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THE ROLE OF THE UISTS AS A LATE SPRING STAGING POST FOR SOME NEARCTIC-BREEDING WADERS

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INTRODUCTION

Between 1983 and 1985, the British Trust for Ornithology and Wader Study Group coordinated studies of the spring migration of four species of wader along the west coast of Britain. The species involved were Turnstone Arenaria interpres, Sanderling Calidris alba, Dunlin C. alpina and Ringed Plover Charadrius hiaticula, and the aims of the study were threefold:

1 To identify their main spring staging areas;

2 To estimate the numbers of each species visiting individual

staging areas through measures of population turnover;

3 To determine whether individuals visit a single staging area

each season or use a network of sites within Britain.

Results from the West Coast Spring Passage Project (WCSPP) revealed striking differences in migration strategies among species (Moser & Carrier 1983, Moser et al. 1985, in prep.). In particular, contrary to Ferns (1981a), available evidence suggests that adult Turnstone may exhibit little movement between sites in Britain during a spring passage, instead fattening at one site before proceeding to breeding sites in north-east Canada and north-west Greenland via staging posts in Iceland. However, of only seven recorded movements (from the WCSPP and ringing recoveries) by adult Turnstone between British estuarine sites within a single spring (March-May), four involved resightings on the western coast of the Uists between 16 and 29 May. This is an area where large numbers of migrant and wintering waders were known to occur but from which few quantitative passage data were available (Buxton 1982).

A synthesis of information suggested the hypothesis that the western coast of the Uists might provide an important staging post, possibly alternative to Iceland, for Turnstone and other Nearctic-breeding species departing late in the spring migration period. The main aim of the studies reported here was to investigate this hypothesis for the two WCSPP species which breed solely at high latitudes, i.e. Turnstone and Sanderling, using a combination of counting and colour-marking techniques. The remaining two WCSPP species pose a potentially more complex problem in that, in addition to any individuals on passage to the Arctic, the Uists also support substantial local breeding populations. Efforts were made to count and catch Dunlin, the more abundant of these two species and one in which passage and breeding birds are largely segregated by habitat in May (D Jackson, pers. comm.), but not Ringed Plover. In addition, both counting and colour-marking of Purple Sandpipers Calidris maritima were undertaken, in support of a study on this species being undertaken simultaneously in the Orkneys.

METHODS AND STUDY AREA

Work was focused on the west coast of South Uist and Benbecula during mid and late May 1988, but also involved supporting studies conducted at other localities.

During winter 1987/88, wader ringers along the British west coast were asked to attempt catches of Turnstone and Sanderling during the coming spring migration period. These birds were to be temporarily colour-marked according to the coding system summarized in Table 1. Similarly, a team of NCC biologists intending to visit the Uists in February 1988 were requested to catch and temporarily colour-mark wintering Turnstone and Sanderling there. Finally, wader biologists known to be planning studies in Iceland, Greenland and north-east Canada during spring and summer 1988 were asked to look out for colour-marked birds and the project was publicized in the Wader Study Group Bulletin (Davidson & Piersma 1987).

Our team of five people was present on the Uists between 11 and 25 May, being based at Bornish, South Uist. The first two days were spent in reconnaissance of sites along the entire western coast of the Uists, following which a systematic programme of counting and catching on South Uist and Benbecula was adopted. Counting was concentrated on five stretches of shore (2-6 on Figure 1). These had been identified during the preliminary survey as holding the major proportion of the study species present. Two additional stretches of shore on the south-west coast of South Uist (7-8 on Figure 1) were also censused once, but not subsequently in view of the few birds present. Further census information was obtained from weekly counts of the coastline of the RSPB Balranald Nature Reserve, North Uist (1 on Figure 1). Censuses here were conducted by the RSPB throughout April and May of the three years 1986-88 inclusive. Details of the lengths and substrate types of these stretches are summarized in Table 2.

Censuses on each of the five stretches of shore were conducted within three hours either side of high tide every second or third day. The two Benbecula stretches (2 and 3 on Figure 1) were contiguous and were always censused simultaneously; except where stated otherwise, results from them were combined for data presentation purposes below. The two mid-west South Uist stretches (5 and 6 on Figure 1) were almost contiguous, were always counted simultaneously, and have been similarly treated.

The preliminary survey revealed only a single concentration of birds sufficient to attempt cannon-netting. This was at Ardivachar (57 22 N, 7 27 W), north-west South Uist (Figure 1), where the birds concentrated their feeding on beds of rotting seaweed. Catching was attempted on five days between 13 and 21 May inclusive. All 547 waders captured were ringed (except retraps and controls), aged, sexed and where applicable, raced (according to the criteria of Prater et al. 1977), and their biometrics were recorded. Turnstone, Sanderling and Purple Sandpipers caught up to and including 19 May were colour-marked according to the coding system in Table 3. The only waders caught away from Ardivachar were 15 Dunlin and 1 Ringed Plover dazzled during the night of 16/17 May at Rubha Ardvule (Figure 1). Birds caught by the NCC team in February were cannon-netted at North Bay (57 23 N, 7 26 W), adjacent to Ardivachar.

All sightings made of colour-marked birds were recorded. In addition,

Table 1 Colour codes assigned for distinguishing Sanderling and Turnstone marked in different regions of western Britain, spring 1988.

Region	Time period*	Dye mark	Leg flag
South-west England	early	yellow front	yellow left
	late	yellow rear	"
South Wales	early	yellow front	yellow right
	late	yellow rear	"
North Wales	early	yellow front	red left
	late	yellow rear	"
Liverpool Bay	early	yellow front	red right
	late	yellow rear	"
Morecambe Bay and South Cumbria	early	yellow front	blue left
	late	yellow rear	"
Solway Firth and North Cumbria	early	yellow front	blue right
	late	yellow rear	"
West Scotland (mainland)	early	yellow front	black right
	late	yellow rear	"
Uists	early	blue rear	yellow
	late	red front	various
Orkney	early	-	-
	late	blue front	-

* early = to 30 April; late = from 01 May

Figure 1 Map of the Uists and Benbecula showing places mentioned in the text.

