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BREEDING OF THE MAGPIE PICA PICA ON ANGLESEY, NORTH WALES

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PREFACE

The Magpie is common and widespread on Anglesey: the landscape evidently affords it good habitat. Basic data on the breeding cycle are presented as reference information for pollution studies.

This paper summarises data on certain aspects of the breeding of the Magpie *Pica pica* collected in three years on the island of Anglesey, North Wales. The information was obtained as a consequence of one part of a diverse programme of study on the occurrence and effects of fluoride in a variety of plants and animals; the fluoride originates primarily from the aluminium smelter at Holyhead (see Perkins 1980a, 1980b, Walton 1982, Seel 1983). In the case of the Magpie, the interest was to observe the occurrence of the contaminant in a species of predatory vertebrate, since it has been suggested (Groth 1975) that fluoride may accumulate in animals higher up the food chain. The Magpie was chosen because it is common, widespread and easily sampled.

Magpie nests were examined to provide specimens for the study of fluoride in the species, but, in doing so, various data on breeding were obtained, too, and these provide the context for the fluoride results. The breeding data are described now; the fluoride data are reported partially in Seel (1983), but will be presented more fully elsewhere. The present report is limited to notes on breeding by the fact that the nests were used for the afore-mentioned purpose, but it does high-light several fundamental aspects of breeding meriting further study.

Previous detailed studies on the breeding of the Magpie in Britain are surprisingly few and comprise principally Holyoak (1967), based on dispersed data collected by the

British Trust for Ornithology, and Tatner (1980), who observed the species in the urban environment of Manchester.

METHODS

Data were collected in the years 1977, 1979 and 1981 from nests distributed around Anglesey. In the first year, nests were sought mostly in the west, since that is where the smelter is located, but subsequently more widely when considerable areas of the island were searched systematically from a slowly-moving vehicle, travelling along roads. Nests were found mostly in early spring, that is, before the hawthorn hedges, in which they were most commonly built, came into leaf (usually in early April). The locations of the nests were plotted on 1:25 000 maps at that time in the spring and not examined closely until early April. Only a small proportion of nests were found after bud-burst; consequently, the present description is based primarily on the birds' first clutches - repeat clutches, if any, laid as a rule in further nests, and also very late first clutches, too, would have been largely missed.

All close nest inspections were made by ladder. Confirmation of nests of the year was made at the first such inspection. Nests in active use were re-inspected at intervals in accordance with a timetable of the progress of the contents of each nest; nests which remained unused were re-inspected at c. 15 day intervals up to about late-May.

A combination of information derived from the laying sequence,

hatching date and nestling weight (see below) was used to estimate the date of laying of the first egg. (Additional assumptions were (1) a laying rate of one egg per day (Holyoak (1967) asserted that the Magpie usually has at least one interval between the successive eggs in the same clutch longer than a day, but his data do not provide sufficient justification for introducing this detail here); (2) an incubation period of 18 days (Witherby *et al.* 1943; and (3) a modal clutch-size of six eggs for nests where the actual clutch-size was not determined).

When first found, the largest nestling in each nest was weighed on a 300 g Pesola balance. This weighing was used to estimate age from a simple graph of body weight against time, commencing at 7 g on nestling day 1 (= day of finding of newly hatched young) and increasing linearly to 160 g on day 16. The error arising from the assumption of linearity was slight and within the following range: day 1: nil; days 2-6: 1 day; days 7-11: 2 days; days 12-16: 3 days (cf. Tatner 1980). However, most first nestling weighings were made early in the nestling period, so the error arising in this way was slight. Nests were finally examined on day 24, when one - three of the larger young were weighed.

Most of the nests were used to provide samples for fluoride measurements. Eggs were collected when there were several present in the nest (one from sets of three and two from larger sets - so as not to stop breeding) at sometime

during the overall laying-incubation period, and young were collected on day 24. Consequently, the present paper reports breeding season and clutch-size based on essentially undisturbed nest contents, but breeding success and nestling growth on manipulated clutches.

