Migration pattern, weight, measurements and moult of waders ringing in August-September 1992 in Bahrain

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INTRODUCTION

Following the experience gained during the Bahrain Wader Study project 1991 (Hirschfeld *et al.* 1992), a ringing scheme of waders was repeated in Bahrain in autumn 1992. More traps were used, more ringers present, and the study period was extended by about two weeks. This resulted in an increase in the number of birds ringed.

As in 1991, the ringing site was in the grounds of the General Poultry Factory in Dumistan (50°28'5N 26°08'E, see Figure 1). A few, mostly unsuccessful, attempts were also made to ring waders on the coast.

The ringers, apart from the authors, were Annika Forsten and Tapani Numminen from Finland, and Olivier Girard and Michel Fouquet from France.

OBJECTIVES

- To collect biometric data of waders
- To study moult patterns
- To collect blood samples of Dunlins for DNA-analysis
- To study turn-over rate for ringed waders
- To study age/sex differences among ringed waders

DESCRIPTION OF MAIN TRAPPING SITE

The grounds at the General Poultry Factory are used for dumping chicken waste (excrements, blood *etc.*) that is left in the sun to dry and then collected and sold as manure to local farms. The sludge is deposited in two patches, usually of *c.* 100 x 25 m size. As the sludge dries up, flies lay their eggs in it and waders feed on the developing larvae. The number of larvae in the sludge rapidly changes as the heat dries the sludge. The traps must therefore be moved around every two or three days to optimal feeding areas. On certain days, especially at the beginning of September, the area was disturbed by workers collecting most of the manure, but a few days later there would be enough sludge for larvae to develop and the birds to feed again.

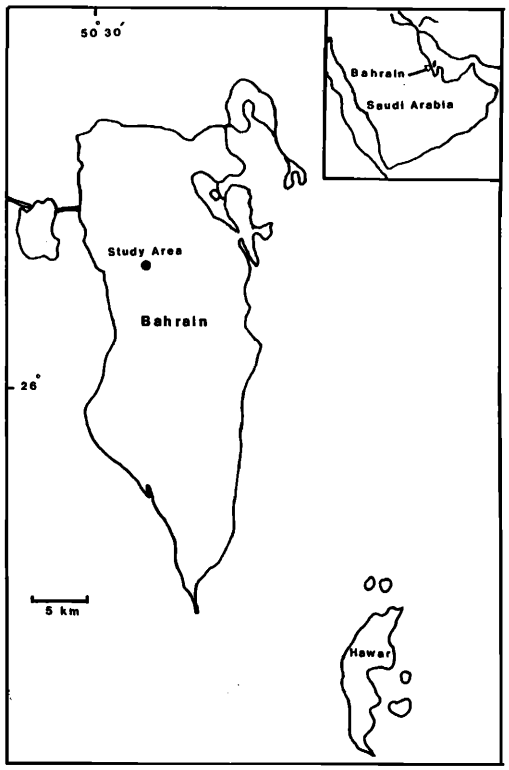
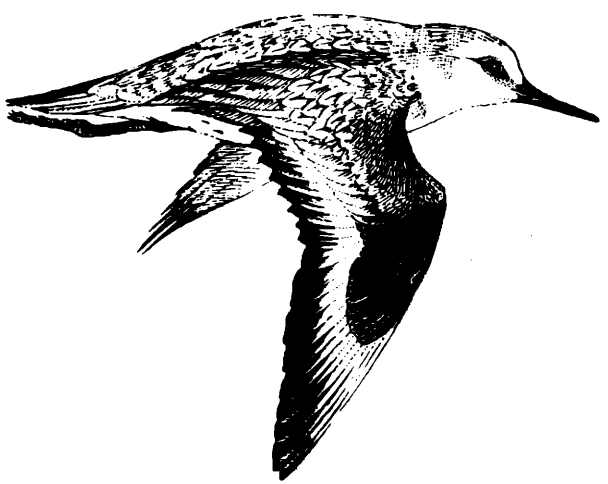


Figure 1. Location of Bahrain and the study area.

The immediate surroundings of the ringing site consist of semi-desert, harbouring typical species as Crested Lark *Galerida cristata* and Graceful Warbler *Prinia gracilis*. A few hundred meters to the northwest is the Hamalah Experimental Farm which with its green fields attract migrant passerines and raptors.