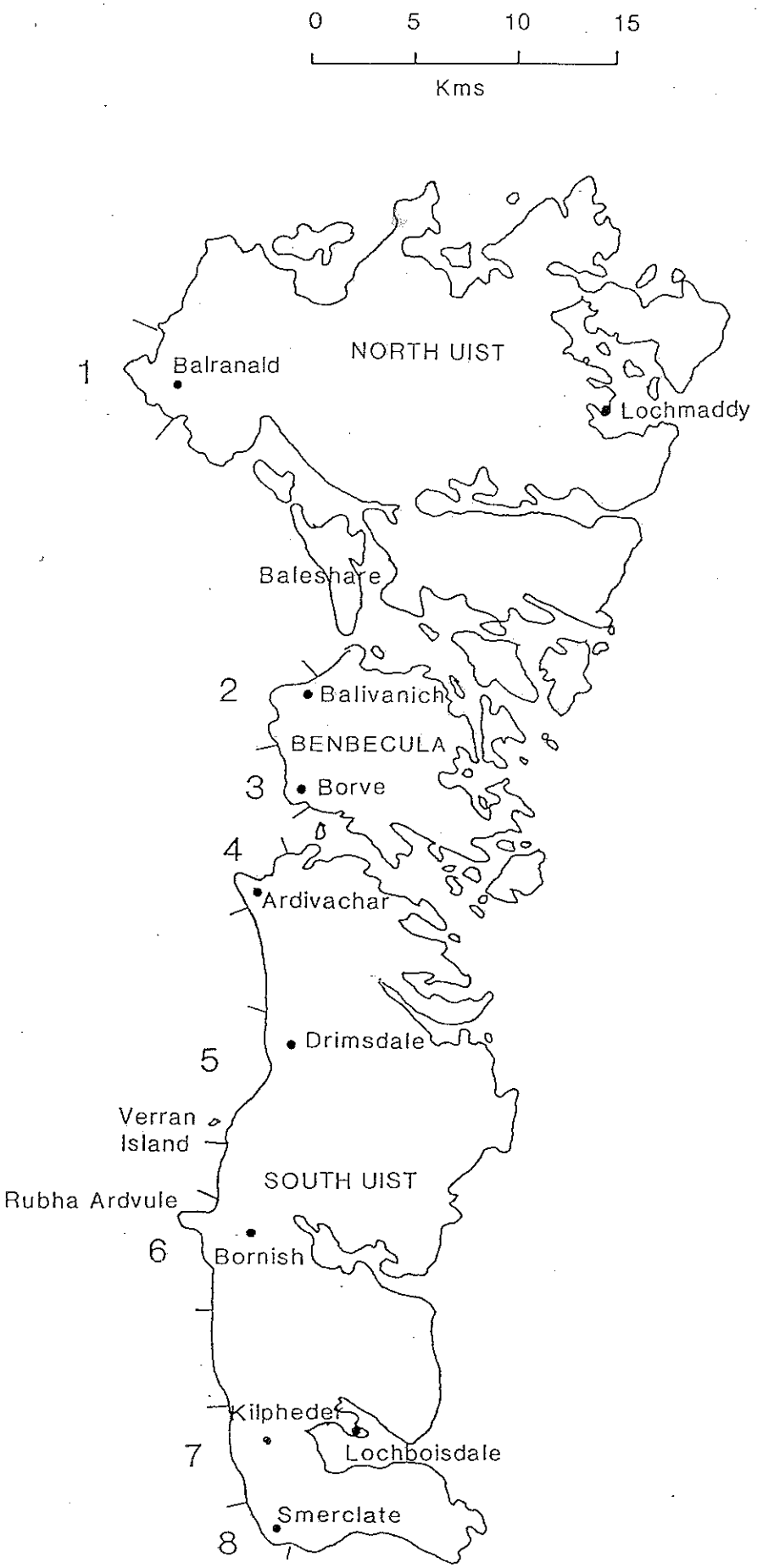


Table 2 Length and habitat composition of surveyed stretches of Uist shore.

Stretch No*	Stretch name	Grid ref. (start and finish)	Length (km)	Sand (%)	Rock (%)
1	Balranald	NF 707718 NF 719694	11.8	50	50
2	Balivanich	NF 775555 NF 761525	5.5	35	65
3	Borve	NF 761525 NF 773497	4.3	65	35
4	Ardivachar/ North Bay	NF 758473 NF 747443	5.7	60	40
5	Verran Island	NF 750376 NF 732332	6.2	65	35
6	Rubha Ardvule	NF 722300 NF 726256	7.2	55	45
7	Kilpheder	NF 731202 NF 733174	3.0	55	45
8	Smerclate	NF 733174 NF 746144	3.7	40	60

* See Figure 1.

systematic counts of the relative proportions of marked to unmarked Turnstone and Sanderling present at Ardivachar were made each day from 20 May onwards for turnover studies.

RESULTS AND DISCUSSION

Counts:

Count data from Balranald reveal two major patterns of change in numbers during April and May among the four species. Turnstone and Purple Sandpiper peak in April and decline through May (Figure 2). By contrast, Sanderling and Dunlin are almost absent early in April, but show pronounced increases in late April and early/mid May before declining in numbers. Birds of all species have almost disappeared by the end of May. In two of the three years, there was clearly a considerable, though short-lived, abundance of Purple Sandpipers during mid April. By contrast, the April increase among Turnstone, though present in each year, was proportionately smaller than that for Purple Sandpiper and could at least in part be explicable through birds already present concentrating together in flocks prior to migration. The pattern of decrease of Turnstone in May varied among the three years, with good numbers remaining later in 1986.

Among Sanderling and Dunlin, the situation is more complex. Wintering Sanderling appear to have very largely departed by the second week of April, and the May increase must be composed of birds from elsewhere. The size of the passage in 1988 was considerably greater than in the other two years and was distinctly bimodal, with peaks around the end of the first and third weeks of May but few birds present in mid month. A double-peaked passage of Sanderling appears also to occur through a number of other west coast sites in Britain during May (Ferns 1980). Passage Dunlin did not begin building up in numbers until towards the end of April, and in each of the three years there was then evidence for two peaks, one during the last week of April or first week of May and the other during the second or third week of May.

Our count data from South Uist and Benbecula in 1988 confirm the distinction between patterns of change in numbers of Turnstone and Purple Sandpiper on the one hand and Sanderling and Dunlin on the other (Figure 3). Both our subjective impressions and the counts indicate that both Turnstone and Purple Sandpiper were declining during the second week of May, and very few of the latter species remained at the end of this period. Turnstone, however, stabilized at low levels during the third week of May before again declining. By contrast, both Sanderling and, especially, Dunlin showed increases in numbers during the third week of May, before declining again in the fourth week. Prior to this, our subjective impression had been that Sanderling had decreased between 11 and 14 May; this cannot be confirmed quantitatively because our counts on 11 May were incomplete, especially along the sandier stretches of beach favoured by Sanderling.

Not revealed at all by our count data was a very brief influx of predominantly Turnstone, Sanderling and Dunlin recorded on the evening of 18 May at Ardivachar beach. Members of our team had been cannon-netting there throughout the day until 20.00 hours, with numbers of these species present being in line with expectations from the trends shown in Figure 3. During a brief visit at 21.00 hours, however, Paul Boyer (BTO regional representative for the Uists) recorded ca 450 Turnstone, 750 Sanderling and 1,000 or more Dunlin, in each case greatly in excess of numbers present previously. On our return at 07.30 on 19 May, numbers were again back at expected levels. Presumably a large, mixed-species flock had alighted for no more than a few hours before continuing on passage.

Figure 2 Counts of migratory waders along the Balranald stretch of coast over three consecutive springs (★- - -★= 1986; o...o = 1987; ▲——▲ = 1988).

