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THE IMPORTANCE OF THE WYRE ESTUARY FOR BIRD POPULATIONS IN RELATION TO THE PROPOSED WYRE BARRAGE

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to

Binnie & Partners

by

S.J. Woolfall
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THE IMPORTANCE OF THE WYRE ESTUARY FOR BIRD POPULATIONS IN RELATION TO THE PROPOSED WYRE BARRAGE

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EXECUTIVE SUMMARY

1. Base line information is given for the assessment of the potential impact of the proposed tidal barrage on the bird populations of the Wyre estuary. This is based on current knowledge of the usage of the estuary by birds.

2. The Wyre estuary lies on the southern edge of the Morecambe Bay estuarine complex and can be considered an integral part of the complex. The Ribble estuary is 20 km south of the Wyre.

3. Morecambe Bay is an extremely important site for waterfowl in winter and on passage. It holds the 14th largest number of wildfowl and 2nd largest number of waders in Britain.

4. The populations of Shelduck, Pintail, Oystercatcher, Grey Plover, Knot, Dunlin, Bar-tailed Godwit, Curlew, Redshank and Turnstone found on Morecambe Bay are of international importance. Wigeon, Teal, Ringed Plover, Golden Plover, Lapwing, Sanderling and Black-tailed Godwit winter on the estuary in nationally important numbers.

5. The Ribble estuary is also extremely important for waterfowl and waders in winter and on passage. It holds the 4th largest number of waterfowl and 3rd largest number of waders in Britain.

6. The numbers of Shelduck, Wigeon, Teal, Oystercatcher, Grey Plover, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit and Redshank found on the Ribble are of international importance. Golden Plover and Lapwing winter on the estuary in nationally important numbers.

7. The Wyre estuary is nationally important for its populations of Black-tailed Godwit, holding 1.9% of the British population in the winter and 4% during the spring and autumn migration.

8. The Wyre is an important high tide roost for Teal and in hard weather can hold more than 1% of the British population

9. The Wyre is a locally important low tide roost for Golden Plover which feed on the Lune at high tide.

10. The numbers of Sanderling on the Lune during spring migration are internationally important. Over 10% of the British population feed and roost off the Pilling coast. Any effects of a Wyre barrage on the mudflats outside the estuary could reduce the importance of the Lune for migrating Sanderling.

11. Redshank and Turnstone have occurred on the Wyre in nationally important numbers for single months in winter and autumn respectively.

12. The patterns of movement of birds between the Wyre and adjacent estuaries is poorly known.

13. At high tide, waders and wildfowl fly into the estuary to the major roost on the shingle spit at Armhill. On spring tides birds are displaced from the smaller roosts at Stannah, Burrow's Marsh, Barnaby's Sands and Knott End Skears to Armhill which can hold over a thousand birds.

14. Low water roosts are used by wildfowl, Lapwing, Golden Plover and gulls.

15. Teal appear to leave the Wyre to feed. However, it is possible that large numbers are still feeding in the gutters and are not counted.

16. The majority of roosting Black-tailed Godwits stay in the Wyre to feed at low tide on the mudflats off Stannah.

17. The Knott End Skears mussel beds at the mouth of the Wyre are the main feeding areas for Oystercatcher, Knot and Turnstone in the southern part of Morecambe Bay.

18. Information is needed through a detailed set of low tide counts in winter, spring and autumn, to determine whether birds roosting in the Wyre and present at low tide are feeding solely within the estuary. Such a study should concentrate on Shelduck, Teal, Oystercatcher, Dunlin, Black-tailed Godwit, Curlew, Redshank and Turnstone.

19. Research is required on the importance of the Wyre as a hard weather refuge for wildfowl, especially Teal.

20. Assessment is needed of the importance of the areas immediately outside the mouth of the Wyre for feeding waterfowl in winter, and especially spring, when large numbers of Sanderling may use the area.

21. The information gained from points 18 and 20 should then be used with the predicted tidal profile of the Wyre post barrage to determine whether the main feeding areas will be reduced or remain exposed after completion of the barrage.

OBJECTIVES

There are three objectives for this study:

1. To describe how many of each species of wader and wildfowl use the Wyre in winter and during the autumn and spring migration periods, and draw comparisons with numbers in the Lune estuary, Ribble estuary, Morecambe Bay, Britain and internationally.

2. To determine, from what is known about the local tidal movements of birds, if the numbers counted roosting in the Wyre underestimate or overestimate the numbers that feed there and hence to what extent there is an inter-dependence between the Wyre and its adjacent estuaries.

3. To describe the species and numbers of waders, gulls and wildfowl breeding in the saltmarshes on the Wyre and place these in the context of national and international estimates of their population size.

1. INTRODUCTION

The Wyre estuary lies on the southern edge of the Morecambe Bay estuarine complex, only 20 km north of the Ribble estuary (Figure 1). The Wyre estuary is 28 kms long and the mouth 500 m wide. The estuary contains two Sites of Special Scientific Interest (SSSI) at Burrow's Marsh and Barnaby's Sands (Figure 2).

In 1989 the Nature Conservancy Council (NCC) was informed of a proposal to construct a tidal barrage across the mouth of the Wyre estuary, for the purpose of producing electricity.

This report gives baseline information for the assessment of the potential impact of the proposed tidal barrage on the bird populations of the Wyre estuary. The report synthesises all currently available data on the distribution and numbers of birds using the Wyre and suggests further work that is required in order to assess the potential impact of a tidal barrage.

For the purpose of assessing its waterfowl populations, the Wyre in the past has been considered as an integral part of Morecambe Bay (Prater, 1981). Analyses concerning the ornithological significance of the Wyre estuary are based on information collected by the Birds of Estuaries Enquiry (BoEE), Britain's national monitoring scheme for waders and wildfowl, for the winters of 1985/86 to 1989/90. BoEE counters conduct the simultaneous high water roost counts, on pre-selected dates in the middle of each month, of the numbers of waders and wildfowl present. Counts are then summed to give a total count for each estuary. Further details of BoEE methods are given by Prater (1981).

The only major report to look specifically at the Wyre is that by Rankine (1990). His report describes the breeding bird and wintering waterfowl populations on the Wyre in relation to the proposed tidal barrage. Rankine documents the high and low tide roosts and feeding areas used by wintering waterfowl and relates the Wyre populations to those of Morecambe Bay and the Ribble estuary. He also comments on the movement of waterfowl between the Wyre and other estuaries.

Much of this report is based on Rankine's data, specifically the roosting and feeding areas, low tide count data and interchange of species between the Wyre and adjacent sites. Figure 2 shows the high tide roosts at Armhill (R1) and the ICI lagoons (R6) and the low tide roosts near Stanah (R2) and Shard Bridge (R3 - R5). Figure 3 shows the low tide feeding areas: Knott End Skears mussel beds (F1), Barnaby's Sands (F2), Stanah (F3) and Shard Bridge (F4 and F5).

The criteria most widely used to assess the importance of a particular site, and that used in these analyses, are that a site is considered, by the Ramsar Convention on Wetlands of International Importance, to be of <u>international</u> importance for a species if it regularly holds 1% or more of the total north-west European population (in the case of wildfowl) or of the east Atlantic flyway population (in the case of waders) for that species. Further, a site is considered to be of <u>national</u> importance if it regularly holds 1% or more of the total British population of a species. Appendix 1 gives the appropriate qualifying levels for wildfowl and waders for both categories of importance.

2. SEASONAL DISTRIBUTIONS OF WADERS AND WILDFOWL

Several species of waders and wildfowl which regularly winter on British coasts in large numbers undertake prodigious migrations from breeding grounds in the Arctic and sub-Arctic. These long distance migrants include Knot from Greenland, Grey Plover from the Taimyr peninsula in the USSR and Turnstone from north-eastern Canada. British estuaries are also used as feeding sites by large numbers of birds en route to their wintering grounds in Africa.

A general pattern for all species is that one or several estuaries are used in the course of each year. The same sites tend to be used annually by individuals - ringing recoveries show that birds not only return to the same estuary, both on passage and in winter, but also to the same section of that estuary. Even if birds only use a site for one or two weeks of the year, it may still be essential for their survival.

The seasonal average peak counts of the major species recorded by the BoEE as occuring on the Morecambe Bay estuarine complex, and the Ribble, Lune and Wyre estuaries are shown in Tables 1 - 4 respectively. Estimates of the national and international populations of each species are given in Table 5.

Morecambe Bay is one of the most important waterfowl sites in Britain, being the second most important estuary for wintering waders and the fourteenth most important estuary for wintering wildfowl (Kirby et al. 1990). Two species of duck (Shelduck and Pintail) and eight species of waders (Oystercatcher, Grey Plover, Knot, Dunlin, Bar-tailed Godwit, Curlew, Redshank and Turnstone) occur in Morecambe Bay in internationally important numbers.

Morecambe Bay also holds nationally important wintering populations of Wigeon, Teal, Ringed Plover, Golden Plover, Lapwing, Sanderling and Black-tailed Godwit (Table 1), Eider, Goldeneye and Red-breasted Merganser.

The Ribble estuary holds the fourth-largest concentration of wintering wildfowl in Britain and is ranked third for waders (Kirby et al. 1990). Three species of duck (Shelduck, Wigeon and Teal) and eight species of waders (Oystercatcher, Grey Plover, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit and Redshank) occur in internationally important numbers. The Ribble also holds nationally important wintering populations of Golden Plover and Lapwing.

The southern part of Morecambe Bay including the Wyre and Lune estuaries together with the Pilling and Cockerham shorelines (Figure 1), has a historical importance as a wildfowl site. In the 1960's, regular (and maximum) winter populations were estimated at 200 (290) Shelduck, 1,360 (4,100) Wigeon, 180 (430) Teal, 1,000 (3,900) Mallard, 105 (240) Pintail and 34 (71) Shoveler (Owen et al. 1986). Scattered mid-winter counts on the Wyre in the early 1980's produced maxima of 190 Shelduck, 24 Wigeon, 1,100 Teal and 600 Mallard. These, together with numbers from the Lune estuary, described by Owen et al. (1986) as "rather doubtfully amalgamated maxima" of 175 Shelduck, 350 Wigeon, 50 Teal and 515 Mallard, suggest a rather lower duck population than in the 1960's.

For wader populations, Prater and Wilson (1970) included the Wyre within their Lune estuary catchment area, showing that several species fed on the Knott End Skear mussel beds at the mouth of the

Wyre and roosted along the Pilling coast at high tide. The Wyre has been counted as part of the BoEE since 1986. However, there has only been full coverage since the beginning of 1989.