Table 1 Total number of birds caught during the study period

Bird Species	August			September																																	October			Total
	20	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	
Ch.hiaticula				1				1	1				1	1				2	1		2	2	3	5		1	3		4		1	2	1	1	3	1			3			40
Ch.pecuarius	1																																0									1
Ch.alexandrinus	2		2	2	8	9	17	9	11	13	12	10	4	4	7	8	13	8	9	17	12	5	9	7	9	12	6	1	2	2	5	8	4	1		2	4	2	7	3	2	268
Ch.mongolus	1			1			2		1	3					1				1	1	3	2	1	3			1	1	1	3	2				1				1	1	1	32
Ch.leschenaultii			1					1								1							2									1										6
Ch.asiaticus																														1												1
P.squatarola																						1																					1
C.alba									1									1							1																		3
C.minuta				1	2	14	2	17	17	5	6	1		3	2	8	4	23	3	7	11	17	31	39	26	12	4		8	7	13	8	17	7	3	4		2	3	1		328
C.ferruginea	4	7	17	14	15	17	16	17	17	12	12	5	1	3	1	3	4	6		3		6	1	4	3	7						2	5	7	2	2			2		1	216
C.alpina					1			1							1	1	9	3	1	6	11	17	20	27	29	21	7	5	11	22	30	29	33	22	6	32	5	14	34	9	8	415
L.falcinellus																							1																				1
P.pugnax							1		1					1			2				1									1	1					2						10
G.gallinago																														1						1						2
T.totanus								1	1	1	1						2	4	1	2	1	5				4										1							24
T.glareola																						1																					1
X.cinereus			2				1		2					1		2	1						2												1								12
A.interpres		7	6	7	6	4	8	4	1	1		1	2	2			3	4	1		2				3																	62
Total	8	14	28	26	32	44	47	51	53	35	31	17	8	15	12	23	38	51	17	36	43	56	70	85	71	57	21	7	26	37	52	50	61	38	16	43	9	20	50	14	12	1423



About 1 km to the southeast lies Nakhl Lawzi (or Dumistan lake) which is saline (the salinity gradient range is 5-60 parts per thousand). The lake is used as a daytime roost by some of the waders feeding at General Poultry.

METHODS

Trapping

The birds were caught using walk-in traps. Eight were of locally made construction, and the ringers made a further 16 traps of the Ottenby-type (Bub *et al.* 1991) during the first two weeks of ringing. Netting was done once on the coast, at Janabiyah, but only caught four Redshanks. The nets melted in the heat of the car boot the next day, and since most of the days were windy, no further attempts at netting were made.

Rings

Steel rings had kindly been provided by NCWCD of Saudi Arabia and had the inscription "NCWCD Riyadh" with an individual number for each bird.

Biometrics

Age and sex determination were made whenever possible, following the criteria given by Prater *et al.* (1977). Each bird was checked for growing tail - and flight-feathers. Growing primaries were classified according to the widely used five-point system (Ginn & Melville 1983) when moult was noticed. In addition, moult of body feathers on the breast and belly were looked for.

Wing length was measured to the nearest mm by the maximum chord method (Evans 1964). Bill was measured to the nearest 0.1 mm from the tip of the upper mandible to the feather-margin. The total head length was taken with the same accuracy from the tip of the bill to the dorsal end of the head as described by Green (1980). This measurement might produce more consistent results as compared to bill-length measurements. The birds were weighed with Pesola spring balance. The accuracy of the reading was within 2% of any particular weight, excluding observer errors.

Moult

Moult was determined using the method described by Ginn & Melville (1983). In the case of Dunlins we checked the inner median coverts and the birds with brownish edges on these feathers were determined as second years. We also looked for so- called "adult buff" median coverts in the middle part of the wings of adults (Gromadzka & Przystupa 1984; Gromadzka 1985).

RESULTS AND DISCUSSION

Wader species characteristics at the trapping site

Most waders are present in large numbers from May to September when the weather is hot and, presumably, more flies are present. It is not unusual to see up to 1,500 waders feeding together at that time. The numbers decrease in October (although some new species, *e.g.* Common Snipe *Gallinago gallinago*, then start turning up in small numbers) and do not build up again until late April.

The waders feed during mornings and evenings, typically leaving the area around 09.00 and returning around 16.00. In the evening, Turnstones *Arenaria interpres* leave the area earliest, just after sunset, followed by Calidris species. Various *Charadrius* species seemed to feed in the area at night, judging from their calls. Pacific Plovers *Pluvialis fulva* and sometimes Grey Plovers *Pluvialis squatarola* came in to roost in small flocks on dry ground adjacent to the sludge in late afternoon.