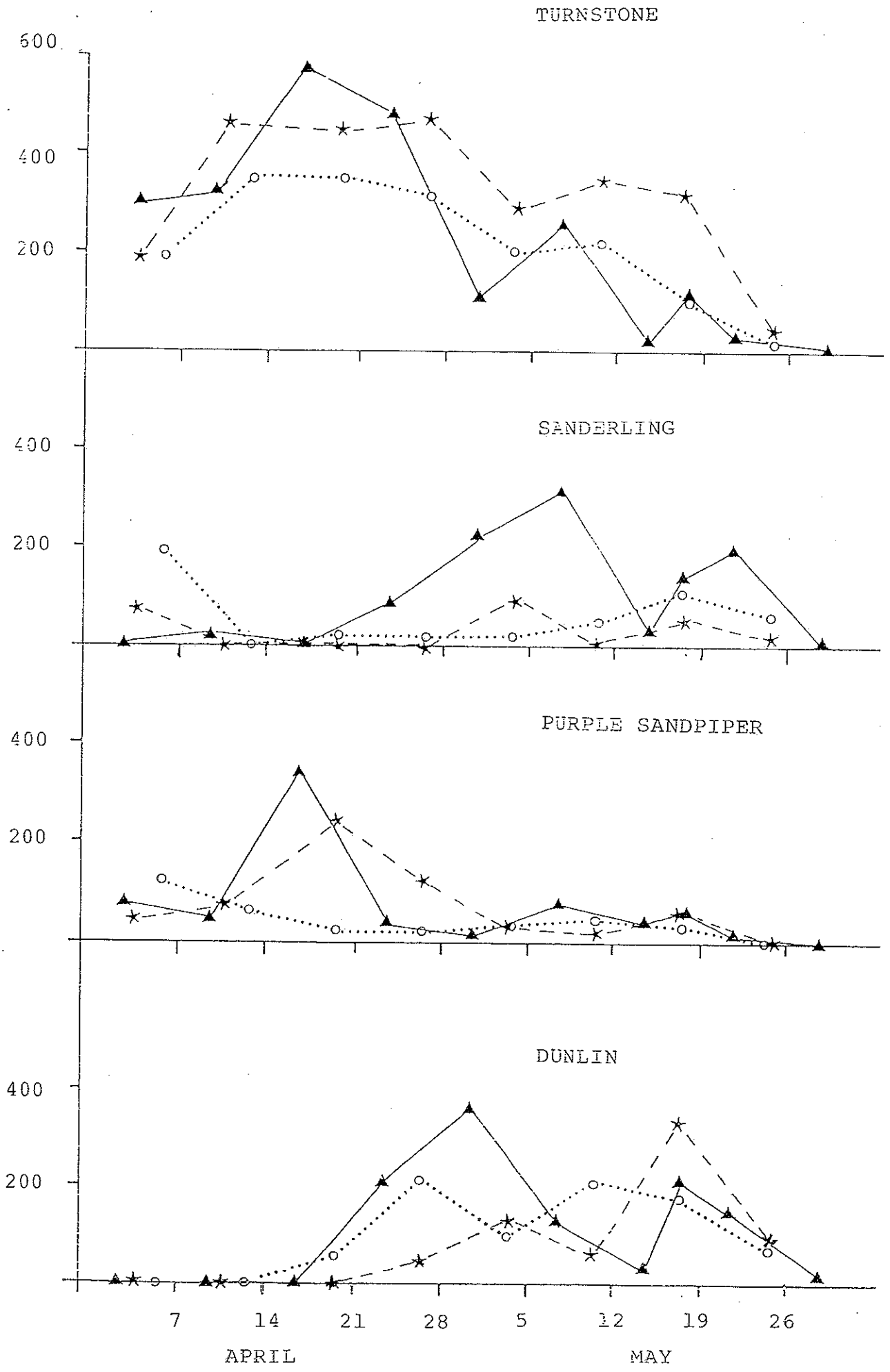
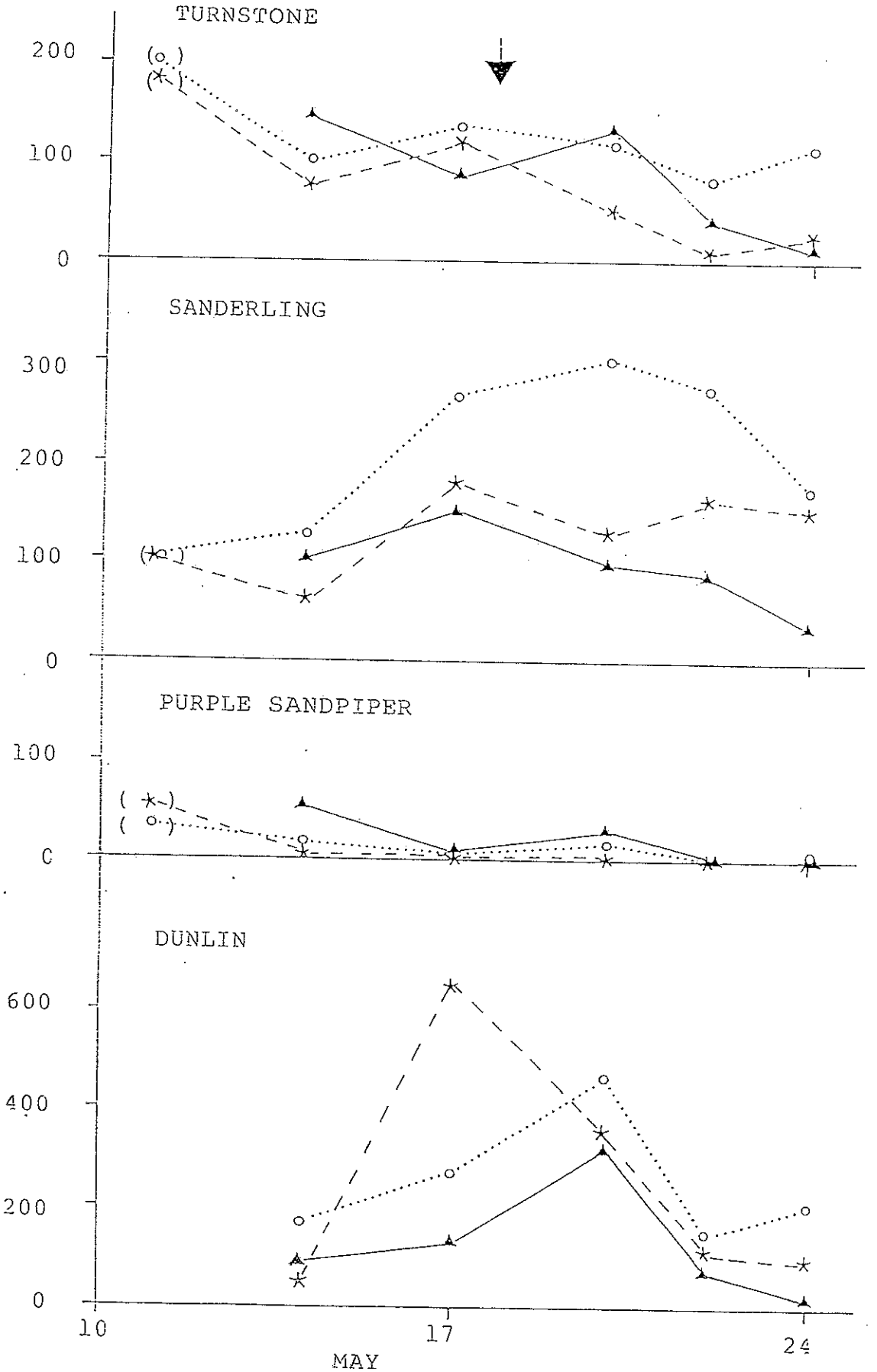


Figure 3 Counts of migratory waders along the Balivanich/Borve (▲——▲), Ardivachar/North Bay (o...o) and Verran/Rubha Ardvule (★- - -★) stretches of coast in mid/late May 1988. Brackets = minimum estimates based on incomplete counts. Arrow = short-term influx of birds not recorded by counts (see text).



Observations of marked birds:

Uist-marked birds:

Table 3 gives a synopsis of all colour-marking of birds on the Uists in early 1988. Of the Turnstone and Sanderling colour-marked during February, two Sanderling were retrapped on 18 April at the same site (T. Dix pers. comm.). Also retrapped on 18 April was another Sanderling which had been ringed at the same site on 25 October 1987. For Turnstone, the only probable resighting from the February catch was of a bird with a "blue-green underside" noted at Ardivachar on 17 May by L. Batten (pers. comm.).

A breakdown of the minimum numbers of Turnstone and Sanderling, flagged during May, known to be present on subsequent days is given in Table 4. Actual figures were certainly higher, not only because of birds not seen but because flag colour was only observed from some of the colour-dyed birds noted. Birds from all catches were sighted subsequently, but the data suggest that Turnstone from the first catch (13 May) had largely disappeared by one week later.

Most resightings of marked birds were made locally along the coast of north-west South Uist (Figure 1, stretch 4). However, Sanderlings from the catches on 18 and 19 May, moved south from Ardivachar to the area between Drimsdale and Verran Island (Figure 1, stretch 5); at least six colour-dyed Sanderling were present there on 20 May and eight on 24 May. Other Sanderling sightings demonstrating dispersal from the ringing site were singles at both Borve and Balivanich on Benbecula on 22 May, and a green-flagged individual at Balranald, North Uist, on the same date. The only colour-dyed Turnstone reported from elsewhere on the Uists were singles near Verran Island, South Uist, on 20 May and at Balranald, North Uist, on 21 May.

No Turnstone or Sanderling was colour-marked after 19 May, and sightings of dyed birds in the Ardivachar area from this time yield some information on turnover (Figure 4). For Turnstone, there is little evidence of systematic decline in the proportion of dyed birds between 20 and 24 May, suggesting little, if any population turnover during this period. By contrast, the Sanderling data show a clear downward trend, from ca 6% dyed birds on 20 May to ca 2% on 24 May. However, because of the considerable observed mobility of individual Sanderling along the Uist coastline, similar to that reported for spring Sanderling populations elsewhere (e.g. Myers 1980), this result cannot reliably distinguish "turnover" resulting from arrival of new birds on the Uists from that caused by the redistribution of the population already present.

