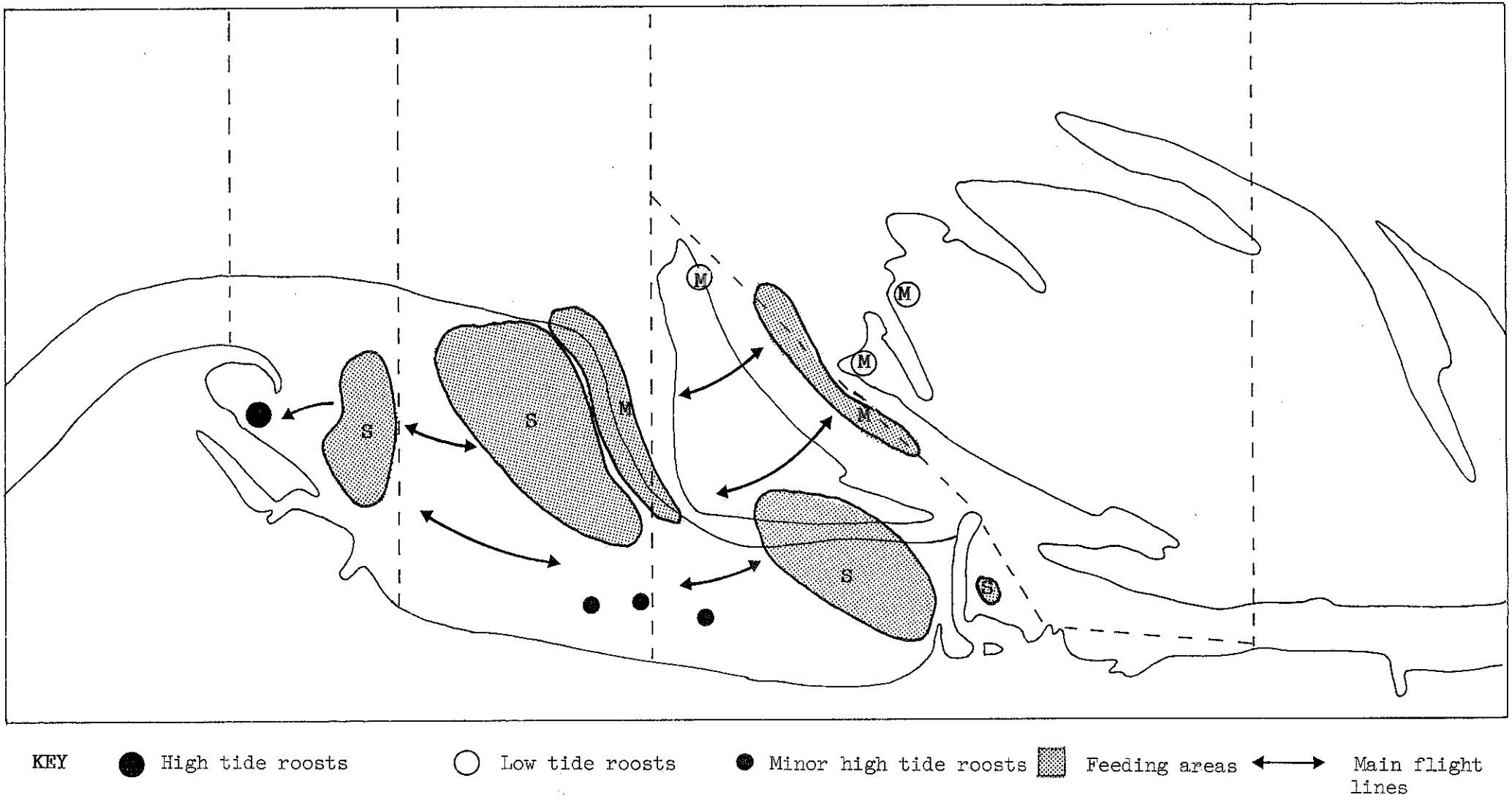


FIGURE 4. The locations of roosts, movements and feeding areas of Shelduck (S) and Mallard (M).

study area over the high tide period to feed in adjacent fields. Redshanks (Figure 7) used two main roost sites. The first was situated in the main creek leading into the colliery and the other was in the flushing pool. However, small numbers of birds frequently occupied numerous other sites, especially on the lower tides.

Distribution during the feeding period

The main feeding and low tide roosting areas of the five species, together with their patterns of movement within the study area, are shown in Figures 4-7. These figures provide generalized pictures only, as the numbers of feeding birds present in each section of the study area were highly variable, being subject to both seasonal (Table 5) and tidal (Table 6) influences. Section A2 is absent from Tables 5 & 6 because it was not always possible to obtain counts from this section, and thus insufficient data were collected to examine such influences.