The high and low tide seasonal distributions of each species of waterfowl using the Wyre, compared to that on surrounding sites is summarised below.

SHELDUCK - Britain supports over one quarter of the north-west European winter Shelduck population (Table 5). The vast majority of these are British breeding birds, augmented by birds from Sweden, West Germany, Belgium, Denmark and the Netherlands (Prater, 1981). Morecambe Bay and the Ribble each hold about 5% of the British wintering population (Tables 1 & 2). Shelduck are present on the Wyre in small numbers, roosting at high tide at several sites. Armhill is the prime site, with roosts also at Shard Bridge and Stannah (Rankine 1990). These last two are often disturbed through boating and yachting activities, at which time the birds will move to the Armhill roost. The low tide counts suggest that nearly one-third of the roosting birds remain to feed in the estuary (Table 6).

WIGEON - The breeding range of this sub-Arctic duck extends from Iceland and Scotland eastwards to the Pacific coast of the USSR. Iceland and the British Isles are the only parts of the regular breeding range to hold wintering birds. It is likely that many British breeding Wigeon remain in the country for the winter, but this small population contributes less than 2% to peak winter numbers (Prater, 1981). The Ribble is the second most important site in Britain for wintering Wigeon (Kirby et al. 1990), holding

13% of the British population (Table 2). The Lune and Wyre hold very small numbers and are not important sites for this species (Tables 3 & 4).

TEAL - Around 100,000 Teal winter in Britain. These come from breeding grounds in Russia, Fenno-Scandia and central Europe. The Icelandic breeding population mainly winters in Ireland and Scotland. British breeding birds tend to be sedentary, except in severe weather when they undertake hard weather movements. Such a movement occured in January 1990 when 1047 Teal were recorded in the Wyre during severe gales. This shows that the Wyre can hold numbers of national importance and may well be an important site for this species in hard weather. Teal roost regularly on both the Armhill site and the ICI pools.

MALLARD - Mallard are the most familiar and widespread ducks of the northern hemisphere. About 500,000 birds winter in Britain, 10% of the north-west European population (Table 5) although only about 52,000 of these winter on estuaries (Prater, 1981). Peak numbers occur in Britain in November and December. Morecambe Bay holds the largest winter concentration of Mallard with almost 1% of the British total (Table 1). Mallard on the Wyre occur mainly at the ICI lagoons and Shard Bridge, the latter population seemingly resident around the yacht club (Rankine, 1990). The peak average winter counts of 128 at high water and 35 at low water (Table 6) indicate that the Mallard is not of major importance on the Wyre.

OYSTERCATCHER - The 280,000 wintering Oystercatchers in Britain form over 30% of the north-west European population. British

breeding birds are augmented by large numbers from Iceland, the Faeroes and Norway. In addition, smaller numbers from the Netherlands, Sweden and western USSR, winter on the southern and south-eastern coasts of England (Prater, 1981). Morecambe Bay holds 20% of the British Oystercatcher population during the autumn/winter period (Table 1). On the Wyre, small numbers of birds which feed on Knott End Skear mussel beds roost at high tide at Armhill. However, this roost is not of major importance in a Morecambe Bay context especially when when compared to the large high tide Oystercatcher roost at Pilling (see Section 3).

RINGED PLOVER - Ringed Plovers are widely distributed on the coasts of Britain, Ireland and continental Europe. They are not abundant in winter, when a total of only 50,000 are present on the east Atlantic flyway, although Britain holds nearly 50% of these birds (Table 5). The wintering population is primarily British breeders, with the addition of birds which breed around the North Sea from the Netherlands to southern Sweden. During migration, large numbers of Ringed Plovers from breeding areas in Iceland and Greenland may stop over to refuel with small numbers of Scandinavian breeding birds also occuring mainly in the autumn. Morecambe Bay, the Ribble and Lune are important sites for the spring passage of Ringed Plover (Tables 1 - 3). Figures for the Wyre (Table 4) show that the estuary is not of major importance for this species.

GOLDEN PLOVER - The wintering range of Golden Plover includes most of western and south-western Europe. British birds tend to winter inland (Lloyd, 1978) and Golden Plover are not a typical estuarine species. However, in hard weather, birds move to the coast

(Prater, 1981). On the Wyre, Golden Plover were recorded only once at the Armhill high tide roost (16 birds in December 1988). In comparison with the Ribble, the Wyre/Lune estuarine unit does not hold important numbers of Golden Plover, although the Wyre is a locally important low tide roost for birds feeding on the Lune (See Section 3).

GREY PLOVER - This species has one of the widest wintering ranges of any wader; from Scotland south to South Africa, east to Japan and New Zealand and along the coasts of North and South America. The wintering distribution of Grey Plover in Britain was essentially south-eastern during the 1970's but a marked population increase has resulted in it becoming widespread throughout the country. The Ribble holds an internationally important population (Table 2). The Wyre is of limited importance for this species, holding small numbers of birds at both high and low water.

LAPWING - Several million Lapwing winter in western Europe. These birds show a complex pattern of dispersion and migration (Imboden, 1974). The majority of Lapwings wintering in Britain occur on inland areas, only moving onto estuaries during severe weather when their feeding grounds on arable fields and grasslands are frozen. Lapwings migrate to Britain from Scandinavia, the low countries, central and eastern Europe and Russia (Prater, 1981). Morecambe Bay and the Ribble are both nationally important for Lapwings in winter, being ranked the second and third most important sites in Britain, respectively. (Kirby et al. 1990). On the Wyre this species roosts regularly, in small numbers, at both the ICI lagoons and Armhill. Lapwings also roost communally with

Golden Plover at Shard Bridge at low tide.

KNOT - Virtually all the Knot that occur in Britain breed in northern Greenland and north-eastern Canada. Small numbers, mainly from the Siberian breeding population, occur on autumn passage. In winter, Britain holds over 60% of the east Atlantic flyway population (Table 5). Morecambe Bay and the Ribble both hold internationally important populations of Knot in winter, spring and autumn (Tables 1 & 2) as does the Lune in winter and spring (Table 3). Only small numbers of Knot use the Wyre (Table 4) at high tide.

SANDERLING - The origins of British wintering Sanderling are not fully known, although it is thought that many are of Siberian origin. The British wintering population is internationally important (Moser, 1987) but its numbers are dwarfed by the very large autumn and, in particular, spring passages of Siberian and Greenland birds. The peak numbers that occur in Britain in July-August and in May are almost entirely due to birds recorded on estuaries in north-west England (Prater, 1981). The Ribble is the top site in Britain for wintering Sanderling (Kirby et al. 1990) and holds almost 22% of the British population on spring passage (Table 2). The data, although showing the very low numbers in the Wyre, highlights the importance of the Lune for this species during spring migration, with over 10% of the British population (Table 3). These birds spend much of their time on the mudflats off the Pilling coast adjacent to the Wyre. Although not roosting or feeding in the Wyre itself, any effects of a barrage on the mudflats outside the estuary could affect this spring Sanderling site.

DUNLIN - Britain is important for three races of Dunlin: as a moulting and wintering ground for the nominate race Calidris alpina alpina (from breeding areas in northern Scandinavia and the USSR), and as a stage post for C.a. arctica breeding in north-east Greenland, and for C.a. schinzii breeding mainly in Britain and Iceland. Passage numbers are swamped by the very large wintering population, Britain holding 30% of the east Atlantic flyway population (Table 1). Dunlin show a similar pattern of distribution to Knot with internationally important populations on Morecambe Bay and the Ribble but small numbers on the Wyre. Birds roost at the Armhill high tide roost, showing an increase in numbers during migration periods (Table 4).

BLACK-TAILED GODWIT - British wintering Black-tailed Godwits are from the Icelandic breeding population which also winter in Ireland and France. Black-tailed Godwits can be difficult birds to census in some estuaries and may move between adjacent estuaries within a few days (Prater, 1981). On autumn and spring migration, very large numbers of birds can occur; for example, in April almost 50% of the European wintering population have been recorded in Ireland alone (Moser, 1987). The Ribble is the top site for wintering Black-tailed Godwits in Britain (Kirby et al. 1990) with over 60% of the British population on the Ribble in autumn (Table 2). However, the data also shows the importance of the Wyre, and to a lesser extent, the Lune for Black-tailed Godwits. The Wyre is nationally important for this species, holding 4% of the British population during spring and autumn passage (Table 4). The Ribble, Lune and Wyre together account for 67% of British Black-tailed Godwits in the autumn.

BAR-TAILED GODWIT - Bar-tailed Godwits have a more northerly breeding range than Black-tailed Godwits, the British wintering birds originating from Scandinavia and western USSR. Britain holds over 60% of the wintering east Atlantic flyway population (Table 5), making our estuaries extremely important for this species. Bar-tailed Godwits prefer the sandier parts of large estuaries, perhaps explaining why their British distribution is restricted to only a few sites. The Ribble is the top British site for this species (Kirby et al. 1990) with over 20% of the total population present in autumn and winter (Table 2). The Wyre appears to be used as a high tide roost site on autumn passage, although numbers are not large (Table 4). No birds are known to feed in the Wyre at low tide (Table 6).

CURLEW - Curlew breeding distribution covers Britain and Ireland in the west, through Fenno-Scandia and Central Europe to eastern USSR and Mongolia. European breeding birds winter largely in western Europe, Britain holding 26% of the east Atlantic flyway population (Table 5). Morecambe Bay holds internationally important populations of Curlew and is the top British wintering site (Kirby et al. 1990). On the Wyre, this species does not occur in large numbers. Birds were recorded feeding throughout the estuary, roosting at high tide on Armhill.

REDSHANK - In winter, numbers of Redshank in Britain are swelled by the Icelandic population which winters almost exclusively on British coasts. These Icelandic birds appear to make up about 50% of the British wintering population. In winter Britain holds 50% of the east Atlantic flyway population (Table 5). Although the seasonal average peak counts show that the Wyre holds no regular

nationally or internationally important Reshank populations (Table 4), the high tide count of 790 birds in February 1988 demonstrates that the Wyre can hold substantial populations on occasions. Birds roost regularly at Armhill, feeding primarily at Shard Bridge (Rankine, 1990).