Three Uist-marked Sanderling were resighted subsequently at Sandgerdi (64 02 N, 22 43 W), Gullbringusysla, south-west Iceland. One bird, marked on 27/28 February, was seen between 2 and 5 May. Another, marked on 19 May, was resighted less than a week later on 25 May. The third was also marked on 19 May and subsequently recorded in Iceland on 22 July, presumably on autumn passage. The red dye on this latter bird was barely visible, but it still retained its green flag.

Birds marked elsewhere:

Data on Turnstone and Sanderling colour-marked elsewhere along the coast of Britain during spring 1988 are summarised in Table 5. Two dyed Turnstones

Table 3 Colour-marking of Turnstone, Sanderling and Purple Sandpiper, Uists 1988 (colour codes given in Table 1).

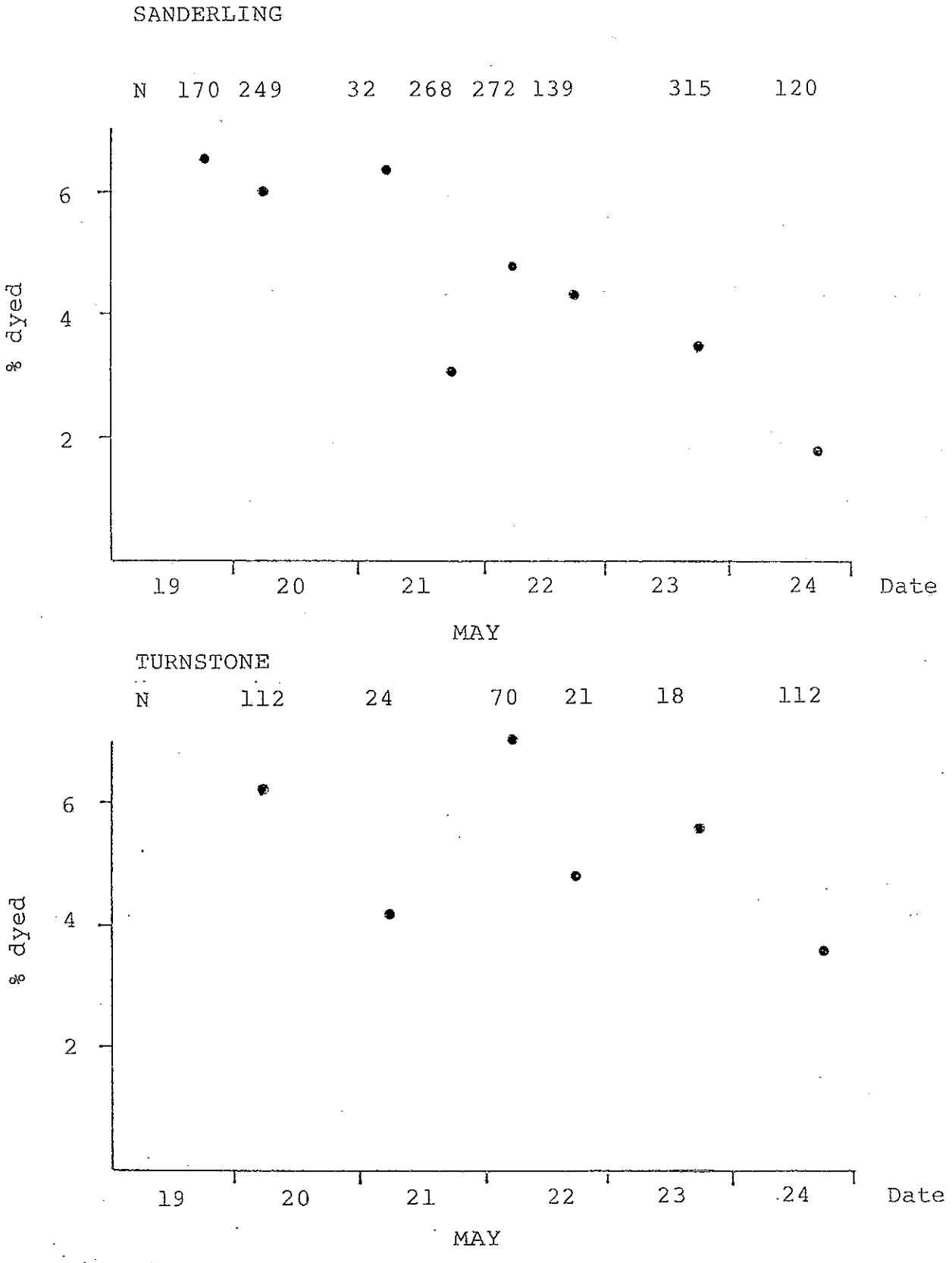
Date	Turnstone			Sanderling			Purple Sandpiper		
	caught/ marked	dye	flag	caught/ marked	dye	flag	caught/ marked	dye	flag
26 Feb	27/27	blue	yellow	0/0	-	-	0/0	-	-
27 Feb	0/0	-	-	24/24	blue	yellow	0/0	-	-
28 Feb	0/0	-	-	2/2	blue	yellow	0/0	-	-
13 May	18/16	red	white	4/4	red	white	8/7	blue	white
16 May	8/8	red	black	3/3	red	black	2/2	blue	black
17 May	0/0	-	-	0/0	-	-	0/0	-	-
18 May	19/14	red	blue	7/7	red	blue	1/0	-	-
19 May	10/9	red	green	47/44	red	green	0/0	-	-
21 May	3/0	-	-	4/0	-	-	0/0	-	-

Table 4 Summary of resightings of colour-flagged birds on the Uists during May 1988.

Species	Flag colour	May 13	14	15	16	17	18	19	20	21	22	23	24
Turnstone	White	(16)	1		2*		4	2					
	Black				(8)	1	2				1		1
	Blue						(14)		1		1		
	Green							(9)	2		2	1	3
Sanderling	White	(4)			1				1				
	Black				(3)		1	1					
	Blue						(7)		2		1		1
	Green							(43)	6	3	15	3	7

* one bird found dead. Bracketed figures refer to number marked.

Figure 4 Changes in the proportion of colour-dyed Sanderling and Turnstone present at Ardivachar, South Uist, in mid/late May, 1988, subsequent to the final colour-dyeing session.



(picric front, blue flag on right leg) were present at Rossall Point, Morecambe Bay on 6 April, with another seen there the day after (A. Dawe pers.comm.). These were presumably from the Flimby catch (Table 5). Another Turnstone (picric front, no flag recorded) was seen in a flock of 400 of this species at Ardivachar, South Uist on 29 April by Paul Boyer (pers. comm.); this may have come from the Solway, Morecambe Bay or Wembury (Table 5). Two more dyed Turnstones (picric front, no flag recorded) were seen on 23 May at Rossall Point (J.S. Cross, pers. comm.); these were marked in March or April on the Solway, Morecambe Bay, Wembury or North Wales (Table 5).

Three Turnstone were subsequently resighted overseas. A bird marked in the first week of May 1988 in Devon, North Wales or Morecambe Bay (yellow rear, no flags or rings seen) was seen near Brjanslaekur (65 31 N, 23 11 W), north-west Iceland, between 13 and 16 May. A Turnstone (picric rear, blue flag on left) from the 7 May Walney catch was sighted on the breeding grounds (16-17 June), near Borupfjord (80 51 N,81 52 W), Ellesmere Island (D.P. Whitfield, pers.comm.). Finally, a bird marked on 4 May on the Taff estuary, South Wales, was seen at Sandgerdi (64 02 N, 22 43 W), south-west Iceland, between 27 and 30 July 1988, presumably on autumn passage.

Sanderlings almost certainly from the 14 May Solway catch (Table 5) were subsequently recorded on the Solway (3 at Rockcliffe on 15 May, 16 at Mawbray on 22 May and 1 at Bowness on 5 June), and a single was seen a long way to the south, on the Alt, Merseyside, on 26 May (F.J. Mawby pers. comm.). A single dyed Sanderling (picric rear, no flags visible) was seen at Ardivachar, South Uist, on each of 20 and 23 May; this/these bird(s) likewise almost certainly had been marked at Mawbray (Solway) on 14 May (Table 5).