Sections A2, A1 and B encompass important feeding grounds for the majority of species (Figures 4-7; Appendix 3), with only limited but regular usage of the other sections of the study area. Only Oystercatchers and Curlews used parts of sections E and F for feeding (Figures 5 & 6), whilst Redshanks were spread widely across the study area (Figure 7).

Table 5. The proportion (%) of individuals of the key species in each section of the study area during December, January and February.

Species	Month	Al	B	C	D	E/F	FP
Mallard	D	32.4	41.7	0	0	25.9	0
	J	82.0	3.7	0	0	14.3	0
	F	0	21.4	0	0	78.6	0
Shelduck	D	71.2	28.5	0.3	0	0	0
	J	51.2	44.0	3.2	0	0	1.6
	F	40.9	49.4	9.7	0	0	0
Oystercatcher	D	33.3	63.3	1.3	0.5	1.6	0
	J	49.5	37.1	1.3	1.6	10.5	0
	F	33.4	59.4	1.1	0.5	5.6	0
Curlew	D	58.3	38.6	0.6	0.3	2.2	0
	J	71.3	26.0	1.1	0.5	0.7	0.4
	F	31.3	65.0	1.2	0.6	1.7	0.2
Redshank	D	30.4	45.7	1.7	4.7	0	17.5
	J	21.5	36.5	4.5	4.3	0	33.2
	F	7.0	37.6	2.6	7.0	0	45.8

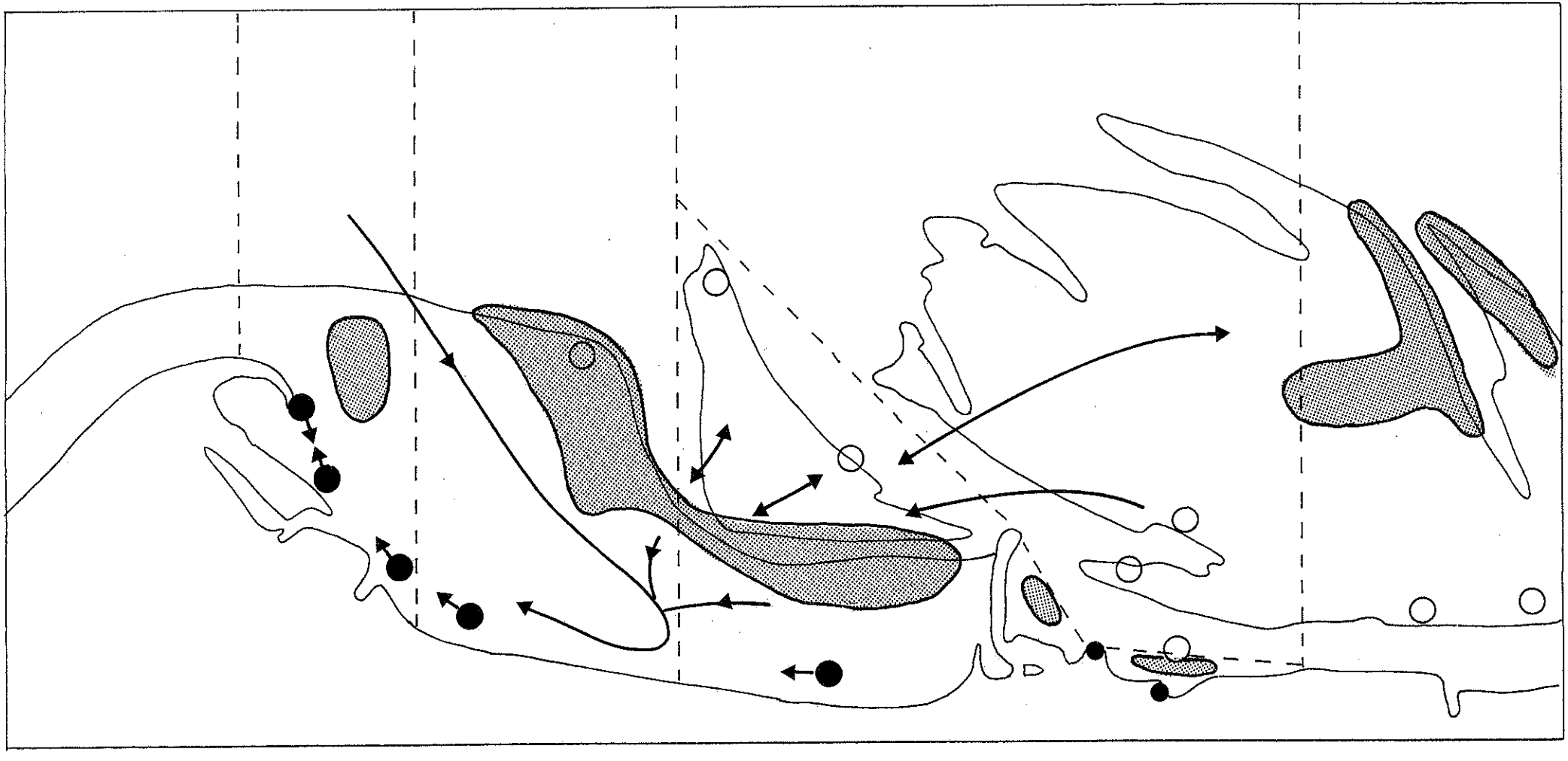


FIGURE 5. The locations of roosts, movements and feeding areas of Oystercatchers.