TURNSTONE - Much of the Greenland/Canadian breeding population of Turnstones winter in Britain. Those breeding in northern Europe largely use Britain as an autumn migration staging post on their way further south to winter predominantly in West Africa (Branson et al. 1978). Counts of Turnstones on estuaries underestimate total numbers in Britain because the birds occur in small scattered flocks on rocky shores, often inaccessible to recorders. Nevertheless, Britain holds a minimum of 64% of the wintering east Atlantic flyway population (Table 5). Table 3 shows the importance of the Lune for roosting Turnstone. Turnstones do not regularly occur on the Wyre in large numbers, although a count of 628 birds in October 1988 on the Armhill roost, shows that the Wyre can hold nationally important populations.

3. MOVEMENT OF BIRDS WITHIN THE WYRE AND TO/FROM ADJACENT ESTUARIES

Interchange of waders between estuaries has been documented for several regions, e.g. Liverpool Bay (Kirby et al. 1988, Mitchell et al. 1988) and the Moray Firth (Symonds et al. 1984,). The movements of waders between roosting and feeding areas within Morecambe Bay have been published in relation to the proposed Morecambe Bay barrage schemes (Prater and Wilson, 1970, Wilson and Marsh, 1987). Only Rankine (1990) documents specific movements of birds within the Wyre.

The high and low tide roost sites on the Wyre are shown in Figure 2 (Rankine, 1990). The main high tide roost at Armhill (R1) is used by all species. On spring tides, this roost can hold over one thousand birds as birds are displaced from Stannah, Burrow's Marsh, Barnaby's Sands and Knott End Skears. Waders, especially Turnstone feeding at Knott End Skears, have also roosted at Rossall Point (Prater and Wilson, 1970). In the 1989/90 winter, severe gales destroyed the high tide roost site at Rossall Point (Blacow, pers. comm.); birds displaced from there used Armhill as an alternative site. Waterfowl will use the ICI lagoons (R6) as a high tide roost if disturbed from Armhill (Blacow, pers. comm.).

The low water roosts (R2 - R5) are used primarily by wildfowl, Lapwing, Golden Plover and gulls. For instance, the low tide roost at Shard Bridge (R4) contained 1000 Golden Plover in February 1990 (Rankine, 1990), part of a mixed Golden Plover/Lapwing flock. These birds roosted at this site both in autumn and throughout the winter, regardless of the weather conditions. At high tide, the Golden Plover and Lapwing fly inland to Pilling to feed.

Flight lines recorded by Rankine for wader and gull species on the Wyre are shown in Figure 2. At high tide, birds fly from Rossall Point to roost at Armhill and from Shard Bridge in the direction of Pilling during low water counts. Lapwings fly up river from the mouth of the estuary to Shard Bridge to roost at low tide; similarly, gull flocks (species unknown) move out of the estuary on rising tides from roosts around Shard Bridge, flying to roost near the Fleetwood landfill site.

Table 6 shows the peak average monthly low tide counts on the Wyre for the period September 1986 to December 1990, (taken from Rankine, 1990). A base parameter of 50+ birds has been set to concentrate on the most important species. Any conclusions drawn from these data must be treated with caution due to the short data set available. The low tide count of 120 Teal suggests that birds may be leaving the estuary to feed elsewhere. However, it is also possible that the Teal are still feeding in the Wyre but are concealed in gutters and hence not counted. More work on this is required through detailed low-tide counts to establish the low tide distribution of Teal on the Wyre.

Studies on the waders of Morecambe Bay (Prater and Wilson 1970, Wilson and Marsh, 1987) have shown the importance of the Knott End Skears mussel beds at the mouth of the Wyre as a low tide feeding site for Oystercatcher, Knot and Turnstone. At high tide, the Oystercatchers roost at Pilling, the main Oystercatcher roost in the southern part of Morecambe Bay. Knot roost on the mudflats adjacent to the Skears, and on spring tides fly direct to the main roost at Pilling. Turnstone roosted at Rossall Point (until its destruction). From the low tide counts, 98% of Turnstone leave

the Wyre to feed, although Rankine found no Turnstone on the Knott End Skears, suggesting that birds appear to travel a considerable distance on occasions to feed outside the Wyre.

One method of interpreting movements of birds is to compare high and low tide counts, to get an estimate of the percentage of each species leaving the estuary and remaining to feed. Figures 4 - 9 show plots of the BoEE high tide counts compared to Rankine's low water counts for six species: Shelduck, Oystercatcher, Dunlin, Black-tailed Godwit, Curlew and Redshank, respectively.

Shelduck show a close correlation between high and low tide counts, suggesting that the same birds remain in the Wyre to both feed and roost (Figure 4). Roosting Oystercatchers leave the estuary to feed on Knott End Skears as indicated by the very low numbers of birds recorded on low tide counts (Figure 5).

Dunlin, Black-tailed Godwit and Curlew all show a similar pattern of correlation between feeding and roosting birds, with a marked peak in the number of feeding birds using the Wyre on spring migration (Figures 6-8). The majority of roosting Black-tailed Godwits stay in the estuary to feed. Their favoured feeding area is the stretch of mudflats off Stannah (Figure 3). It is highly probable that the birds recorded on the Wyre and Lune are birds en route to/from the Ribble, or overspill birds using the Wyre/Lune as extra feeding/roosting grounds.

The number of Redshank recorded at low tide in Figure 9 is probably an under estimate of the total number of feeding birds, showing a similar pattern to that found on other estuaries. Redshank tend to feed in the gullys and creeks rather than in the

open estuary and can often be missed during low tide counts. More work on this is required through detailed low tide counts to establish the exact number and distribution of Redshank on the Wyre.

4. BREEDING BIRDS OF THE WYRE

Since 1979, seventeen species of birds have been recorded breeding on the Wyre at Barnaby's Sands and Burrows Marsh (from Rankine, 1990) (Table 7).

Breeding waterfowl comprise the following six species: Shelduck, Mallard, Oystercatcher, Ringed Plover, Lapwing and Redshank. The maximum number of breeding pairs for these species, compared to their national and international populations is listed in Table 8.

Shelduck bred annually from 1979 up to 1984, after which breeding became irregular. 1984 was the best year with six pairs hatching 45 young; three pairs produced no young in 1990. Mallard have not bred on the estuary since 1985.

The four wader species have bred in occasional years with little success. Oystercatcher have never produced young; Ringed Plover hatched only one young in 1980; Lapwing hatched five young in 1983 and two in 1988. Redshank bred successfully for the first time in 1990 with two birds hatched.

As on many saltmarshes, flooding can be a major cause of nest failure on the Wyre. Two species have been flooded out due to the position of their nest sites: Oystercatcher on the shingle spit at Armhill in 1983 and Redshank in 1979 which attempted to nest on the edge of the saltmarsh creeks. Oystercatcher and Lapwing also breed in fields adjacent to the saltmarsh and will bring their young onto the marsh. However, neither species occur in large numbers (Table 8).

From Table 8 it is obvious that the Wyre holds only small breeding populations of waterfowl.

Of the ten other species listed as breeding, Grey Partridge, Skylark, Stonechat, Linnet and Corn Bunting are currently showing steep declines in their British breeding populations (Marchant et al. 1990). Although specific figures for the maximum number of breeding pairs on the Wyre are not available for these species, their populations will be small when compared to their estimated national populations given in Table 8 (Blacow, pers. comm.).

5. CONCLUSIONS

Four species of wildfowl (Shelduck, Wigeon, Mallard and Teal) and thirteen species of wader (Oystercatcher, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank and Turstone) are found on the Wyre estuary in winter and on spring and autumn passage. Numbers of wildfowl using the Wyre are in general small although large numbers of Teal can occur on the estuary in winter during spells of hard weather.

The Wyre is nationally important for Black-tailed Godwit in winter and especially on spring and autumn passage, when the estuary holds 4% of the British population. The Wyre is locally important for winter low tide roosts of Lapwing and Golden Plover, which feed inland at Pilling during high tide.

The Wyre is not of major importance for Ringed Plover, Grey Plover, Sanderling, Dunlin, Bar-tailed Godwit, Curlew, Redshank and Turnstone which occur only in small numbers. However, nationally important populations of Redshank and Turnstone have occured in autumn and winter on single high tide count dates, although the Wyre is not considered to be nationally important for these species at present.

The majority of roosting Shelduck and Black-tailed Godwit stay in the Wyre to feed at low tide. The Knott End Skears mussel beds at the mouth of the estuary are important low tide feeding grounds for Oystercatcher, Knot and Turnstone during winter, spring and autumn, the majority of Oystercatcher and Knot roosting on the Pilling coast. The mudflats off the Pilling coast, adjacent to the

Wyre, are important for Sanderling on spring passage.

The numbers of Teal and Redshank recorded feeding in the Wyre at low tide are probably under estimating the total number of birds present. Both species will feed in gutters and can be missed.

Six species of waterfowl (Shelduck, Mallard, Oystercatcher, Ringed Plover, Lapwing and Redshank) and ten other species have bred on the Wyre between 1979 and 1990 on an irregular basis. The breeding populations on the Wyre are small compared to the estimated national populations for the seventeen species.

6. RECOMMENDATIONS FOR FURTHER WORK

This study has shown that the Wyre, although not having extremely large bird populations, could be of considerable importance for one species in particular, the Black-tailed Godwit. It also holds on occasions substantial numbers of several other species.

There are three areas of further work that are required to assess fully the impact of a tidal barrage across the Wyre on bird populations:

1. A detailed set of counts around the tidal cycle in winter, spring and autumn, to ascertain whether birds roosting in the estuary and present at low tide are feeding soley within the estuary or not. Such a study should concentrate on the more important species within the estuary: Shelduck, Teal, Oystercatcher, Dunlin, Black-tailed Godwit, Curlew, Redshank and Turnstone.

2. The importance of the Wyre as a refuge during periods of hard weather. An analysis is required to ascertain whether large numbers of wildfowl congregate on the Wyre during periods of severe weather, particularly Teal.

3 An assessment of the importance of areas immediately outside the mouth of the Wyre for feeding waders and wildfowl. This study should concentrate on both the winter period and, in particular, the spring migration period when it is possible that the area is used by very large numbers of Sanderling.

The information gained by points 1 and 3 should then be used in conjunction with the predicted tidal profile of the Wyre post barrage to ascertain whether there will be a substantially reduced feeding area post barrage or whether the main feeding grounds will still remain exposed after building of the barrage.