The fields at Hamalah Experimental Farm regularly attract raptors, such as Pallid Harriers *Circus macrourus* and Marsh Harriers *C. aeruginosus* during migration.

One species new for Bahrain, a Kittlitz Plover *Charadrius pecuaris* was caught on August 20 and is apparently a new species for Arabia. It breeds in Africa, the nearest place to Arabia being Egypt, and has turned up as a vagrant in Israel (Shirihai & van der Berg 1987), Morocco (*Dutch Birding* 12: 39) and in Cyprus (Flint *in litt.*).

Number of waders ringed

A total number of 1,423 waders of 18 species were ringed and for an additional 11 individuals (birds found dead or controls) biometric data were collected. Table 1 shows the daily ringing totals and daily totals for the species.

Noteworthy are the low catches during 3-7 September when disturbance was intensive at the site due to manure being removed by workers. The human disturbances during the rest of the period were fairly consistent. The many peaks indicate waves of newly arrived birds and on a few occasions extremely weak birds were caught. One very thin Curlew Sandpiper even died after being caught. Catches were decreased towards the end of the project because there were too many suitable feeding places and the birds spread out in the area.

Unlike the previous year, most birds were generally caught in the mornings, and some evening catches were extremely poor. We can find no reason for this, and the aspect needs to be studied more in the coming years.

Six controls of ringed waders were made. Two were Little Stints: a juvenile caught on 4 October 1991 was re-captured as an adult on 14 September. Moskwa XB495836 was caught as an adult on 17 September and had been ringed as an adult on 24 July 1986 at Zharkul

Lake, north-central Kazakhstan (51°20'N 64°30'E) (Swedish Ringing Centre). Three were Dunlins: one was caught as an adult on 14 September and was ringed at Jubail, Saudi Arabia on 22 November 1991, and two adult birds that had been ringed on 1 October 1991 were re-captured, one on 15 September and the other on 27 September. One Redshank caught on 13 September had been ringed as a first-year bird at Tarut bay, Saudi Arabia on 2 December 1991.

Passage dynamics of some species of waders

We believe that the numbers caught were in proportion to those present at least for the common species and hence show the waves of migration passage through the site.

Little Stint: The first bird was caught on 26 August and four peaks of passage can be recognized (Figure 2). The first juvenile was caught on 2 September with the peak of juveniles about two weeks after the first peak of adults. Generally, the passage was much longer and earlier than in 1991 (Hirschfeld *et al.* 1992).

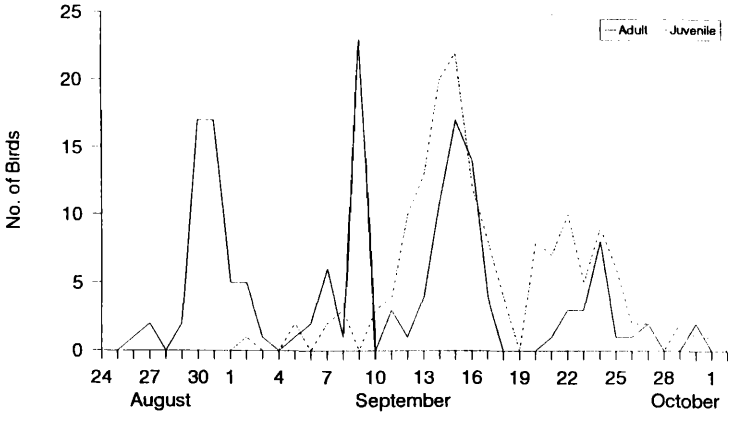


Figure 2. Passage dynamics of adult and juvenile Little Stint.

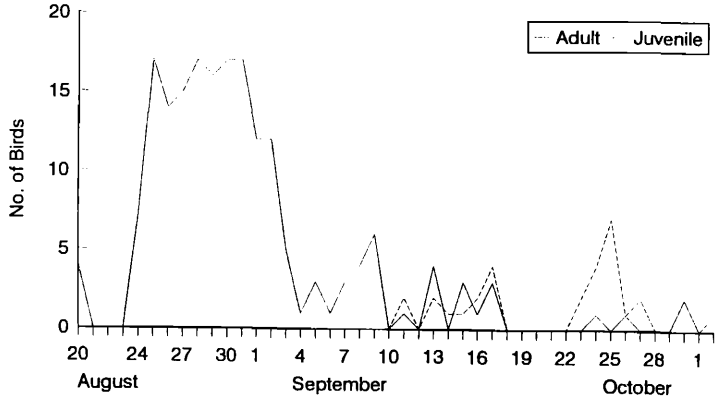


Figure 3. Passage dynamics of adult and juvenile Curlew Sandpiper.