Mallards were not recorded in sections C, D or the flushing pool (Table 5) but occupied only sections A2 (Table 4), A1, B and E/F. They were most frequent in sections A1 and B on the falling and rising tide, as the birds moved to and from the main roosting areas (Figure 4). At low tide, the outer part of section B and section E provided them with secure roosting sites (Figure 4) and the birds often congregated there (Table 6).

Shelducks were mainly concentrated in sections A2 (Table 4), A1 and B (Table 5); the proportion in A1 was distinctly greater in December when human disturbance was at a low level in this section (see below). Shelducks, like Curlews and Redshanks, showed a relatively stable distribution during the tidal cycle (Table 6), indicating the presence of favoured feeding areas. Conversely, Oystercatchers and Mallards undertook regular movements (Figures 4 & 5), often to the more remote parts of the study area.

Oystercatchers and Curlews favoured sections A2 (Table 4), A1 and B, although small numbers regularly occupied other sections of the study area (Table 5). A1 and B were particularly important feeding areas on rising and falling tides (Table 6). During low tide periods Oystercatchers frequented sections E and F (Table 6), many occupying low tide roosts, although some fed along the outer channel of section F (Figure 5). The outer part of section B was, however, the main low tide roosting area for Oystercatchers (Table 6; Figure 5).

Table 6. The proportion (%) of individuals of the key species in each section of the study area during low, rising and falling tide periods.

Species	Tide	Al	B	C	D	E/F	FP
Mallard	L	14.0	14.5	0	0	71.5	0
	R	33.8	41.2	0	0	25.0	0
	F	63.2	36.8	0	0	0	0
Shelduck	L	64.2	34.5	1.2	0	0	0
	R	48.2	46.2	5.6	0	0	0
	F	63.7	31.8	4.5	0	0	0
Oystercatcher	L	16.0	68.7	1.0	0.6	13.7	0
	R	54.9	26.3	3.3	2.9	12.6	0
	F	66.9	31.7	0.9	0.2	0.3	0
Curlew	L	55.3	41.3	0.7	0.4	1.9	0.4
	R	51.2	45.7	0.7	0.4	1.6	0.4
	F	56.6	42.4	0.7	0.3	0	0
Redshank	L	12.8	46.6	2.3	6.4	0	31.9
	R	19.3	32.8	2.5	4.8	0	40.6
	F	28.2	56.5	11.1	3.4	0	0.8