RESULTS

Breeding season

As a rule, laying began in late-March, achieved a broad peak in early/mid-April, and was concluded in early-May (Fig. 1).

There was some variation in the three different years: laying in 1977 closely resembled the average pattern; in 1979 it began at the typical time but achieved a pronounced peak in mid-April with the latest clutch being started in mid-May; in 1981 it first occurred in mid-March and achieved its peak in early-April. Mean dates of laying were as follows:- 1977: 14 April, s.d. 9, n = 62; 1979: 14 April, s.d. 9, n = 154; 1981: 9 April, s.d. 8, n = 196; in all years: 12 April, s.d. 9, n = 412.

Local variation in laying date is shown in Table 1, in which the data are arranged by the 10-km National Grid Squares for Anglesey. Breeding began on about the same date on most of the island, but was, on average, a little later in the extreme north-west.

FIGURE 1. Breeding season of the Magpie *Pica pica* on Anglesey, as shown by the distribution of the dates of the first egg in all clutches.

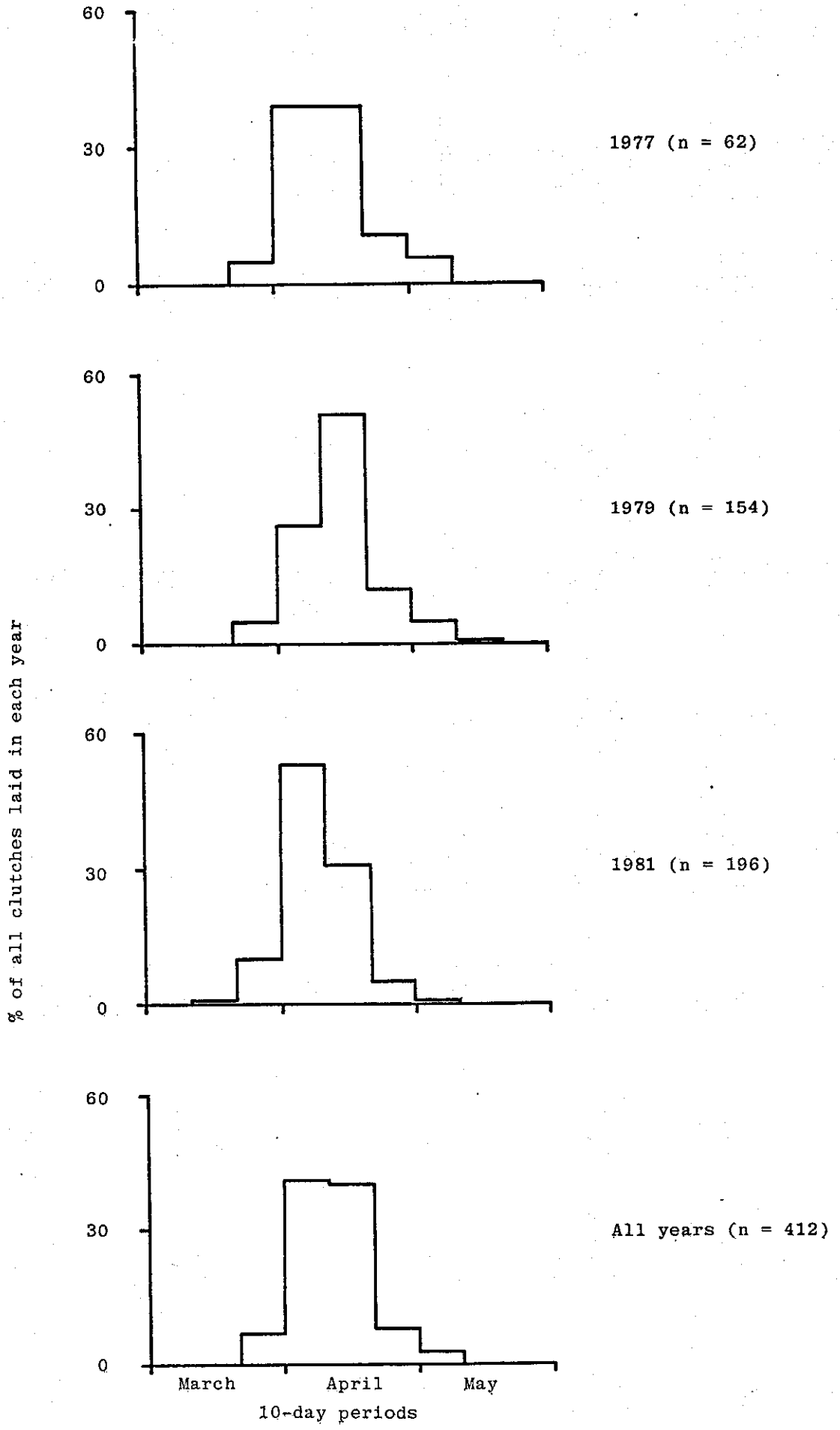

TABLE 1

Local variation in mean date of laying of the first egg in all clutches of the Magpie *Pica pica* on Anglesey - all years combined.

Square			Square			Square			Square			Square		
n	$\bar{x}$	s.e.	n	$\bar{x}$	s.e.	n	$\bar{x}$	s.e.	n	$\bar{x}$	s.e.	n	$\bar{x}$	s.e.
			39/18	15 April (45.7)	2.6	49/13	13 April (44.2)	1.8						
28/67	11 April (42.3)	1.3	38/92	12 April (43.4)	0.9	48/37	12 April (43.1)	1.1	58/17	10 April (40.5)	1.5	68/5	16 April (47.0)	1.1
27/18	11 April (41.9)	1.7	37/50	10 April (40.9)	1.2	47/36	11 April (42.1)	1.3	57/16	10 April (41.3)	2.2	67/1	-	-
						46/41	11 April (42.3)	1.7	56/1	-	-			

Notes. 1. Each 'square' is the 10 km square within 100 km National Grid Square No. SH.

2. ( ) = mean date of laying by day number, day 1 being 1 March.

3. s.e. = standard error (in days) of the mean date expressed as a day number.

Clutch-size