Curlew Sandpiper: A large passage of adults occurred between 25 August and 3 September (Figure 3). Small numbers were then caught at the beginning of October. The first juvenile was caught on 11 September but passage of juveniles was smaller (Figure 3) than in the previous autumn (Hirschfeld *et al.* 1992). Passage of males and females overlapped but the peak of males was six days earlier than females.

Dunlin: Dunlins arrive late on the study area. This is consistent with previous observations at high tide roosts in Bahrain (Hirschfeld in prep.) and is explained by the fact that adult Dunlins moult flight-feathers on breeding grounds (see also "Moult" below).

The first bird was caught on 26 August but a strong passage occurred after 10 September. The first juvenile Dunlin was caught on 13 September and the passage of adults and juveniles overlapped in time, although adults were more numerous (Figure 4). Four peaks of both ages can be recognized in September. In comparison to the previous year (Hirschfeld *et al.* 1992), the passage was generally earlier and longer.

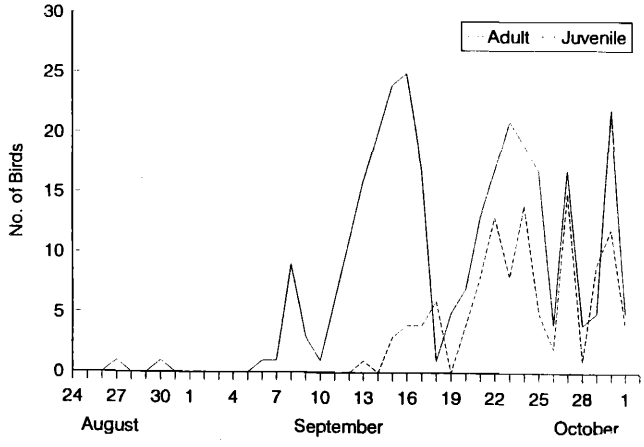


Figure 4. Passage dynamics of adult and juvenile Dunlin.

Kentish Plover: This species was caught in large numbers in comparison to the previous autumn (Hirschfeld *et al.* 1992). The capture results show considerable day-to-day variation (Figure 5), this reflects different catching efficiency rather than real passage pattern. Many re-captures (22.1% of the total ringed) suggest that many Kentish Plovers were local birds.

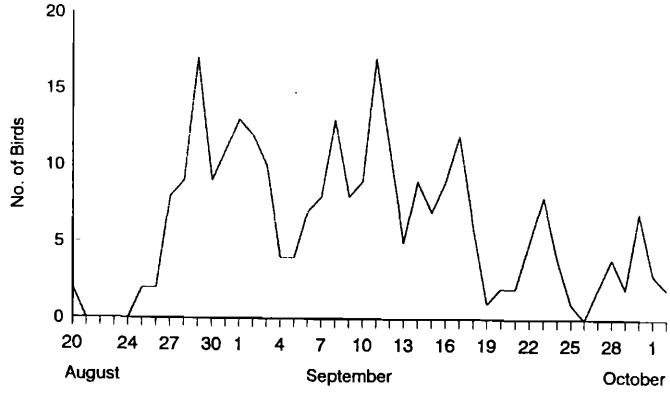


Figure 5. Passage dynamics of adult and juvenile Kentish Plover.

Turnstone: The capture results poorly reflect the timing of passage of this species. Turnstones were caught mainly at the end of August and later only single birds were caught, although many of them were still present in the area.

Weight

Kentish Plover: Mean weight (37.8 g) of the birds caught in Bahrain was smaller than birds caught in September in France (Glutz *et al.* 1975) and very similar to the data from Arabian Gulf (Etheridge 1971; Uttley *et al.* 1988) and Morocco (Glutz *et al.* 1975). Of the re-captured birds, 19 (32.2%) increased weight by 0.3 g per day (maximum 1 g per day). 35 birds (59.3%) decreased weight by a mean of 0.4 g per day. This decrease concerned mainly individuals re-captured after 1-3 days and/or multiple re-captures. The rest of the birds showed stable weight. Rather low weight of birds caught in Bahrain, in spite of extremely good food supplies, correlate with generally small measurements and it seems to be typical for the population from this region. The low weight increases and many re-captures of Kentish Plover suggest that most of the birds were either locally breeding birds, or birds having arrived at their wintering grounds in Bahrain.