ACKNOWLEDGEMENTS

I am grateful to Dr. Nigel Clark, Dr. Robert Prys-Jones and Ray Waters who provided advice and supervision throughout this work. I am also indebted to Callum Rankine for the use of his data, Len Blacow who provided local knowledge and Elizabeth Murray who kindly drew the figures. I must thank the Nature Conservancy Council and the Royal Society for the Protection of Birds, co-sponsors of the Birds of Estuaries Enquiry, and the many hundreds of BoEE participants who have contributed so much of their time and energy to estuarine research.

REFERENCES

Branson,N.J.B.A., Ponting,E.D. & Minton,C.D.T. (1978). Turnstone migrations in Britain and Europe. Bird Study 25: 181-187

Imboden,C. (1974). Zug, Fremdansiedlung und Brut periode des Kiebitz Vanellus vanellus in Europa. Der. Orn. Beob. 71: 5-134.

Kirby,J.S., Cross,S., Taylor,J.E. & Wolfenden,I.H. (1988). The distribution and abundance of waders wintering on the Alt Estuary, Merseyside, England. Wader Study Group Bull. 54, 23-28.

Kirby,J.S., Waters,R.J. & Prys-Jones,R.P. (1990). Wildfowl and Wader Counts 1989-90. The Wildfowl & Wetlands Trust, Slimbridge.

Lloyd,D. (1978). Golden Plover Survey. BTO News No. 95:6.

Marchant,J.H., Hudson,R., Carter,S.P. & Whittington,P. (1990). Population Trends in British Breeding Birds. BTO, Tring.

Mitchell,J.R., Moser,M.E. & Kirby, J.S. (1988). Declines in midwinter counts of waders roosting on the Dee estuary. Bird Study 35, 191-198.

Moser,M.E. (1987). A Revision of Population Estimates for Waders (Charadrii) Wintering on the Coastline of Britain. Biol.Conserv. 39, 153-164.

Owen,M., Atkinson-Willes,G.L. & Salmon,D.G. (1986). Wildfowl in Great Britain. Cambridge University Press.

Piersma,T. (1986). Breeding waders in Europe. A review of population size estimates and a bibliography of information sources. Bull. Wader Study Group 48, suppl., 1-116.

Pirot,J.-Y., Laursen,K., Madsen,J. & Monval,J.-Y. (1989). Population estimates of swans, geese, ducks and Eurasian Coot Fulica atra in the Western Palearctic and Sahelian Africa. Pp. 14-23. In: Boyd,H. & Pirot,J.-Y. (Eds.) Flyways and reserve networks for water birds. IWRB Spec. Publ. 9. Slimbridge, UK, 109pp.

Prater,A.J. (1981). Estuary Birds of Britain and Ireland. Poyser, Calton.

Prater,A.J. & Wilson,J. (1970). The relationship between roosting and feeding areas of waders in Morecambe Bay. Morecambe Bay Barrage Feasibility Study: Biological Aspects, Appendix D.

Rankine,C.A. (1990). The Environmental Impact of the Proposed Wyre Barrage, Lancashire, with Special Reference to Birds. M.Sc. Thesis. Lancaster University.

Smit,C.J. & Piersma,T. (1989). Numbers, midwinter distribution and migration of wader populations using the East Atlantic flyway. Pp. 24-63. In: Boyd,H. & Pirot,J.-Y. (Eds.) Flyways and reserve networks for water birds. IWRB Spec. Publ. 9, Slimbridge, UK, 109pp.

Symonds,F.L., Langslow,D.R. & Pienkowski,M.W. (1984). Movements of wintering shorebirds within the Firth of Forth: species differences in usage of an intertidal complex. Biol. Conserv. 28, 187-215.

Wilson,J. & Marsh, P.J. (1987). Birds. In: Robinson,N.A. & Pringle,A.W. (Eds.), Morecambe Bay: An Assessment of Present Ecological Knowledge. A Resource Paper of the Centre for North-

West Regional Studies, University of Lancaster in conjunction with the Morecambe Bay Study Group.

Appendix: Qualifying levels for national and international importance. (from Kirby et al. 1990).

	National	International
Mute Swan	180	1,800
Bewick's Swan	70	170
Whooper Swan	60	170
Pink-footed Goose	1,100	1,100
European White-fronted Goose	60	3,000
Greenland White-fronted Goose	100	220
Greylag Goose: Iceland pop.	1,000	1,000
Barnacle Goose: Greenland pop.	200	320
Svalbard pop.	100	100
Dark-bellied Brent Goose	900	1,700
Shelduck	750	2,500
Wigeon	2,500	7,500
Gadwall	50	120
Teal	1,000	4,000
Mallard	5,000	50,000**
Pintail	250	700
Shoveler	90	400
Pochard	500	3,500
Tufted Duck	600	7,500
Scaup	40*	1,500
Eider	700	20,000**
Long-tailed Duck	200	20,000
Common Scoter	350	8,000
Goldeneye	150	3,000
Red-breasted Merganser	100	1,000
Goosander	50	1,250

Appendix (cont.)

Oystercatcher	2,800	9,000
Avocet	5*	700
Ringed Plover	230 p=300	500
Golden Plover	2,000	10,000
Grey Plover	210	1,500
Lapwing	10,000	20,000**
Knot	2,200	3,500
Sanderling	140 p=300	1,000
Purple Sandpiper	160	500
Dunlin	4,300 p=2,000	14,000
Ruff	15*	10,000
Snipe	?	10,000
Black-tailed Godwit	50	700
Bar-tailed Godwit	610	1,000
Whimbrel	+ p=50	700
Curlew	910	3,500
Spotted Redshank	2*	?
Redshank	750 p=1,200	1,500
Greenshank	4*	?
Turnstone	450	700

\+ 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.
p passage

Table 1. Seasonal average peak counts, 1985/6 - 1989/90 for Morecambe Bay with British and international importance.

	Winter			Spring			Autumn		
	Mean	% Brit.	% Euro.	Mean	% Brit.	% Euro.	Mean	% Brit.	% Euro.
Shelduck	3,992	5.5	1.5	2,236	3.0	0.9	1,108	1.5	0.4
Wigeon	2,641	1.1	0.4	17	+	+	897	0.4	0.1
Teal	1,186	1.2	0.3	161	0.2	+	572	0.6	0.1
Mallard	4,387	0.9	0.1	528	0.1	+	1,757	0.4	+
Pintail	2,145	8.6	3.1	13	+	+	609	2.4	0.9
Shoveler	15	0.2	+	9	0.1	+	11	0.1	+
Oystercatcher	56,776	20.3	6.3	13,066	4.7	1.4	53,863	19.2	6.0
Ringed Plover	435	1.9	0.9	1,623	5.4	3.2	863	2.9	1.7
Golden Plover	1,943	1.0	0.2	312	0.2	+	1,560	0.8	0.1
Grey Plover	2,018	9.6	1.3	755	3.6	0.5	1,474	7.0	0.9
Lapwing	16,951	1.7	0.8	998	0.1	+	15,486	1.5	0.7
Knot	26,308	11.9	7.5	15,061	6.8	4.3	6,415	2.9	1.8
Sanderling	192	1.3	0.2	3,374	11.2	3.3	995	3.3	0.9
Dunlin	43,036	10.0	3.0	9,299	4.6	0.6	21,102	10.5	1.5
Black-tailed Godwit	144	2.8	0.2	142	2.8	0.2	184	3.7	0.3
Bar-tailed Godwit	2,650	4.3	2.6	205	0.3	0.2	551	0.9	0.5
Curlew	10,167	11.1	2.9	7,061	7.7	2.0	13,628	14.9	3.9
Redshank	7,176	9.5	4.7	4,574	3.8	3.0	8,493	7.0	5.6
Turnstone	1,891	4.2	2.7	1,586	3.5	2.2	1,750	3.9	2.5

Table 2. Seasonal average peak counts, 1985/86 - 1989/90, for the Ribble with British and international importance.

	Winter			Spring			Autumn		
	Mean	% Brit.	% Euro.	Mean	% Brit.	% Euro.	Mean	% Brit.	% Euro.
Shelduck	4,173	5.5	1.7	1,297	1.7	0.5	1,044	1.4	0.4
Wigeon	33,792	13.5	4.5	398	0.2	+	9,934	4.0	1.3
Teal	5,763	5.7	1.4	118	0.1	+	1,757	1.8	0.4
Mallard	1,400	0.3	+	290	+	+	925	0.2	+
Shoveler	24	0.3	0.1	9	+	+	19	0.2	+
Oystercatcher	13,934	5.0	1.6	5,018	1.8	0.6	10,764	3.8	1.2
Ringed Plover	42	0.2	0.1	2,743	9.1	5.5	678	2.3	1.4
Golden Plover	5,259	2.6	0.5	2,407	1.2	0.2	2,382	1.2	0.2
Grey Plover	2,906	13.8	1.9	3,054	14.5	2.0	2,319	11.0	1.6
Lapwing	16,512	1.7	0.8	332	+	+	4,699	0.5	0.2
Knot	41,327	18.8	11.8	29,253	13.3	8.4	46,558	21.2	13.3
Sanderling	2,401	17.2	2.4	6,452	21.5	6.5	2,910	9.7	2.9
Dunlin	13,998	3.3	1.0	12,728	6.4	0.9	19,258	9.6	1.4
Black-tailed Godwit	1,429	28.6	2.0	1,695	33.9	2.4	3,057	61.1	4.4
Bar-tailed Godwit	12,544	20.6	12.5	2,082	3.4	2.1	13,289	21.8	13.3
Curlew	881	0.9	0.3	468	0.5	0.1	1,012	1.1	0.3
Redshank	1,573	2.1	1.1	909	0.8	0.6	1,535	1.3	1.0
Turnstone	336	0.7	0.5	142	0.3	0.2	385	0.9	0.6

+ <0.05%

Table 3. Seasonal average peak counts, 1985/86 - 1989/90, for the Lune with British and international importance.