Overseas, two resightings again almost certainly from the mid May Solway catch were made. One was of a bird noted at Sandgerdi (64 02 N, 22 43 W), south-west Iceland, between 19 and 21 July. The other was seen in a large flock on 23 September at Esiama (4 56N, 2 21W), west Ghana (M. Avery pers. comm.), providing some insight into how far south the wintering grounds of these birds extend.

Among birds caught for ringing on the Uists, one Sanderling and six Dunlin were controls from elsewhere (Table 6). The Sanderling was an adult which was likely to have been wintering on the Solway. Of the Dunlin, three had been ringed earlier in May in previous years on the Solway, Morecambe Bay and in Portugal respectively.

Biometrics

A synopsis of the numbers and species composition of birds caught on the Uists in May 1988 is given in Table 7, and a summary of basic biometrical information for waders caught in small numbers, i.e. Purple Sandpiper, Ringed Plover and Redshank, is provided in Table 8. A breakdown of the age, sex and race composition of the catches of Turnstone, Sanderling and Dunlin is provided in Table 9 and data obtained from each of these species are analysed in more detail below.

Turnstone:

A total of 56 Turnstone were cannon-netted, with no retraps. Of these birds,

Table 5 Numbers of Turnstone and Sanderling dye-marked at west coast mainland sites, spring 1988. See Table 1 for colour-marks used.

Date	Location	Turnstone caught/marked	Sanderling caught/marked
Early spring:			
6 March	Flimby, Solway	24/24	0/0
20 March	Walney, Morecambe Bay	20/20	4/4
16 April	Wembury, Devon	5/4	0/0
30 April	Pontlyfni, North Wales	14/14	0/0
Late spring:			
1 May	Caernarvon, North Wales	8/8	0/0
2 May	Wembury, Devon	25/15	0/0
4 May	Taff, Severn	30/26	0/0
7 May	Walney	63/60	1/1
14 May	Mawbray, Solway	0/0	332/292
15 May	Mawbray	0/0	510/0
16 May	Walney	4/0	3/0
18 May	Walney	1/0	0/0

Table 6 Summary of birds controlled on the Uists during May 1988

		Ringed				Controlled		
	Species	Ring no.	Date	Place	Age/ sex	Date	Place	Age/ sex
Local movements:	Turnstone	XS73604	010588	Ardivachar (57 22N,7 27W)	6	190588	Ardivachar	5
	Purple Sandpiper	NV28655	210387	Rubha Ardvule (57 14N,7 26W)	6	130588	Ardivachar	6
	Purple Sandpiper	XR61509	271187	Drimsdale (57 19N,7 25W)	4	130588	Ardivachar	6
	Dunlin	NS74295	160685	Rubha Ardvule	6	170588	Rubha Ardvule	6
Others:	Sanderling	NS75667	081187	Siddick,Cumbria (54 42N,3 30W)	4	190588	Ardivachar	6
	Dunlin	NS20525	060983	North Slob, Wexford (52 22N,6 25W)	3	170588	Rubha Ardvule	6M
	Dunlin (schinzii)	NS05801	080582	Annan,Waterfoot (54 58N,3 15W)	6	190588	Ardivachar	6F
	Dunlin (schinzii)	NS18664	140587	Walney, Morecambe Bay (54 05N,3 15W)	6	190588	Ardivachar	6M
	Dunlin	Lisbon D003702	090585	Faro, Algarve Portugal (37 01N,7 56W)	6	190588	Ardivachar	-
	Dunlin (schinzii)	Paris SA771233	?	?	?	190588	Ardivachar	6M
	Dunlin (schinzii)	BX69224	010881	Point of Ayr, Dee estuary (53 21N,3 19W)	4	210588	Ardivachar	6M

Table 7 Summary of birds caught on Uists in May 1988

	New	Retraps	Controls
Dunlin	392	3	7
Purple Sandpiper	9	0	2
Turnstone	55	0	1
Sanderling	63	1	1
Redshank	1	0	0
Ringed Plover	12	0	0
Black-headed Gull	8	0	0
Common Gull	3	0	0
TOTAL	543	4	11

Table 8 Biometrics of Purple Sandpiper, Ringed Plover and Redshank caught on the Uists in May 1988. Mean, S.D. and sample sizes shown.

Measurement	Purple Sandpiper	Ringed Plover male	Ringed Plover female	Redshank
Wing (mm)	132.8 (2.89) 11	132.9 (2.32) 8	134.5 (2.38) 4	165 - 1
Bill (mm)	32.8 (3.00) 11	14.5 (0.64) 8	14.4 (0.57) 4	37 - 1
Head & bill (mm)	57.5 (2.56) 11	41.5 (0.57) 8	41.5 (0.83) 4	68.9 - 1
Tarsus & toe (mm)	51.0 (2.07) 6	47.8 (1.28) 8	46.5 (0.58) 4	79 - 1
Weight (gms)	86.6 (7.04) 11	66.9 (6.70) 8	67.1 (5.74) 4	124 - 1

Table 9* Summary of age ratios for Turnstone, Sanderling and Dunlin caught on the Uists in May 1988.

Date	Catch	Turnstone			Sanderling			Dunlin		
			Age			Age			Age*	
		N	Ad.	Imm.	N	Ad.	Imm.	N	Ad.	Imm.
130588	1	8	7	1	3	3	0	14	13	1
	2	10	9	1	1	1	0	2	2	0
160588	1	8	8	0	3	3	0	32	30	1
170588	1	-	-	-	-	-	-	15	15	0
180588	1	3	3	0	-	-	-	8	8	0
	2	11	9	1*	7	7	0	110	107	3
	3	5	2	3	-	-	-	-	-	-
190588	1	1	1	0	20	18	2	88	85	2
	2	-	-	-	25	24	1	15	14	1
	3	9	8	1	-	-	-	24	20	2
	4	-	-	-	2	2	-	80	78	2
210588	1	1	1	0	4	4	-	10	10	0
	2	-	-	-	-	-	-	4	4	0

* A few individuals not aged.

seven (12.5%) were aged as juveniles. Juveniles tended to be shorter-winged than adults and weighed substantially less (Figure 5), averaging 99g (N=7) versus 121g (N=48) of adults. Adult weight varied little among the catches on different days, with no significant trend being apparent (Table 10).

Adult Turnstone caught on the Uists in mid May 1988 averaged 17% heavier than Uist birds caught in February and ca 10% heavier than those caught at Wembury in mid April and at Pontlyfni (North Wales) in late April (Table 10). They were similar in weight to those caught in early May at Morecambe Bay, but averaged 6% lighter than ones caught at Caernarvon and 13% lighter than ones caught on the Taff estuary, both also in early May. Most striking of all, the Uist birds caught in mid May averaged 21% lighter than Turnstone caught in Orkney at approximately the same time. Indeed, only a single Orkney bird fell within the range of the Uist birds (102-148g), the remainder ranging from 149-169g (Figure 6). Adult Turnstones from the second of the two catches in North Wales, which were made only one day apart, were likewise considerably heavier than those from the first catch (Table 10).

Sanderling:

Sixty-five Sanderling were caught on the Uists during May, with only a single recapture; only three birds (4.7%) were classified as juveniles (Table 9). Female Sanderling tend to be slightly larger than males (Prater et al. 1977), and discriminant function analyses based on bill and wing length have been found to indicate sex with an overall probability of misclassification of 10%-15% (Maron & Myers 1984, Wood 1987). Based on this approach, Wood (1987) concluded that at Teesmouth there was a general excess of females over males in the population throughout the year, including in May. Unfortunately, Wood's discriminant function cannot straightforwardly be applied to the Uist data because recorded mean bill length differs by a highly significant 4% between the Teesmouth and Uist populations ($t = 3.11$, $n = 101$, $P<0.01$), although their recorded mean wing lengths are extremely similar (Table 11). A noticeable concentration of long-billed and long-winged birds in the Uist data set does, however, tend to imply that it is at least unlikely that females were in a minority there (Figure 7).