Lesser Sandplover: Mean weight (53.3 g) was a little lighter than from birds caught in Sharjah in late autumn and winter (Etheridge 1971). Of the five birds that were caught 10 days or more from ringing, the weight gains per day were 0.14, 0.27, 0.46, 0.6 and -0.15 g respectively.

Little Stint: Mean weight of the birds caught in Bahrain (24.9 g) was much lighter than in the previous autumn (30.7 g) (Hirschfeld *et al.* 1992) and very similar to other data from the Arabian Gulf (Uttley *et al.* 1988). 25 birds weighed less than 20 g compared to the previous autumn where there were none. The lightest bird weighed 16 g only, which is one of the lowest weights ever recorded for this species (Cramp & Simmons 1983). Mean weight increase of 15 re-captured birds was 0.75 g per day with a maximum of 2 g per day. The weight of nine birds was stable or decreased by mean 0.4 g per day (up to 7 g during nine days).

Dunlin: Mean weight (46.8 g) was smaller than in the birds caught the previous year at the same place (51.0 g) (Hirschfeld *et al.* 1992). The range of weight of Dunlin shows that many more birds arrived in Bahrain in bad condition in 1992 than in the previous autumn. 42 Dunlins weighed less than 40 g in comparison to only six birds in 1991. Mean weight increase of 18 re-captured birds was 1.04 g per day, with a maximum of 5 g after one day and 26 g after eight days. Weight decrease was recorded in 14 birds with a mean of 0.6 g per day (maximum 7 g after two days), mainly in birds re-captured after 1-3 days. Eight birds showed a stable weight when re-captured.

Curlew Sandpiper: Mean weight (67.7 g) was very similar to the previous year (Hirschfeld *et al.* 1992) and no significant differences in the range of weight was noticed. Mean weight increase of nine re-captured birds was 2.6 g per day with a maximum of 3.5 g per day. The weight of five birds re-captured after 1-4 days decreased up to 4 g. For one bird a decrease of 7 g during 13 days was apparently caused by a broken bill.

Turnstone: Mean weight (114.8 g) of birds caught in Bahrain was similar to that of the birds caught in September-October in the Netherlands (Glutz *et al.* 1977) and in South Africa (Summers & Waltner 1979) although the range of weight (74-168 g) was greater. A male re-captured after eight days increased its weight by 28 g (3.5 g per day). Another two birds decreased their weight by 11 g and 4 g after one day.

It seems that in August-September 1992 many birds, especially Dunlins and Little Stint, arrived in Bahrain in much worse condition than in the previous autumn. Some birds were so exhausted that a few of them died in the traps. It could be related with very poor breeding season in 1992 in Arctic tundra (Gromadzka *in litt.*)

Biometrics and moult

Kentish Plover: Measurements of the birds caught in Bahrain fit well to biometric data from the Arabian Gulf and the Red Sea. They are rather small although the range of measurements was much wider (Table 2) than given by Cramp & Simmons (1983) for this region.

According to Cramp & Simmons (1983) Kentish Plover complete moult early September to early October and the birds from the Mediterranean and the Red Sea start moult even earlier (Pienkowski *et al.* 1976; Cramp & Simmons 1983). In September 54.7% of birds caught in Bahrain had all primaries new while 30.5% had all old and 14.8% were in active primary moult (Table 10). It suggests that Bahraini birds probably belong to another population moulting later than more western populations.

Lesser Sandplover: According to data given by Cramp and Simmons (1983) the best distinction between subspecies groups is wing/tarsus ratio (over 4.10 for *mongolus* group and under 4.09 for *atrifrons* group), we found that five of the caught birds belonged to the *mongolus* group and 26 to the *atrifrons* group (for juveniles 3 mm was added to the wing to make it comparable with adult). Taking into account wing/bill ratio (over 7.70 for the *mongolus* group and under 7.70 for the *atrifrons* group) we found that 12 of the caught birds belonged to *mongolus* and 19 to *atrifrons* group. Of 14 adults, seven had all old primaries, five new, and two were in active moult (Table 10). However, Cramp & Simmons (1983) base their material on skins, and if we added 3 mm to our live sample's wing lengths (to compensate for the shrinking of skinned birds' measurements) we get slightly different results, with *mongolus* dominating in wing/bill ratio, but *atrifrons* dominating in wing/tarsus ratio so it is perhaps best to treat our findings in this respect as inconclusive.

Table 2. Measurements and weight of adult and juvenile Kentish Plover.