	Winter			Spring			Autumn		
	Mean	% Brit.	% Euro.	Mean	% Brit.	% Euro.	Mean	% Brit.	% Euro.
Shelduck	506	0.6	0.2	230	0.4	0.1	238	0.4	0.1
Wigeon	623	0.2	0.1	29	+	+	250	0.1	+
Teal	475	0.4	0.1	13	+	+	161	0.1	+
Mallard	1,076	0.2	+	140	+	+	904	0.1	+
Shoveler	3	+	+	1	+	+	10	0.1	+
Oystercatcher	6,999	2.5	0.8	971	0.4	0.1	5,125	1.8	0.6
Ringed Plover	98	0.4	0.2	771	2.6	1.5	140	0.5	0.3
Golden Plover	1,192	0.6	0.1	128	0.06	+	720	0.4	0.1
Grey Plover	620	2.9	0.4	465	2.2	0.3	374	1.8	0.3
Lapwing	6,142	0.6	0.3	188	+	+	5,839	0.6	0.3
Knot	6,838	3.1	1.9	5,543	2.5	1.6	2,282	1.0	0.7
Sanderling	148	1.0	0.2	3,199	10.7	3.2	787	2.6	0.8
Dunlin	6,289	1.5	0.5	4,689	2.3	0.3	6,066	3.0	0.4
Black-tailed Godwit	80	1.6	0.1	106	2.1	0.2	109	2.2	0.2
Bar-tailed Godwit	890	1.5	0.9	107	0.2	0.1	229	0.4	0.2
Curlew	1,305	1.4	0.4	593	0.7	0.2	1,043	1.2	0.3
Redshank	1,115	1.5	0.7	750	0.6	0.5	1,073	0.9	0.7
Turnstone	725	1.6	1.0	628	1.4	0.9	653	1.5	0.9

+ <0.05%

Table 4. Seasonal average peak counts, 1985/86 - 1989/90, for the Wyre with British and international importance.

	Winter			Spring			Autumn		
	Mean	% Brit.	% Euro.	Mean	% Brit.	% Euro.	Mean	% Brit.	% Euro.
Shelduck	159	0.2	0.1	55	0.07	+	111	0.1	+
Wigeon	36	+	+	0	+	+	15	+	+
Teal	349	0.3	0.1	8	+	+	49	+	+
Mallard	88	+	+	52	+	+	142	+	+
Shoveler	33	0.3	0.1	0	+	+	17	0.2	+
Oystercatcher	472	0.2	+	355	0.1	+	268	0.1	+
Ringed Plover	23	0.1	+	35	0.2	0.1	50	0.2	0.1
Grey Plover	13	0.1	+	13	0.1	+	3	+	+
Lapwing	1,025	0.1	+	33	+	+	430	+	+
Knot	71	+	+	124	0.1	+	43	+	+
Sanderling	2	+	+	13	0.1	+	4	+	+
Dunlin	121	+	+	259	0.1	+	386	0.1	+
Black-tailed Godwit	89	1.9	0.1	205	4.1	0.3	194	3.8	0.2
Bar-tailed Godwit	2	+	+	0	+	+	36	+	+
Curlew	152	0.2	+	39	+	+	135	0.1	+
Redshank	310	0.4	0.3	443	0.6	0.4	277	0.4	0.3
Turnstone	71	0.2	0.1	81	0.2	0.1	195	0.4	0.3

+ <0.05%

Table 5. Estimates of British populations (Prater, 1981, Moser, 1987) and international populations (Pirot et al, 1989, Smit & Piersma 1989) of wildfowl and waders.

Species	British Estimate	International Estimate
Shelduck	75,000	250,000
Wigeon	250,000	750,000
Teal	100,000	400,000
Mallard	500,000	5,000,000
Pintail	25,000	70,000
Shoveler	9,000	40,000
Oystercatcher	280,000	900,000
Ringed Plover	23,000	50,000
Golden Plover	200,000	1,000,000
Grey Plover	21,000	150,000
Lapwing	1,000,000	2,000,000
Knot	220,000	350,000
Sanderling	14,000	100,000
Dunlin	430,000	1,400,000
Black-tailed Godwit	5,000	70,000
Bar-tailed Godwit	61,000	100,000
Curlew	91,000	350,000
Redshank	75,000	150,000
Turnstone	45,000	70,000

Table 6. Peak average monthly low tide counts on the Wyre September 1986 to December 1990 (flocks recorded at 50+) with month of count where known (data from Rankine, 1990).

Species	Peak Average Monthly Count	
Shelduck	121	FE
Teal	120	#
Mallard	35	MA
Shoveler	1	MA
Oystercatcher	700	FE
Ringed Plover	53	MY
Golden Plover	1000	FE
Grey Plover	7	MY
Lapwing	1357	#
Knot	120	#
Dunlin	650	MY
Black-tailed Godwit	271	MA
Curlew	175	MA
Redshank	348	#
Turnstone	9	#

month not known

Table 7. Species which have bred on Barnaby's Sands and Burrows Marsh, 1979-90 (Rankine 1990).

Species	Years Bred
Shelduck	1979-84, 1987-88 1990
Mallard	1979, 1981-84
Grey Partridge	1979, 1981, 1988, 1990
Oystercatcher	1980, 1983, 1990
Ringed Plover	1980, 1982
Lapwing	1979, 1981, 1983, 1988
Redshank	1979-81, 1983-84, 1990
Common Tern	1979-84, 1987
Skylark	1979, 1982-84, 1988
Meadow Pipit	1980-84, 1986
Stonechat	1979-80
Sedge Warbler	1988-89
Whitethroat	1981-84, 1986-88, 1990
Linnet	1979-81, 1983-84, 1988, 1990
Yellowhammer	1980-82
Reed Bunting	1981, 1983, 1988
Corn Bunting	1979, 1981

Table 8. Maximum number of breeding pairs on the Wyre with British and European estimates of population size (Marchant et al 1990, Owen et al 1986, Piersma, 1986).

Waterfowl	Maximum Number Breeding Pairs	British Popn. Estimate	European Popn. Estimate
Shelduck	6	12,000	#
Mallard	2	70,000-150,000	11/2 million
Oystercatcher	3	33,000-43,000	218,000
Ringed Plover	2	8600	90,000
Lapwing	5	200,000-225,000	869,000
Redshank	8	30,000-33,000	268,000
Other Species			
Grey Partridge	#	200,000-400,000	#
Common Tern	#	12,000	#
Skylark	#	2,000,000	#
Meadow Pipit	#	1-11/2 million	#
Stonechat	#	10,000-20,000	#
Sedge Warbler	#	150,000-200,000	#
Whitethroat	#	400,000-500,000	#
Linnet	#	600,000-700,000	#
Yellowhammer	#	11/2 million	#
Reed Bunting	#	400,000	#
Corn Bunting	#	30,000	#