Clark et al. (1982), working on the Solway, also caught substantial numbers of Sanderling on passage in May. Based on sexing by plumage characteristics (cf Prater et al. 1977), a ca 2:1 predominance of males was recorded among the Solway birds, at variance with the conclusions of Wood (1987) for the Teesmouth population. However, closer analysis throws doubt on the reliability of the sexing technique adopted by Clark et al. (1982). The Solway and Teesmouth birds differed in mean recorded bill and wing lengths by only ca 1.2% and 0.2% respectively (Table 11), and application of Wood's discriminant function to the Solway data set (Clark, in litt.) suggests an apparently balanced sex ratio (Figure 8). Moreover, examination of the bill/wing scattergram of Solway birds designated on plumage characteristics as "male" and "female" (Figure 8) reveals a proportion of relatively long-billed, long-winged males that is totally unexpected from the results of Maron & Myers (1984) and Wood (1987). Possibly the most parsimonious explanation of this is that, whereas it is possible correctly to distinguish spring passage Sanderling with chestnut on their heads/backs as males, other males in greyish plumage are inseparable from females.

Figure 5 Wing length and weight of adult and juvenile Turnstone caught at Ardivachar, South Uist, in mid May 1988.

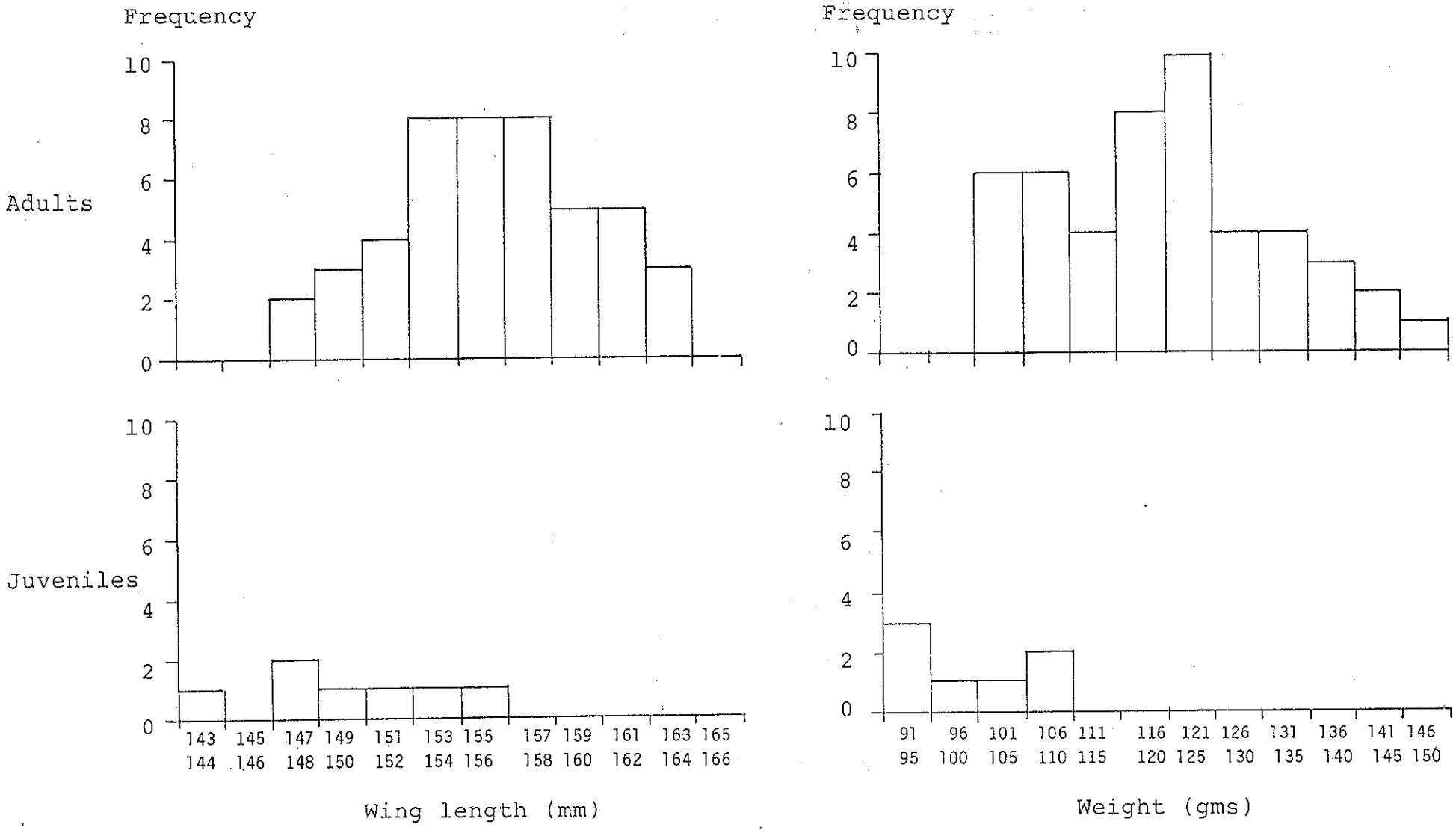


Table 10 Average weights (gms) of adult Turnstones caught in the Uists and at several other locations during winter-spring 1988.

Location	Dates	mean	sd	range	N
South Uist, Hebrides	26 Feb	103.6	5.52	93-114	17
South Uist	13 May	119.1	10.77	103-138	16
	16 May	118.4	13.22	102-138	8
	18 May	125.1	12.05	102-148	14
	19 May	121.4	10.11	108-135	9
	21 May	(119.0)	-	-	1
	13-21 May	121.2	11.32	102-148	48
Sanday, Orkney	15-17 May	153.2	12.76	124-169	9
Walney, Morecambe Bay	7 May	117.8	10.02	90-141	60
	16 May	123.0	14.73	107-136	3
	18 May	(114.0)	-	-	1
	7-18 May	118.0	10.12	90-136	64
Pontlyfni, North Wales	30 April	110.1	9.19	97-131	11
Caernarvon, North Wales	1 May	129.4	10.63	113-142	7
Taff, Severn	4 May	139.7	10.82	115-158	26
Wembury, Devon	16 April	109.5	5.51	103-115	4
	2 May	121.1	10.32	108-139	15

Figure 6 Comparative weights of adult Turnstone caught on South Uist and on Sanday, Orkneys, in mid May 1988.