Clutches varied in size from two to eight eggs: the most frequent were 5 (21%), 6 (46%) and 7 (19%) (Table 2). The mean was 5.76, s.d. 1.06.

Annual variations in clutch-size were slight. A seasonal decrease produced an approximate reduction of about one egg between the beginning and end of laying; the greatest decrease was in 1977.

Local variation in clutch-size was assessed as follows, to allow for local variations in laying date. The seasonal decline in mean clutch-size was accepted as the dominant trend. All the useable clutch data were sorted into groups corresponding to the 10 km squares, and pairs of 'local' mean values for clutch-size and laying date calculated for each group (in each year and all years together). The difference between each 'local' mean laying date and the 'overall' mean laying date for each year was then multiplied by the corresponding regression coefficient for the dominant seasonal trend to give the amount by which the 'local' clutch-size needed to be adjusted. Corrected mean clutch-sizes for each 10 km square are given in Table 3: these show irregular variation in clutch-size across most of Anglesey, except for the east, where mean values were a little above average.

Nestling weight

Owing to the afore-mentioned clutch manipulations, it was

TABLE 2

Seasonal and annual variations in clutch-size in the Magpie *Pica pica* on Anglesey.

Year	Clutch-size	Frequencies of clutch-sizes in successive 10-day periods								
		March 11-20	21-31	April 1-10	11-20	21-30	May 1-10	11-20	Whole Year	%
1977	2									
	3					2	1		3	8
	4				1		1		2	6
	5			3	3	2	1		9	25
	6			6	7	2			15	42
	7			3	3				6	17
	8				1				1	3
	$\underline{n}$			12	15	6	3		36	
	$\bar{x}$			6.00	6.00	4.67	4.00		5.61	
	sd			0.74	1.00	1.37	1.00		1.18	
1979	2				1			1	2	2
	3				1	1			2	2
	4			2	5	2	1		10	9
	5		1	4	7	4	1		17	16
	6			12	29	3	2		46	43
	7		3	9	13	2			27	25
	8			3					3	3
	$\underline{n}$		4	30	56	12	4	1	107	
	$\bar{x}$		6.50	6.23	5.80	5.25	5.25	(2)	5.83	
	sd		1.00	1.04	1.07	1.22	0.98	-	1.16	