No population estimates available

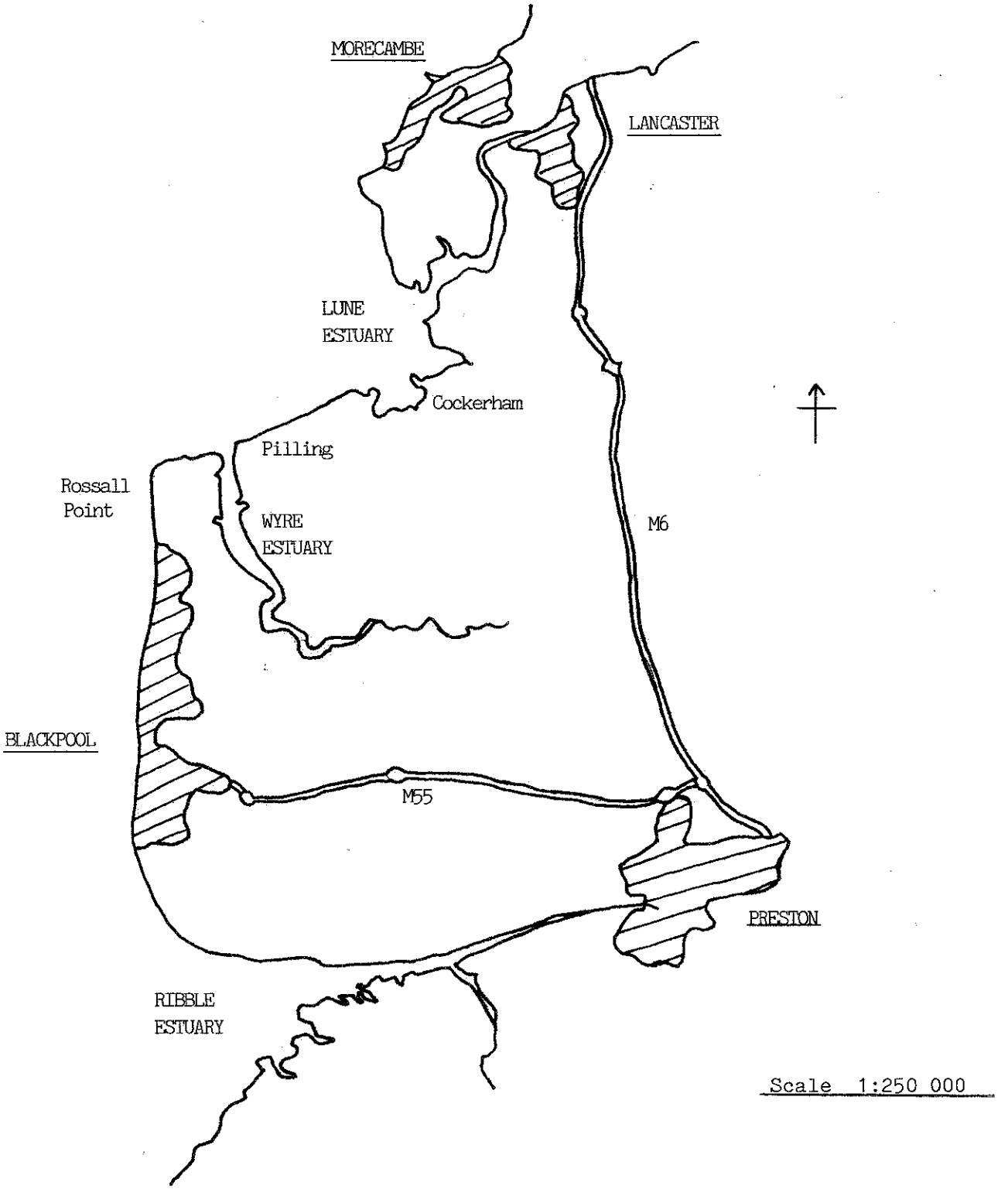

Figure 1. The Wyre in geographical context

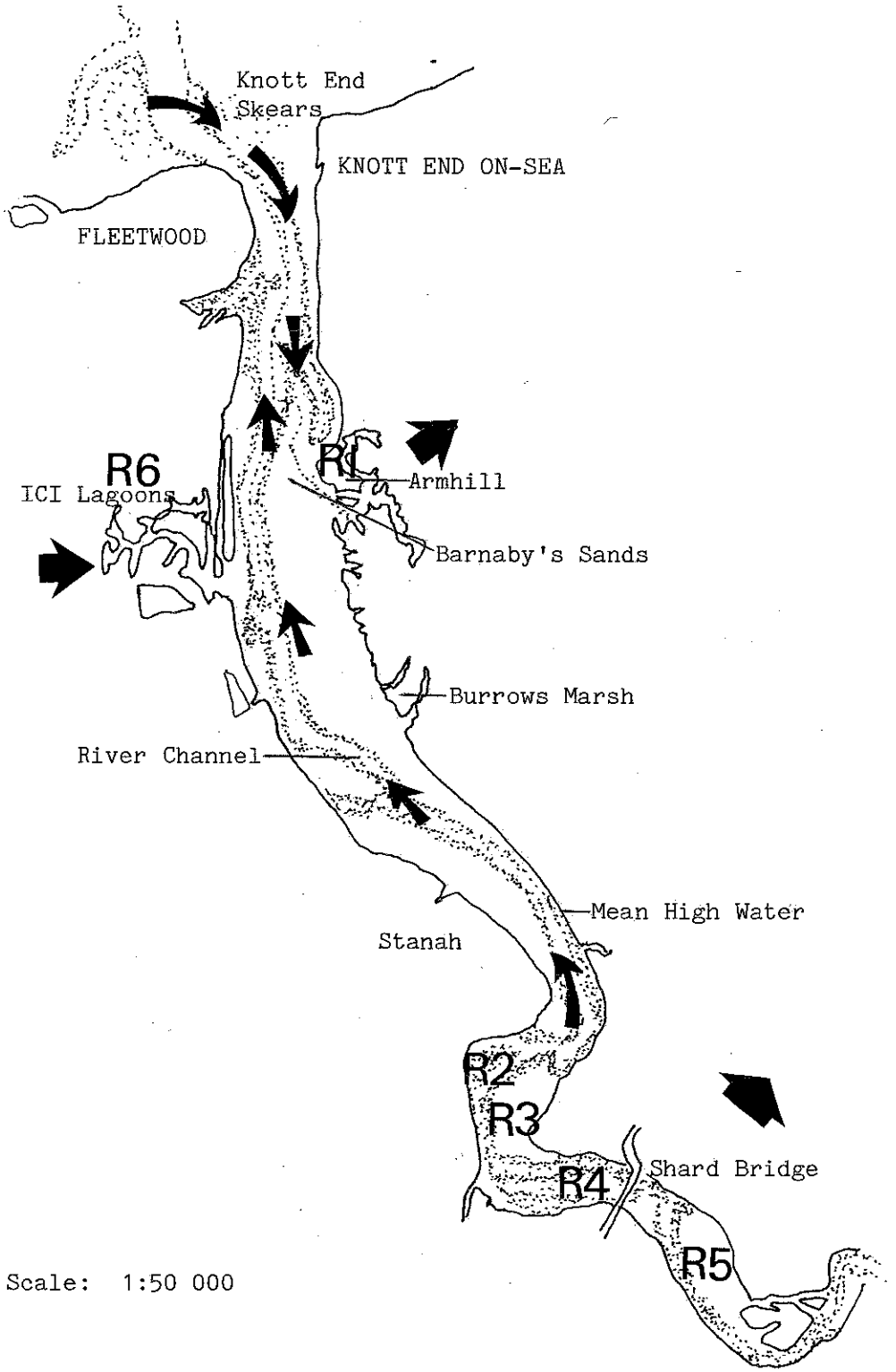

Figure 2. High and low tide roost sites, with flight lines recorded for wader and gull species, on the Wyre (from Rankine, 1990).

R1, R6 High tide roosts R2 - R5 Low tide roosts

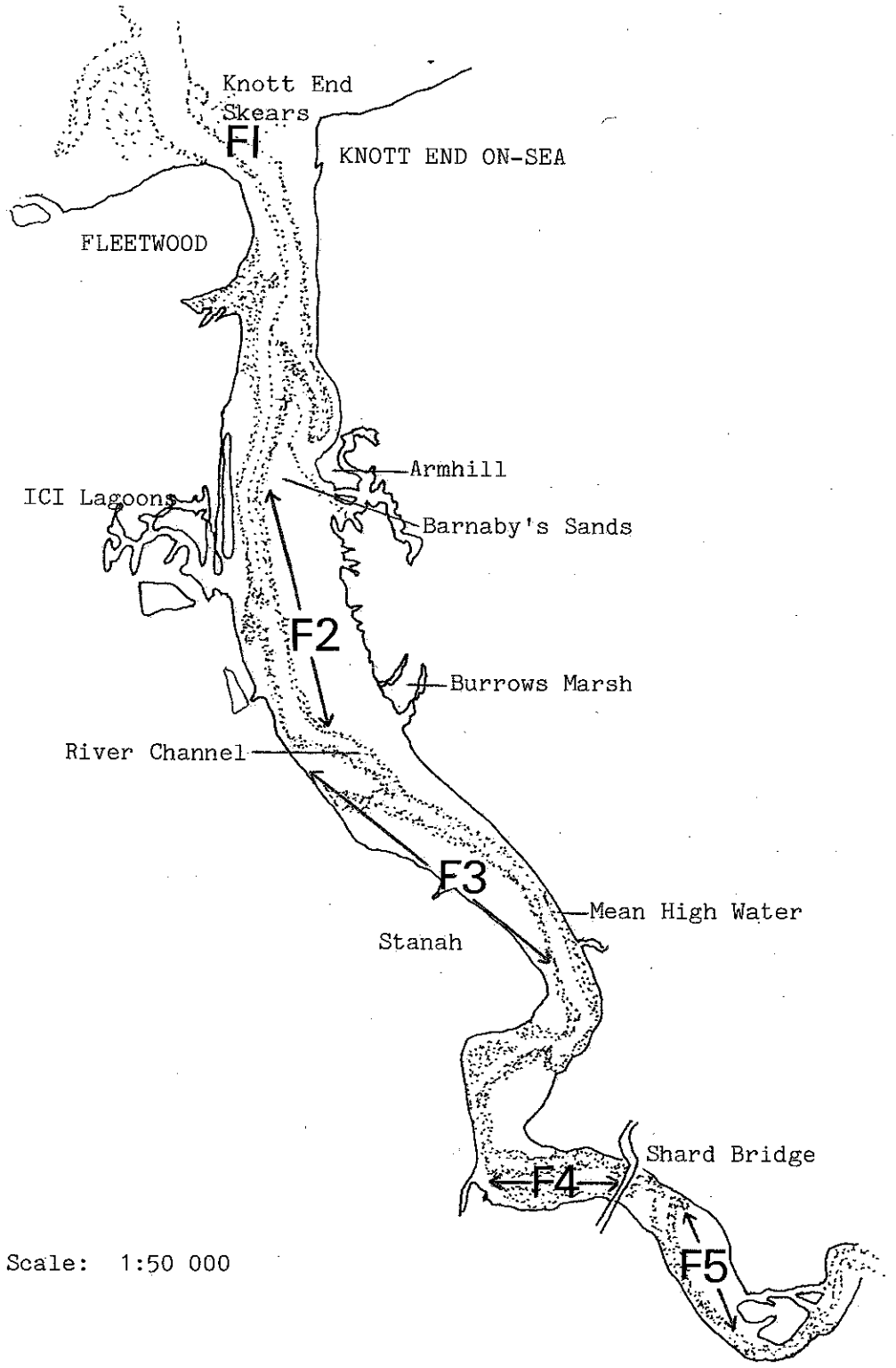

Figure 3. Low Tide Feeding Sites for waterfowl on the Wyre (from Rankine, 1990).