	Adult (n=222)			Juvenile (n=44)		
	X	SD	Range	X	SD	Range
Wing	107.8	2.79	101.0-116.0	107.5	3.16	98.0-112.0
Bill	15.1	0.76	13.1-17.0	15.0	0.80	13.1-16.7
Head	41.8	0.98	39.5-44.1	41.6	1.11	39.5-44.7
Tarsus	28.8	1.10	25.7-32.0	28.8	1.30	26.7-32.4
Weight	37.7	3.51	27.0-49.0	38.3	3.49	28.0-46.0

Table 3. Measurements and weight of Lesser and Greater Sandplover.

	Lesser Sandplover (n=31)			Greater Sandplover (n=6)		
	X	SD	Range	X	SD	Range
Wing	128.5	2.84	123.0-133.0	144.7	2.50	141.0-147.0
Bill	16.8	0.92	14.9-18.7	24.5	1.03	23.0-25.0
Head	45.7	1.15	43.9-47.7	57.1	1.44	55.8-59.8
Tarsus	33.0	1.24	30.0-36.1	39.5	0.75	38.3-40.5
Weight	53.3	6.66	38.0-67.0	89.0	9.57	75.0-105.0

Table 4. Measurements and weight of adult and juvenile Ringed Plover.

	Adult (n=26)			Juvenile (n=21)		
	X	SD	Range	X	SD	Range
Wing	129.0	2.07	125.0-133.0	128.4	2.20	125.0-132.0
Bill	14.5	0.66	13.6-16.6	14.0	0.60	2.7-14.7
Head	40.8	0.70	39.5-42.1	40.6	0.79	39.2-42.5
Tarsus	25.6	0.88	23.9-27.3	25.8	0.77	24.0-27.5
Weight	56.1	9.23	43.0-74.0	49.3	5.40	40.0-60.0

Greater Sandplover: Measurements of six birds caught in Bahrain, with especially long wing, bill and tarsus (Table 3) fit well to *Ch. leschenaultii crassirostris*.

Ringed Plover: Both measurements and moult indicate that birds belonged to *Ch. hiaticula tundrae*. As shown in the Table 4 they were short-winged and the majority of birds (93.6%) had not started primary moult until the end of September (Table 10). The late moult is typical for this subspecies from North Fenno-Scandia and Russia which begin moult in November in winter quarters (Cramp & Simmons 1983).

Little Stint: The birds caught in Bahrain had a very wide range of wing and bill length, both for adults and juveniles (Table 5) bill length exceeded data given by Cramp & Simmons (1983). 88.8% of birds were in active moult (Table 10), mainly in the middle of the process (mean moult score 26.3), while 10% had not started moulting and only 1.2% had completed the moult (Table 10). The progress of moult during August-September is shown on Figure 6.

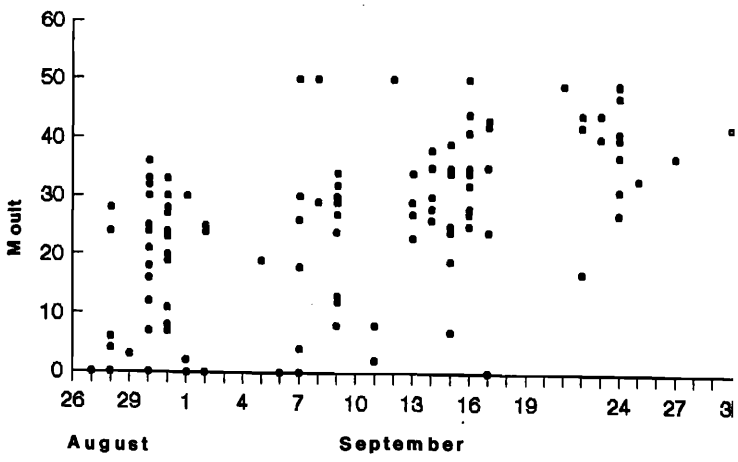


Figure 6. The progress of moult during August to September for Little Stint.

Table 5. Measurements and weight of adult and juvenile Little Stint.