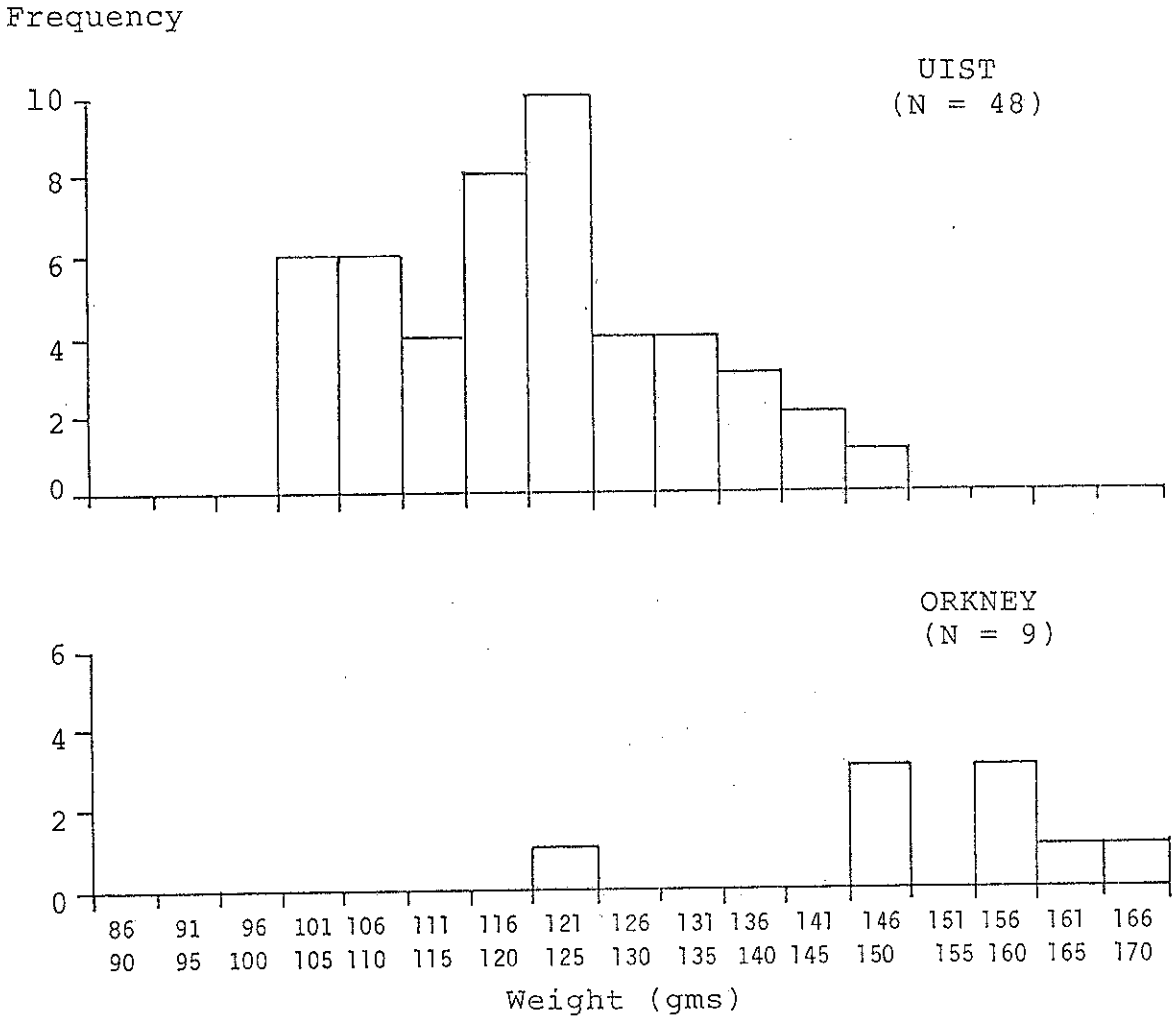


Table 11 Biometrics of adult Sanderlings caught on the Uists (spring 1988), on the Solway* (spring 1982) and at Teesmouth+ (winter). Mean and S.D. shown.

	Wing length (mm)	Bill length (mm)	Weight (gms)
Uists (n=61)	127.3 (3.54)	25.4 (1.51)	61.9 (6.61)
Solway (n=102)	127.8 (3.33)	24.7 (1.50)	66.3 (6.48)
Teesmouth (n=42)	127.5 (4.78)	24.4 (1.71)	-

* data from Clark (in litt.)
+ data from Wood (1987)

Figure 7 Bill/wing scattergram for Sanderling caught at Ardivachar, South Uist, in mid May 1988.

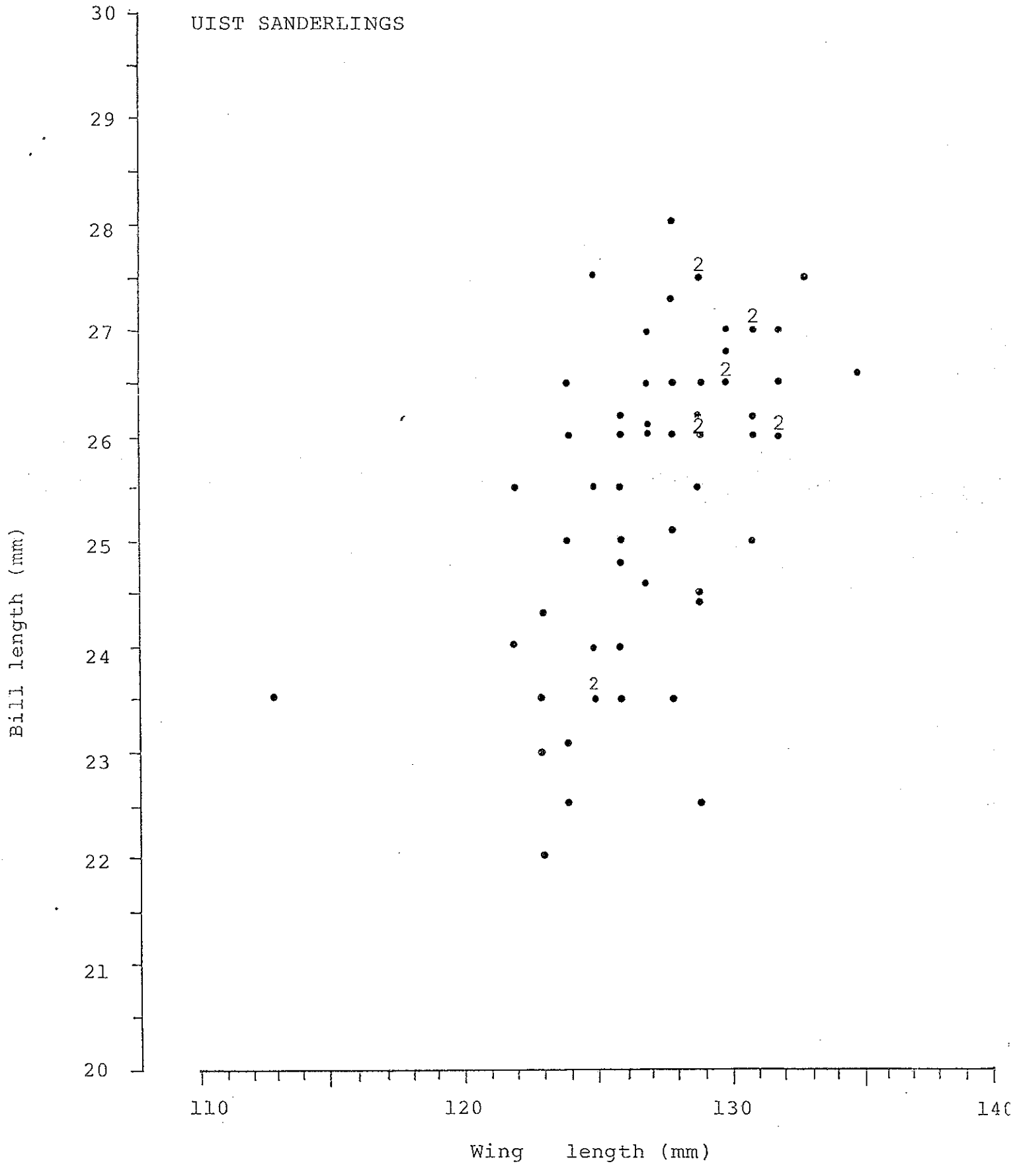
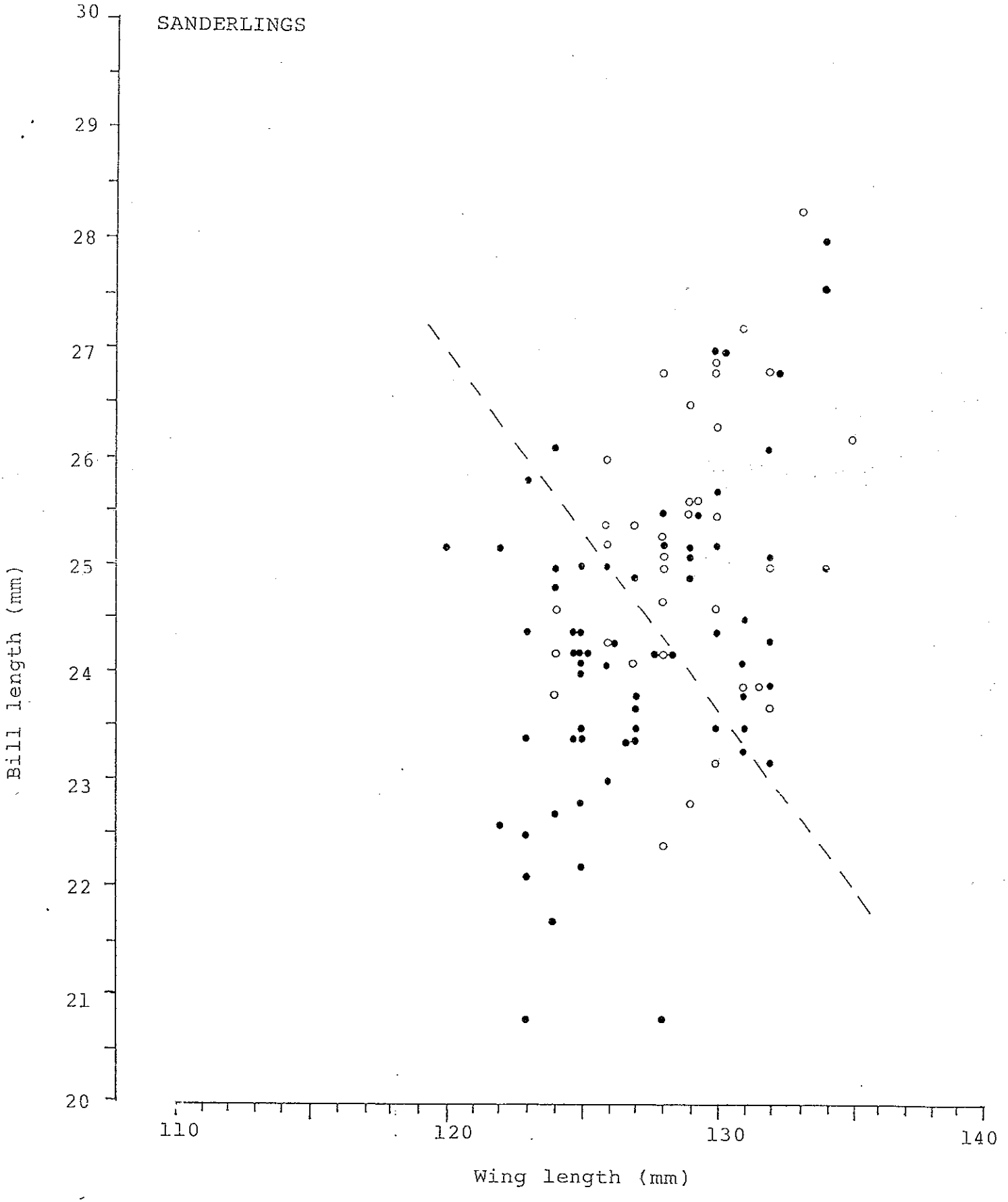