SHELDUCK
HIGH/LOW TIDE COUNTS

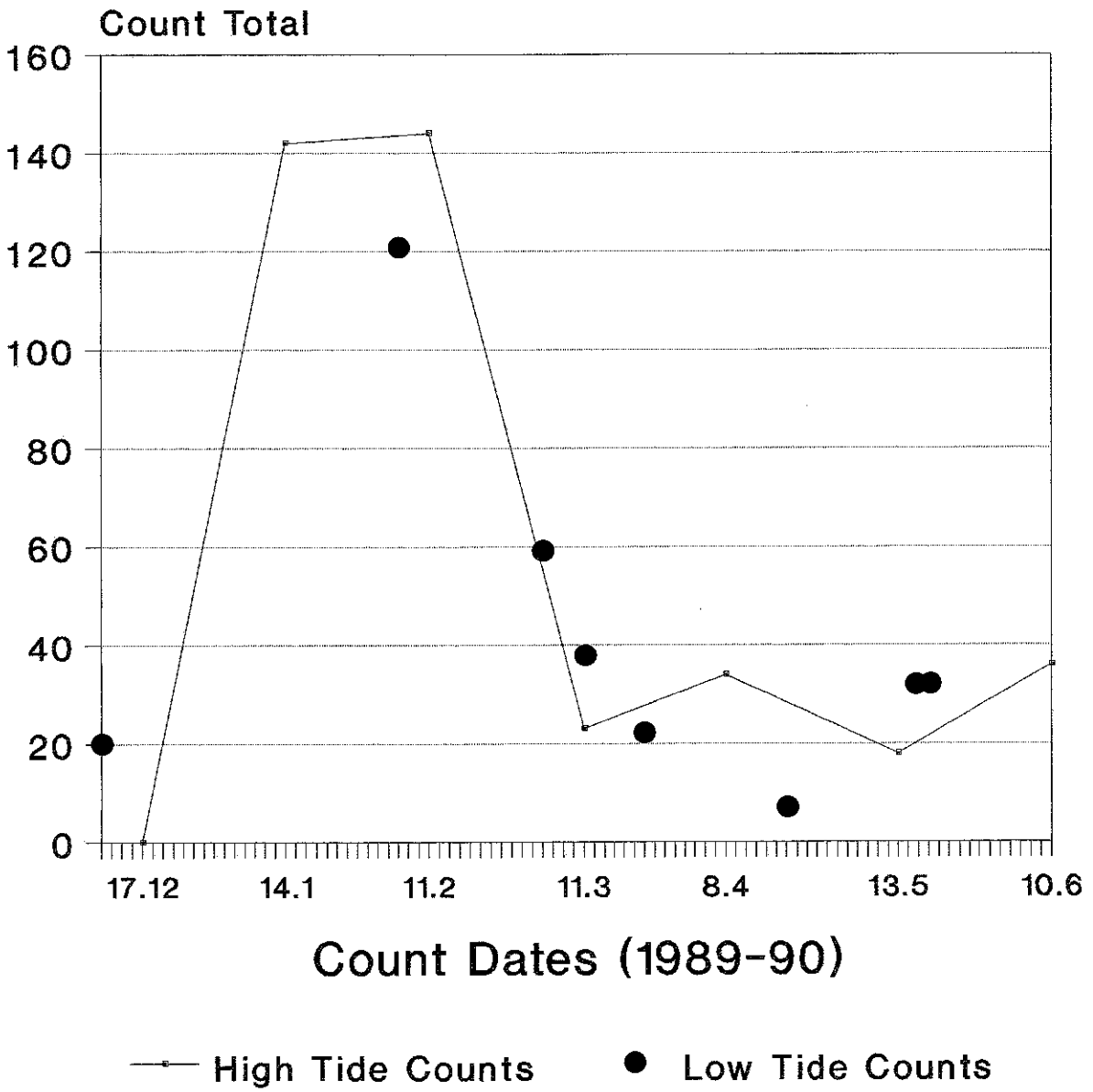

Figure 4. Comparison of high tide and low tide counts for Shelduck on the Wyre

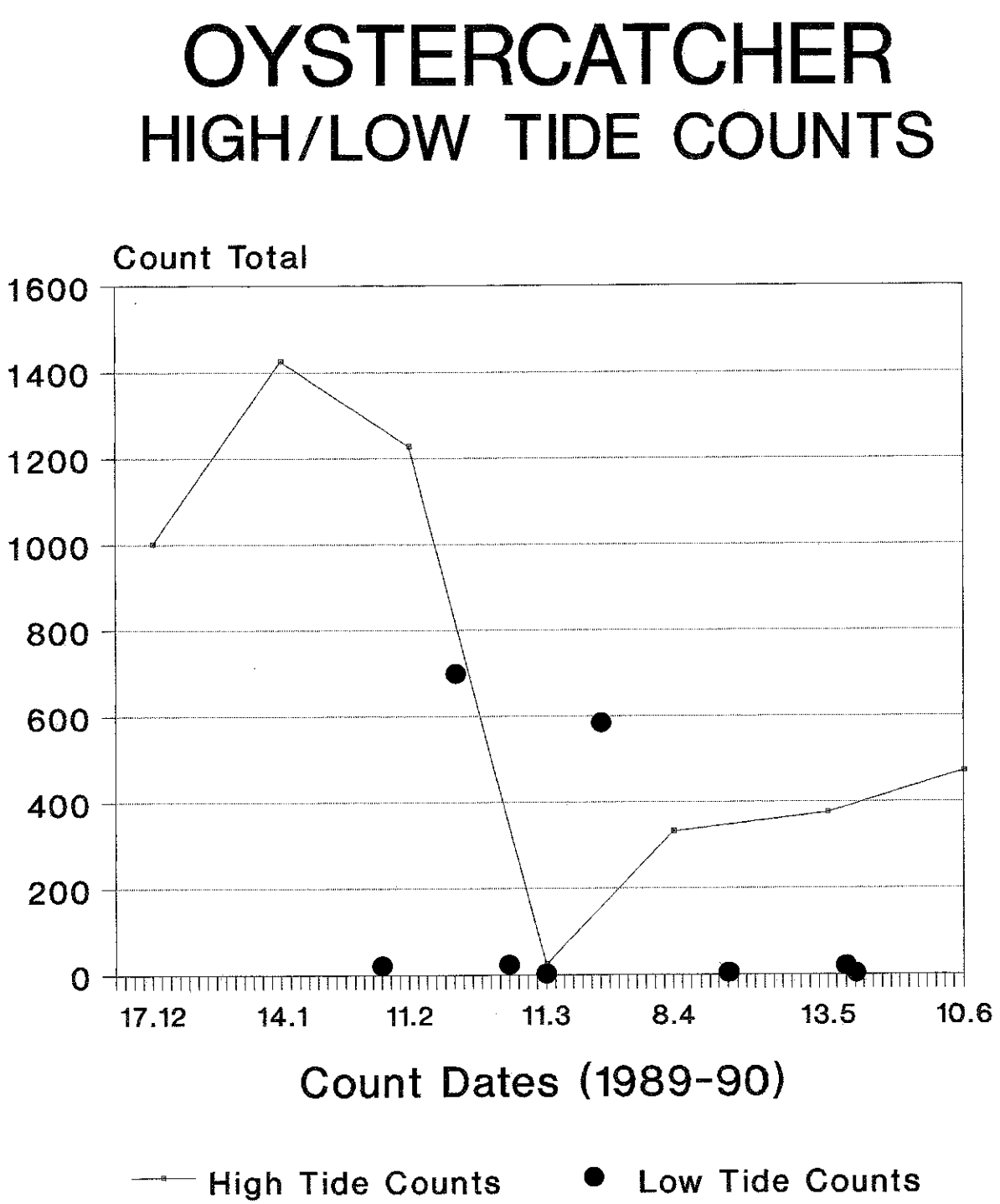

Figure 5. Comparison of high tide and low tide counts for Oystercatcher on the Wyre