	Adult (n=170)			Juvenile (n=156)		
	X	SD	Range	X	SD	Range
Wing	97.9	2.70	92.0-104.0	98.9	2.44	92.0-104.0
Bill	18.4	1.09	15.4-21.3	18.4	0.85	15.6-20.7
Head	39.0	1.19	35.9-41.9	38.4	1.06	35.4-41.6
Tarsus	21.8	0.83	18.5-24.1	21.5	0.77	19.8-23.6
Weight	24.8	3.65	18.0-41.0	25.1	4.58	16.0-38.0

Dunlin: The biometric data collected in autumn 1992 confirmed the very wide range of measurements (Table 6) as shown the previous year (Hirschfeld *et al.* 1992). Some birds were very small with wing length 110-112 mm and bill length less than 30 mm. On the other hand very large individuals were caught with the bill exceeding 40 mm (Figure 7). These birds could be assigned to *C. a. sakhalina*. Because of the much wider overlapping of measurements of different subspecies of Dunlin than was presumed before (Meininger & van Swelm 1989; Gromadzka *in litt.*), it is difficult to judge exactly the origin of birds caught in Bahrain. Eastern populations of Dunlin start to migrate after finishing the moult on the breeding grounds (Gromadzka 1989) and moult pattern of birds caught in Bahrain confirm their eastern origin. Out of 295 adults only one had not commenced it's moult, while eight birds (2.7%) were in active moult. The rest (97%) had all new primaries, although the majority of them were still in breeding plumage (Table 10). Among 219 adults, 92.2% had whitish edges to median wing coverts, 7.3% slightly buffish edges and one bird (0.5%) had buff fringes. Twenty three adults (7.8% of adults) were recognized as second-year birds.

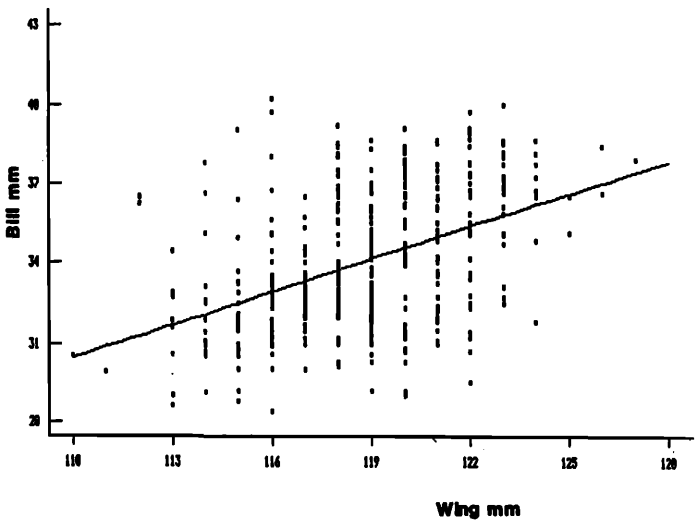


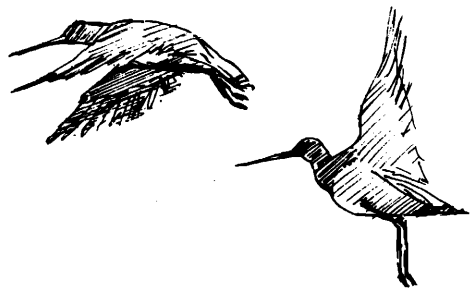
Figure 7. The relationship between bill and wing length of Dunlin.

Table 6. Measurements and weight of adult and juvenile Dunlin.

	Adult (n=304)			Juvenile (n=113)		
	X	SD	Range	X	SD	Range
Wing	118.6	2.78	110.0-136.0	119.1	3.06	110.0-127.0
Bill	34.2	2.62	28.4-40.2	33.5	2.47	28.8-38.6
Head	57.9	3.19	51.2-66.2	57.2	2.71	51.5-62.6
Tarsus	26.0	1.07	22.6-30.2	25.5	1.19	22.5-29.6
Weight	46.7	5.33	35.0-63.0	46.8	5.98	33.0-64.0

Curlew Sandpiper: The range of wing, bill and tarsus length exceeded data given by Cramp & Simmons (1983). Differences between adults and juveniles were not significant (Table 7) assuming that males have bill length less than 38 mm and females more than 39 mm (Elliott *et al.* 1976). A few more caught birds (54%) were found to show biometrics of males (Table 8), as in the previous autumn (Hirschfeld *et al.* 1992). The majority (63.4%) had not begun moulting while 32.8% were in active moult and 3.8% had finished (Table 10). The progress of moult during August-September is shown on Figure 8. 52.3% of the males had not started moulting while 43.0% were in active moult (mean moult score 16.8), the same figures for females were 70.0% and 26.7% (mean moult score 24.0). It confirms that females start primary moult later than males (Cramp & Simmons 1983). It is also interesting that 3.8% adults had finished their moult in September, although normally moult is completed in winter quarters.

Turnstone: All but one bird were adults. There was no significant differences between males and females (Table 9). None of adult had finished moulting, 11% were in active moult, and the rest had not started moulting (Table 10).