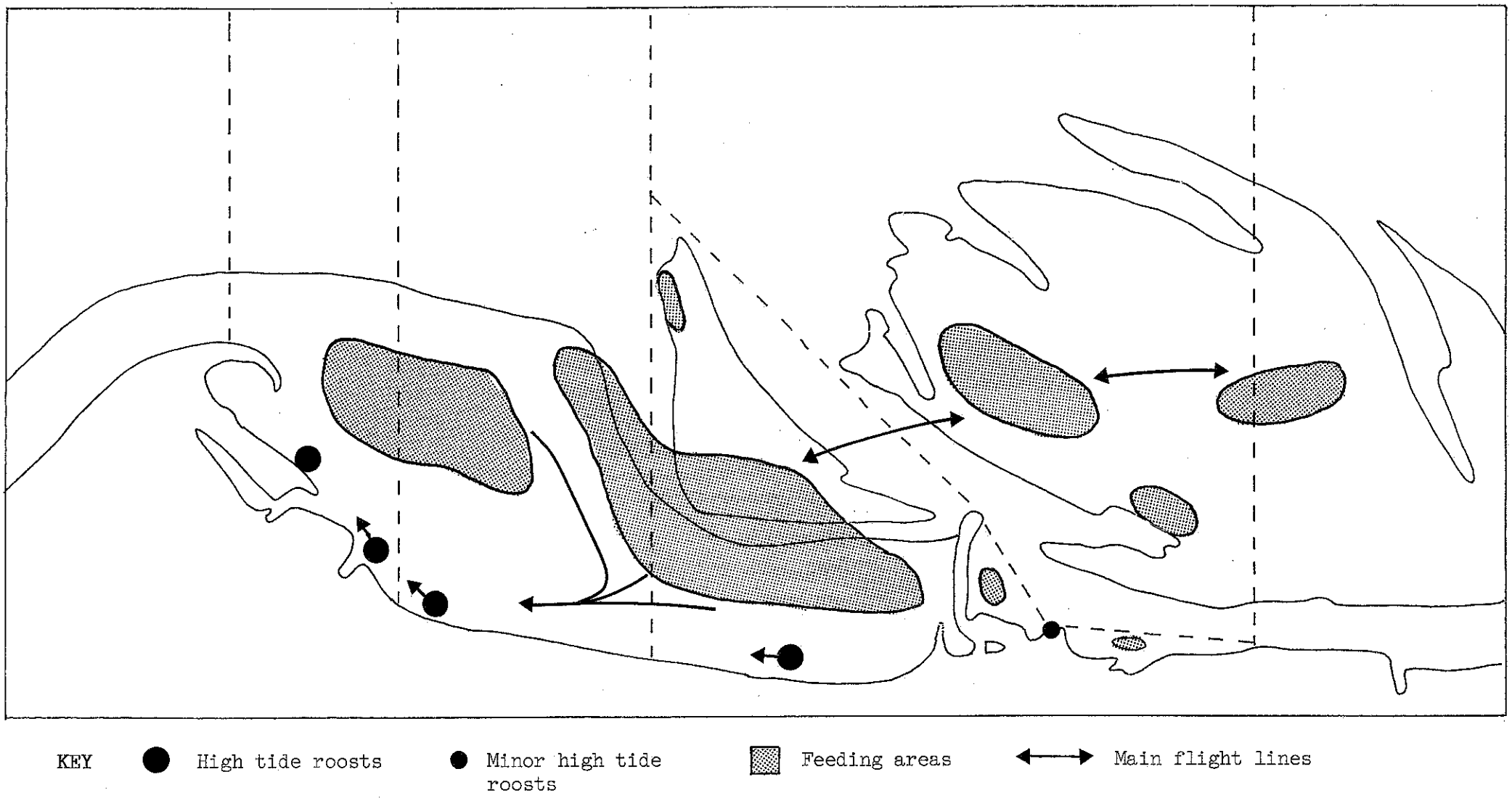


FIGURE 6. The locations of roosts, movements and feeding areas of Curlews.