DUNLIN
HIGH/LOW TIDE COUNTS

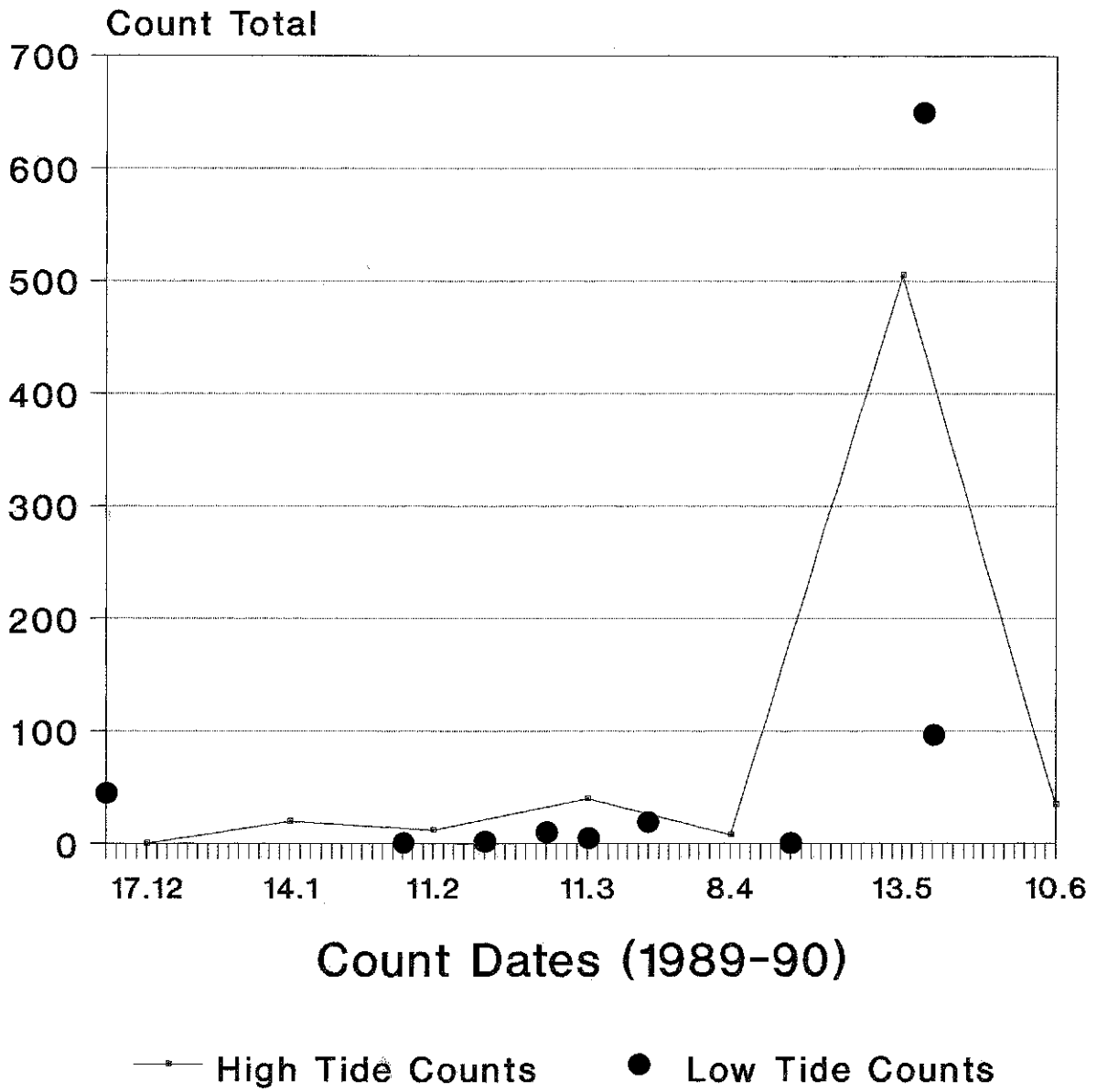

Figure 6. Comparison of high tide and low tide counts for Dunlin on the Wyre

BLACK-TAILED GODWIT
HIGH/LOW TIDE COUNTS

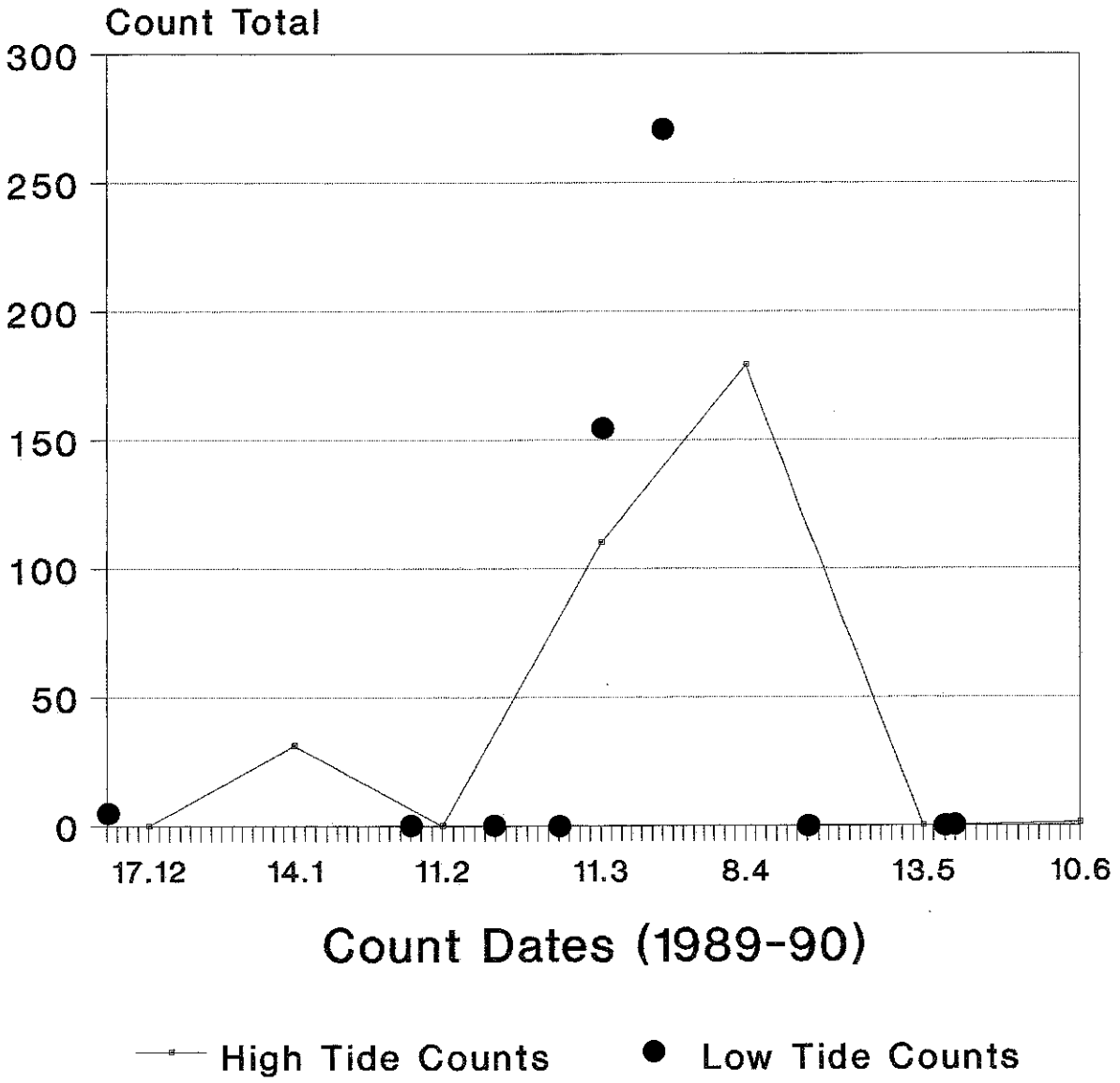

Figure 7. Comparison of high tide and low tide counts for Black-tailed Godwit on the Wyre

CURLEW
HIGH/LOW TIDE COUNTS

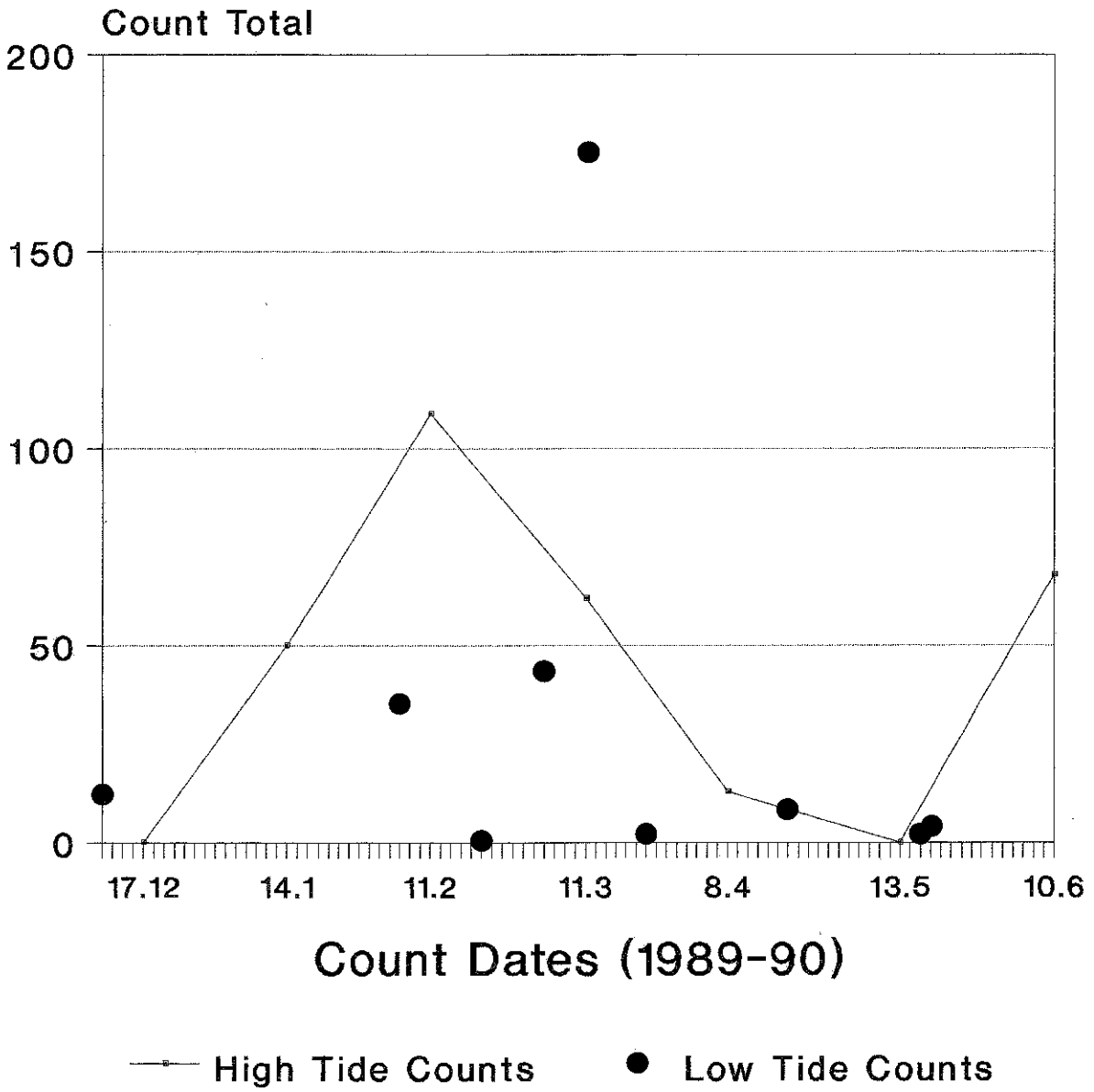

Figure 8. Comparison of high tide and low tide counts for Curlew on the Wyre

REDSHANK
HIGH/LOW TIDE COUNTS

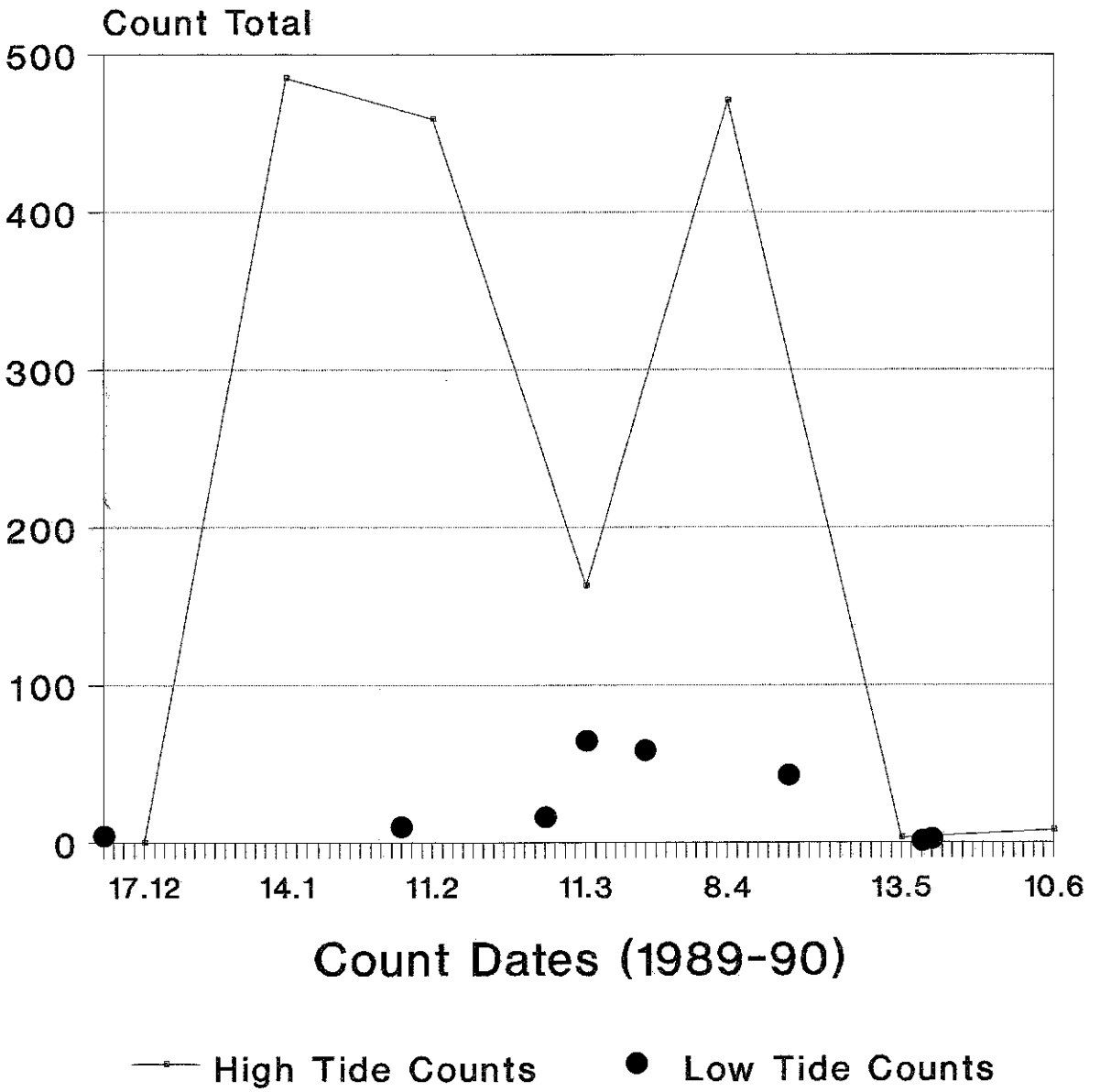

Figure 9. Comparison of high tide and low tide counts for Redshank on the Wyre