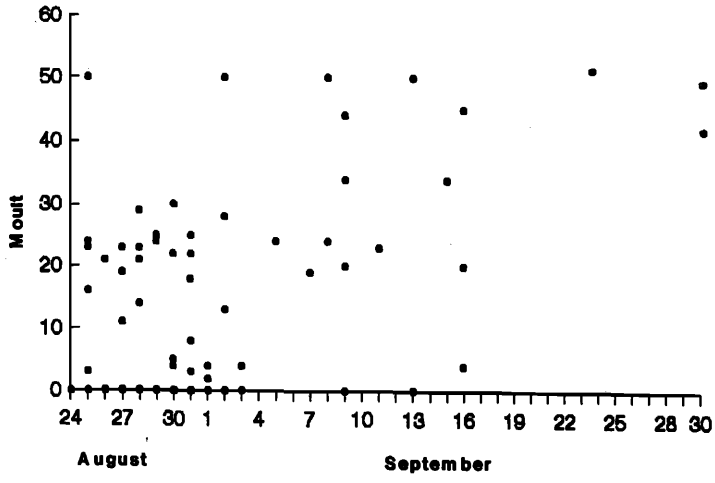


Figure 8. The progress of moult during August to September for Curlew Sandpiper.

Table 7. Measurements and weight of adult and juvenile Curlew Sandpiper.

	Adult (n=186)			Juvenile (n=29)		
	X	SD	Range	X	SD	Range
Wing	131.4	3.13	121.0-140.0	130.8	3.25	120.0-137.0
Bill	38.1	2.97	30.7-45.4	38.0	2.19	34.6-42.2
Head	64.2	3.16	54.6-70.8	61.5	2.14	58.5-66.3
Tarsus	31.2	1.86	27.6-39.9	30.5	1.39	28.0-34.4
Weight	69.1	12.52	42.0-98.0	57.7	6.49	41.0-75.0

Table 8. Measurements and weight of female and male Curlew Sandpiper.

	Female (n=89)			Male (n=104)		
	X	SD	Range	X	SD	Range
Wing	132.9	2.83	120.0-140.0	130.1	2.94	121.0-130.0
Bill	40.8	1.47	39.1-45.4	35.7	1.67	30.7-37.9
Head	64.9	1.88	60.4-70.8	59.6	1.73	54.6-62.7
Tarsus	32.0	1.27	29.2-34.9	30.3	1.95	27.6-39.9
Weight	69.8	12.89	47.0-98.0	65.4	12.23	41.0-95.0

Table 9. Measurements and weight of adult male and female Turnstone.

	Female (n=37)			Male (n=24)		
	X	SD	Range	X	SD	Range
Wing	154.3	3.48	143.0-160.0	153.9	3.30	148.0-160.0
Bill	22.3	1.07	20.2-24.6	21.7	1.26	19.5-24.1
Head	50.3	2.35	41.6-57.7	49.8	1.12	47.6-52.3
Tarsus	25.5	0.77	24.0-26.9	25.5	0.85	23.8-27.4
Weight	114.4	21.40	74.0-147.0	118.6	25.30	78.0-168.0

Table 10. Primary moult scores of some species of wader caught in August/September 1992 in Bahrain.

Species			Moult Score					
	N	O	1-10	11-20	21-30	31-40	41-49	50
Kentish Plover	223	68	1	2	1	8	21	122
Ringed Plover	25	22	-	-	-	-	-	2
Lesser Sandplover	13	7	-	-	-	1	1	5
Little Stint	170	17	16	23	61	3	14	2
Curlew Sandpiper	186	118	13	9	29	6	4	7
Dunlin	295	1	-	1	2	1	4	286
Turnstone	63	56	1	-	2	1	3	-

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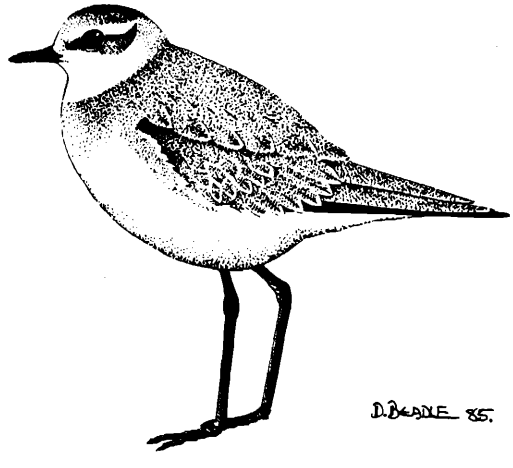

Mongolian Plover