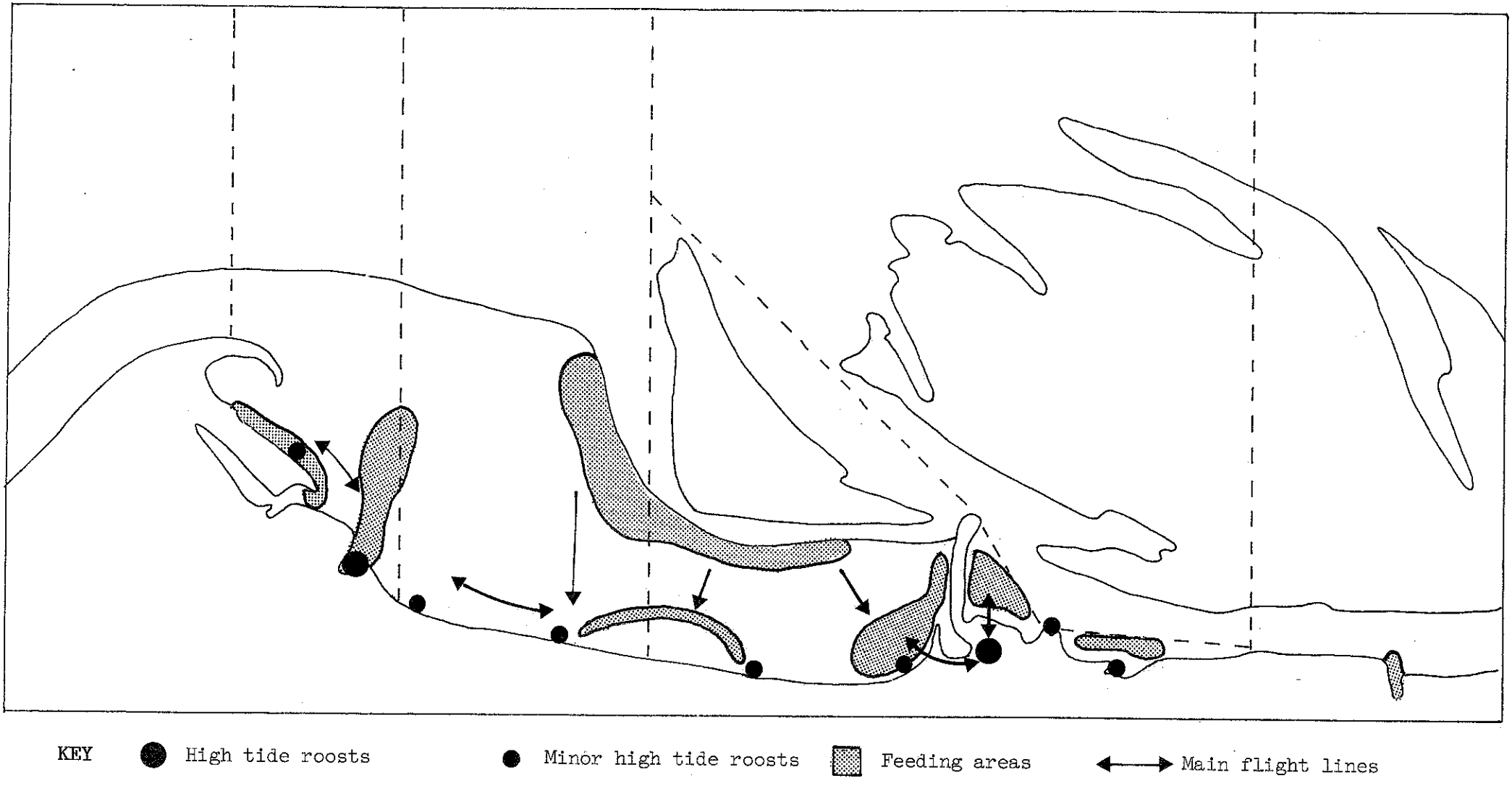


FIGURE 7. The locations of roosts, movements and feeding areas of Redshanks.

Redshanks favoured sections A2 (Table 4; 50% of those counted in the study area, on average), A1, B and the flushing pool (Table 5), although small numbers regularly fed in sections C (especially on the falling tide; Table 6) and D. Thus, section C provided those Redshanks roosting in the flushing pool (Figure 7) with a close and early feeding area as the tide receded. Few Redshanks occurred in the flushing pool during the falling tide period (Table 6) because sea-water was retained in the pool at this time (see Figure 3). However, the flushing pool was an important feeding area at other times (Table 6).

Human disturbance

Cockle harvesting was the main agent of human disturbance during the study period. This activity was restricted to certain sections of the study area (Table 5) and generally occurred throughout the time that access to the mudflats was possible. Sections C and D were unaffected and only small numbers of people were present in sections E and F, probably due to difficulty of access. Section A1 was most affected with up to 312 people and 13 tractors and trailers recorded there in February (Table 7). As winter progressed, the centre of harvesting gradually shifted from within section A2 to section A1 and culminated on the border between sections A1 and B (Table 7). Tractor access to the cockle beds was from the Point of Ayr, which was also where the crop was sorted and loaded onto vehicles for despatch. Some of the cockles were marketed locally although large quantities were exported to Portugal and the Netherlands. Access to the cockle beds on foot was mainly via the Ffynnongroew footbridge.

This activity obviously displaced many birds, although without detailed study one can only speculate on its possible effect. The area in which harvesting was concentrated has, in previous winters, been the main feeding area for Oystercatchers (R. Corran, pers.comm.).

Table 7. Numbers of people harvesting cockles (Cardium edule) in sections of the study area during December 1986 - March 1987. Figures are maximum daily counts and the number of tractor-trailer units present are given in brackets.

DATE	SECTION A2	SECTION A1	SECTION B	SECTIONS E&F	TOTAL
10 Dec	60	0	0	20	80
11 Dec	0	60	0	18	78
15 Dec	0	40	0	0	40
29 Dec	0	65(4)	0	3	68(4)
04 Jan	0	5(1)	0	0	5(1)
10 Jan	0	106(11)	0	8	114(19)
21 Jan	0	150(10)	0	5	155(10)
22 Jan	0	173(12)	0	2	175(12)
07 Feb	0	14(5)	0	15	29(5)
13 Feb	0	111(5)	10	0	121(5)
17 Feb	0	143(8)	13	12	168(8)
18 Feb	0	312(13)	25(2)	4	341(15)
20 Feb	0	150(7)	50	12	212(7)
22 Feb	0	43(3)	173(12)	0	216(15)
08 Mar	7	38(2)	10	4	59(2)
22 Mar	6(1)	186(15)	?	32	224(16)

DISCUSSION

The Dee estuary is internationally important for its wintering wildfowl and waders, a conclusion reached by many previous authors (eg. Buxton 1978, DECG 1979, Prater 1981, Mitchell 1986). Based on 1981/82 to 1985/86 BoEE data, three species of wildfowl and seven species of waders are present in internationally important numbers. Prater (1981) listed nine species of waders as internationally important; three of these, Dunlin, Knot and Bar-tailed Godwit have since undergone substantial declines on the estuary (Mitchell et al in prep), although Knot still occur in internationally significant numbers.