Figure 8 Bill/wing scattergram for Sanderling caught on the Solway on 22 May 1982 (from Clark, in litt.). ● = male, o = female according to plumage characteristics. Line represents the discriminant function of Wood (1987).



Dunlin:

A total of 402 Dunlin were captured (Table 7), only twelve (3%) of which were juveniles (Table 9). The majority (293) were assigned to race on the basis of plumage characteristics; among adults, only one was alpina, whilst 44 (15%) were arctica and the remainder (84.6%) were schinzii (Table 12). Individuals of the race schinzii averaged slightly larger and heavier than arctica Dunlins, and, in both races, females were larger and heavier than males (Table 13).

Our Dunlin catches on the Uists showed that male arctica outnumbered females by almost 3:1, whereas among schinzii there were 1:8 females for every male. These differing sex ratios for the two races accord well with two documented facts of Dunlin migration: firstly, Icelandic birds of the race schinzii mainly migrate up the west coast of Britain from mid April through early May, whereas Greenlandic arctica peak in late May (Ferns 1981b, Cramp & Simmons 1983); secondly, male Dunlin arrive back on the breeding grounds on average earlier than females (Jonsson 1987). Our catches were concentrated in mid May, thus including a preponderance of female schinzii and male arctica.

Predation:

Four species of raptor were observed over beaches on the Uists and Benbecula, of which three were observed to attack waders. Buzzards Buteo buteo were seen a number of times over beaches, but we observed no attempted predation on waders. Male Hen Harriers Circus cyaneus were seen at both Ardivachar and at Borve, and at the latter site one was seen to take a Sanderling off the shore. A female Merlin Falco columbarius was present on at least two occasions at Ardivachar, capturing a Dunlin off the shore on one of these. Similarly, a young male Peregrine Falco peregrinus was present on at least two days at Ardivachar, stooping on waders on both occasions and capturing a Dunlin on one of these.

Table 12 Sex ratios of the two main races of Dunlin caught on the Uists in May 1988.

		schinzii		arctica	
Date	Catch	male	female	male	female
130588	1	-	-	-	-
	2	-	-	-	-
160588	1	1	3	1	1
170588	1	-	-	-	-
180588	1	1	1	3	0
	2	26	51	11	5
	3	-	-	-	-
190588	1	25	45	4	3
	2	3	3	1	1
	3	1	13	6	0
	4	26	40	4	2
210588	1	4	2	1	0
	2	3	0	1	0
		90	158	32	12

- not raced.

Table 13 Biometrics of adult schinzii and arctica Dunlin caught on the Uists, May 1988. (mean, S.D. and sample size given).

Measurement	schinzii		arctica	
	male (N=91)	female (N=153)	male (N=30)	female (N=13)
Wing (mm)	114.1 (2.22)	117.8 (2.70)	113.4 (3.00)	117.8 (2.74)
Bill (mm)	28.5 (1.35)	32.7 (1.69)	27.1 (1.86)	31.6 (2.33)
Weight (gms)	49.2 (4.84)	54.2 (4.70)	47.5 (4.20)	52.2 (3.84)

CONCLUSIONS

Our studies of migrating Nearctic-breeding waders on the Uists in mid/late May 1988 have probably raised more questions than they have answered. Both the species of main interest, Turnstone and Sanderling, were present in lower numbers than had been hoped, and only ca 60 of each could be caught. Our results clearly show a May influx of Sanderling and Dunlin, but not on a large scale in relation to the total migrating populations of each. In the case of Turnstone, the evidence of the Balranald counts suggests that numbers steadily decline from mid April onwards, but that good numbers remain into mid May in some years (e.g. 1986) but not in others (e.g. 1988). Although not confirmed by the available count data or our trapping results, the evidence of colour-mark sightings in previous years indicates there must be at least some mid/late May staging on the Uists in some years by Turnstone. Depending on prevailing weather conditions, this might vary both in degree and duration. Thus, Paul Boyer's observations on the evening of 18 May clearly point to a very brief influx of birds, including Turnstone.

The situation on the Uists in mid May 1988 was in striking contrast to that observed concurrently on Sanday in the Orkneys. Here, Ron Summers (in litt.) both observed very large numbers of migrating Turnstone (ca 2,500, twice the average winter population) and found his birds to weigh substantially more than those on the Uists. Evidence from other sites along the west coast of Britain confirmed a striking inter-site variability in weights of Turnstone caught at similar times within a single spring. Analysis of results from west coast ringing groups which have data spanning a number of springs should provide more insight into how site-specific these patterns really are.

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Chris Thomas and Digger Jackson endeavoured to catch waders on the Uists in February on our behalf, and spring catches on the mainland were made by the Devon & Cornwall Wader Ringing Group, the Celtic Wader Research Group, Scan Wader Ringing Group and Morecambe Bay Wader Ringing Group. Jack Sheldon's efforts with the latter group must be highlighted. The Zoology Departments of both Durham and Edinburgh Universities allowed use of their cannon-netting equipment. In addition to those already mentioned, Mark Avery, Leo Batten, John Cross, Tony Dawe, Gudmundur Gudmundsson, Frank Mawby and Phillip Whitfield provided important additional sightings of dye-marked birds. Our thanks are due to Lina Prairie and Neil Whitehouse for carrying out the 1988 Balranald counts and making the data available. Dorothy Smallwood-Keating and Tracey Jarvis typed the manuscript and Liz Murray kindly drew the figures. Many thanks to all!

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