High proportions of the total Dee populations of five species, Mallard, Shelduck, Oystercatcher, Curlew and Redshank, winter within the study area. Indeed, the study area normally held up to 13% of the Dee's Mallards, 15% of Shelducks, 20% of Oystercatchers, 22% of Redshanks and 45% of Curlews, and on some occasions held considerably more. Mitchell (1986) obtained similar results and stressed the importance of the area to Oystercatchers (accounting for 30-35% of the Dee population), Redshanks (20%) and Curlew (25%).

The vast majority of the birds feeding in the study area also roosted there, with the main wildfowl and wader roost being situated close to the Point of Ayr colliery. Redshanks however, favoured a nearby creek and the flushing pool located within Mostyn Docks itself.

The mudflats situated between Mostyn Quay and the Point of Ayr were by far the most important feeding areas for the majority of species. Buxton (1978) and the DECG report (1979) also identified Mostyn Bank as an important feeding area and show feeding distributions closely

reflecting those obtained in this study. During 1986/87, cockle fishing excluded birds from a large part of this area, and it seems probable that even higher populations would be found there in winters lacking this exceptional level of human disturbance. Other sections of the study area contained relatively few feeding birds, with even the extensive flats of Salisbury Middle (sections E and F) apparently providing few feeding opportunities. This central part of the estuary supports comparatively low invertebrate populations (DECG 1979) which is presumably why relatively few birds occur there. This area was, however, used at low tide by Oystercatchers and Mallards and provided the birds with relatively safe roosting sites. Sections C and D were largely insignificant as feeding grounds, though the flushing pool was important to both feeding and roosting Redshanks.

The proposed removal of section C would probably have little effect on the overall abundance of wildfowl and wader species occupying the study area, because relatively few birds would be displaced. However, the construction of groynes could potentially have a more serious effect on the birds using the area, especially on Mostyn Bank which at present holds the largest concentrations of each species. The groynes are likely to cause changes in tidal flow and sedimentation which will probably lead to changes in patterns of erosion and deposition, exposure time, salinity, water chemistry etc.. These in turn may affect the diversity and abundance of invertebrate populations present which will have repercussions on the numbers, density and survival of bird populations present. Although the precise effects of such reclamations on birds are difficult to predict (eg. Evans 1979) it seems likely, both in view of the importance of the study area to birds and of the evidence available from previous studies (eg. Zwarts 1976, Prater 1978 and Goss-Custard 1979, 1980), that the effect would be deleterious. More detailed

studies would be necessary to address this question.

CONCLUSION

The Dee estuary is internationally important for three species of wintering wildfowl and seven species of wintering waders, with the Mostyn Dock study area supporting a considerable proportion of the populations of Mallard, Shelduck, Oystercatcher, Curlew and Redshank. The proposed area of land claim is relatively small, will affect an area which currently supports few birds and is thus unlikely to result in appreciable declines in the bird populations present. The construction of groynes, however, could indirectly have a much greater effect on the present system and might lead to decreases in the current levels of wildfowl and wader populations on the Dee.

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Appendix 1. Qualifying levels for national and international importance.

(from Salmon et al 1987).

	National	International
Mute Swan	180	1,200
Bewick's Swan	50	120
Whooper Swan	60	100
Pink-footed Goose	1,000	1,000
European White-fronted Goose	60	2,000
Greenland White-fronted Goose	100	150
Greylag Goose: Iceland pop.	1,000	1,000
Barnacle Goose: Greenland pop.	200	300
Svalbard pop.	100	100
Dark-bellied Brent Goose	900	1,300
Shelduck	750	1,250
Wigeon	2,000	5,000
Gadwall	50	550
Teal	1,000	2,000
Mallard	5,000	20,000 **
Pintail	250	750
Shoveler	90	1,000
Pochard	500	2,500
Tufted Duck	600	5,000
Scaup	40 *	1,500
Eider	500	20,000 **
Long-tailed Duck	200	5,000
Common Scoter	350	10,000 **
Goldeneye	150	2,000
Red-breasted Merganser	100	400
Goosander	50	750

Appendix 1. (cont.)

Oystercatcher	2,800		7,500	
Avocet	5	*	260	
Ringed Plover	230	p=300	1,000	
Golden Plover	2,000		10,000	
Grey Plover	210		800	
Lapwing	10,000		20,000	**
Knot	2,200		3,500	
Sanderling	140	p=300	150	p=500
Purple Sandpiper	160		?	
Dunlin	4,300	p=2,000	20,000	**
Ruff	15	*	10,000	
Snipe	?		10,000	
Black-tailed Godwit	50		400	
Bar-tailed Godwit	610		5,500	
Whimbrel	-	p=50	500	
Curlew	910		3,000	
Spotted Redshank	2	*	500	
Redshank	750	p=1,200	2,000	
Greenshank	4	*	500	
Turnstone	450		500	

- British population very small.

* Where 1% of the British wintering population is less than 50 birds, 50 is normally used as a minimum qualifying level for national importance.

** A site regularly holding more than 10,000 wildfowl or 20,000 waders qualifies as internationally important by virtue of the absolute numbers.

Appendix 2a. The numbers of wildfowl and waders on the Dee estuary during December, 1981/2 - 1986/87.

	1981	1982	1983	1984	1985	Mean	1986
Mallard	1340	2200	4950	4480	4455	3485	5325
Teal	1750	925	2920	3310	4480	2677	2565
Wigeon	870	2015	330	910	999	1025	1130
Pintail	5335	7325	8975	6280	5800	6743	2565
Shoveler	5	4	5	7	5	5	5
Pochard	0	24	35	7	10	15	0
Goldeneye	21	38	62	6	4	26	3
Shelduck	1980	3075	4855	4460	4850	3844	3075
Red-b.Merganser	17	13	19	14	16	16	8
Oystercatcher	25125	28430	30360	18940	38000	28171	11300
Lapwing	1570	4925	4320	6950	8125	5178	5175
Ringed Plover	60	200	66	69	38	87	56
Grey Plover	650	1490	625	820	872	891	1000
Turnstone	3	12	3	40	386	89	565
Curlew	1745	2015	1775	1770	4680	2397	3510
Black-t.Godwit	34	350	1285	82	245	399	405
Bar-t.Godwit	3480	40	6	3	79	722	146
Redshank	2680	3185	1790	2074	3305	2607	5920
Knot	25315	10680	14230	6765	7210	12840	5920
Dunlin	16380	21135	21950	9920	8800	15637	10640

Appendix 2b. The numbers of wildfowl and waders on the Dee estuary during January, 1981/2 - 1986/87.

	1982	1983	1984	1985	1986	Mean	1987
Mallard	480	2825	(5045)	2630	3855	2967	4320
Teal	95	1140	(3815)	2650	3485	2237	2010
Wigeon	180	141	(316)	1601	1230	694	3660
Pintail	5395	2655	(7970)	6000	5400	5484	3740
Shoveler	0	39	(30)	6	9	17	3
Pochard	0	6	(31)	119	0	31	0
Goldeneye	1	13	(14)	12	0	8	14
Shelduck	1070	2555	(4060)	718	4265	2534	3160
Red-b. Merganser	6	11	(4)	7	8	7	5
Oystercatcher	42505	24030	(16120)	19600	26700	25791	20700
Lapwing	380	-	(3660)	166	1810	1504	65
Ringed Plover	0	21	(2)	48	27	20	0
Grey Plover	115	560	(700)	682	730	557	856
Turnstone	8	0	(25)	37	890	192	616
Curlew	2135	1210	(2600)	768	1760	1695	1150
Black-t. Godwit	1290	0	(1150)	171	165	552	773
Bar-t. Godwit	1055	116	(0)	25	28	245	37
Redshank	1615	1410	(1475)	1547	3435	1896	3685
Knot	4300	10240	(17960)	19500	7280	11856	12170
Dunlin	5400	11780	(8250)	8000	8240	8334	12300

Appendix 2c. The numbers of wildfowl and waders on the Dee estuary during February, 1981/2 - 1986/87.

	1982	1983	1984	1985	1986	Mean	1987
Mallard	1420	620	2941	2951	3580	2302	1340
Teal	760	195	818	2090	1930	1159	1500
Wigeon	300	655	297	534	837	525	520
Pintail	4510	5175	4500	3580	3416	4236	2500
Shoveler	2	0	8	8	0	4	4
Pochard	0	0	0	55	0	11	1
Goldeneye	2	8	8	6	0	5	3
Shelduck	1470	730	2900	1510	5670	2456	2170
Red-b. Merganser	2	19	7	5	18	10	47
Oystercatcher	23350	22380	28657	12600	31500	23697	24600
Lapwing	4325	170	2001	2035	1974	2101	2475
Ringed Plover	81	155	26	50	52	73	63
Grey Plover	720	610	846	420	1905	900	800
Turnstone	52	21	35	25	645	156	620
Curlew	2545	1075	1822	2435	2438	2063	2210
Black-t. Godwit	385	500	1050	371	430	547	180
Bar-t. Godwit	285	130	208	19	73	143	3
Redshank	2880	2110	2672	1170	3001	2367	6415
Knot	6525	3930	11200	6885	10150	7738	6970
Dunlin	9670	13370	10890	8660	7510	10020	8100

Appendix 3. Number of birds in each section of the study area through the winter. Values are medians and range.

Species	Month	A1	B	C	D	E/F	FP	Σ Medians.
Mallard	D	100 (0-250)	129 (0-292)	0	0	80 (0-380)	0	309
	J	(200)	9 (0-38)	0	0 (0-2)	35 (0-333)	0	244
	F	0 (0-117)	30 (0-100)	0 (0-52)	0	110 (0-316)	0	140
Shelduck	D	200 (30-300)	80 (16-200)	1 (0-11)	0	0 (0-2)	0	281
	J	64 (21-100)	55 (4-326)	4 (0-19)	0 (0-2)	0	2 (0-2)	125
	F	67 (0-260)	81 (46-336)	16 (3-58)	0 (0-6)	0 (0-26)	0	164
Oyster-catcher	D	500 (50-2000)	950 (400-3000)	19 (3-76)	7 (0-74)	24 (0-500)	0	1500
	J	2000 (30-3000)	1500 (80-3020)	54 (4-500)	60 (0-1200)	425 (0-1110)	0 (0-1)	4039
	F	1350 (100-3500)	2400 (50-5800)	43 (0-127)	19 (0-650)	228 (0-1100)	0	4040
Curlew	D	400 (100-500)	265 (26-400)	4 (2-37)	2 (1-4)	15 (0-50)	0 (0-10)	686
	J	400 (100-600)	146 (32-500)	6 (1-34)	3 (0-5)	4 (0-17)	2 (0-7)	561
	F	205 (30-600)	425 (135-1007)	8 (0-20)	4 (0-10)	11 (0-420)	1 (0-5)	654
Redshank	D	200 (0-300)	300 (21-500)	11 (0-200)	31 (10-120)	0 (0-15)	115 (0-680)	657
	J	100 (100-300)	170 (23-360)	21 (5-78)	20 (0-39)	0 (0-26)	155 (0-410)	466
	F	40 (0-425)	214 (3-682)	15 (0-192)	40 (10-347)	0 (0-21)	260 (1-796)	569

Appendix 4. Number of birds in each section of the study area according to state of tide. Values are medians and range.

Species	Tide	A1	B	C	D	E/F	FP	Σ Medians.
Mallard	L	25 (0-200)	26 (0-100)	0 (0-2)	0	128 (0-380)	0	179
	R	46 (0-105)	56 (0-292)	0 (0-2)	0 (0-2)	34 (0-316)	0	136
	F	84 (0-250)	49 (0-250)	0 (0-52)	0	0 (0-120)	0	133
Shelduck	L	160 (20-300)	86 (4-326)	3 (0-58)	0 (0-2)	0 (0-2)	0 (0-2)	249
	R	94 (6-300)	90 (27-336)	11 (0-29)	0 (0-6)	0 (0-26)	0 (0-2)	195
	F	100 (0-300)	50 (16-150)	7 (2-40)	0 (0-2)	0 (0-7)	0 (0-2)	157
Oyster-catcher	L	350 (30-3000)	1500 (700-5010)	20 (3-84)	13 (0-1200)	300 (0-1110)	0	2183
	R	1000 (235-3000)	480 (50-2500)	60 (0-500)	52 (0-650)	230 (0-1100)	0 (0-1)	1822
	F	1900 (500-3500)	900 (80-5800)	27 (4-107)	5 (0-68)	10 (0-600)	0	2842
Curlew	L	375 (50-600)	280 (96-989)	5 (3-34)	3 (0-5)	13 (0-50)	2 (0-7)	678
	R	350 (30-500)	312 (135-1007)	5 (0-37)	3 (1-10)	11 (2-420)	2 (1-10)	683
	F	400 (50-600)	300 (26-600)	5 (2-20)	2 (0-10)	0 (0-65)	0	707
Redshank	L	60 (0-300)	219 (23-682)	11 (0-200)	30 (5-177)	0 (0-26)	150 (0-410)	470
	R	100 (9-300)	170 (3-400)	13 (0-82)	25 (6-347)	0 (0-21)	210 (4-796)	518
	F	200 (0-425)	400 (80-510)	79 (0-192)	24 (0-115)	0	5 (0-270)	708

Appendix 5. Scientific names of birds mentioned in the text.

Shelduck	Tadorna tadorna
Wigeon	Anas penelope
Teal	Anas crecca
Mallard	Anas platyrhynchos
Pintail	Anas acuta
Red-breasted Merganser	Mergus serrator
Oystercatcher	Haematopus ostralegus
Ringed Plover	Charadrius hiaticula
Grey Plover	Pluvialis squatarola
Lapwing	Vanellus vanellus
Knot	Calidris canutus
Sanderling	Calidris alba
Dunlin	Calidris alpina
Black-tailed Godwit	Limosa limosa
Bar-tailed Godwit	Limosa lapponica
Curlew	Numenius arquata
Spotted Redshank	Tringa erythropus
Redshank	Tringa totanus
Turnstone	Arenaria interpres