TABLE 2 (continued)

1981	2			1				1	1
	3				1			1	1
	4			3	2	3		8	6
	5		1	11	15	3	1	31	25
	6	1	5	38	19			63	51
	7		1	14	3			18	15
	8			1	1			2	2
	n	1	7	68	41	6	1	124	
	$\bar{x}$	(6)	6.00	5.93	5.59	4.50	(5)	5.74	
	sd	-	0.58	0.92	0.89	0.55	-	0.93	
All years	2			1	1			3	1
	3				2	3	1	6	2
	4			5	8	5	2	20	7
	5		2	18	25	9	3	57	21
	6	1	5	56	55	5	2	124	46
	7		4	26	19	2		51	19
	8			4	2			6	2
	n	1	11	110	112	24	8	1	267
	$\bar{x}$	(6)	6.18	6.02	5.75	4.92	4.75	(2)	5.76
	sd	-	0.75	0.94	1.00	1.14	1.04	-	1.06

TABLE 2 (continued)

Summary regression data

Year	N	Regression constant[1]	Regression co-efficient	S.E. of co-efficient	R^2	P	Mean date of laying[1]
1977	36	9.524	-0.0829	0.0178	38.9	<0.001	47.2
1979	107	8.136	-0.0510	0.0124	13.9	<0.001	45.2
1981	124	7.467	-0.0427	0.0113	10.5	<0.001	40.4
All years	267	7.815	-0.0475	0.0073	13.9	<0.001	43.2

Note. 1. Day 1 = 1st March.

TABLE 3

Local variation in mean clutch-size of the Magpie *Pica pica* on Anglesey

Year	Square		Square		Square		Square		Square	
	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$
			39		49					
1977			0	-	0	-				
1979			4	5.87	2	-				
1981			8	5.66	8	6.16				
All years			12	5.67	10	5.88				
	28		38		48		58		68	
1977	9	5.50	13	5.88	3	-	0	-	0	-
1979	18	5.54	27	5.70	6	5.27	4	6.15	1	-
1981	15	5.69	23	5.67	14	5.87	4	6.62	3	-
All years	42	5.59	63	5.74	23	5.57	8	6.36	4	6.20
	27		37		47		57			
1977	0	-	10	5.43	1	-	0	-		
1979	7	5.97	9	5.58	8	6.15	7	6.57		
1981	2	-	10	5.71	16	5.45	6	6.06		
All years	9	5.98	29	5.68	25	5.67	13	6.31		
					46		56			
1977					0	-	0	-		
1979					14	5.73	0	-		
1981					14	5.91	1	-		
All years					28	5.79	1	-		

Notes. 1. Each 'square' is the 10 km square within 100 km National Grid no. SH.

2. Each original mean clutch-size has been corrected to allow for (1) variation in the mean date of laying in each 10 km grid square, (2) the seasonal decline in mean clutch size (given in Table 2).

3 Mean clutch-sizes are given only where n ≥4.

useful to examine only overall trends in final nestling weight. However, the Magpie sometimes fails both to hatch one or more eggs and to rear some of its young, so the clutch manipulations may not have greatly affected the nestling weights. Table 4 shows mean weights on day 24: there was no variation in weight with final brood-size. Table 5 shows the seasonal variation in weight of all broods grouped together: the data suggest that weights were greatest in mid-season.

Nesting success

Nesting success was measured by the presence or absence of young on day 24. This was unknown for 463 nests (Table 6). (This number excludes a few further nests where the stage at which failure occurred was quite unknown or where the adults had obviously been disturbed by our inspections). Only 57% of nests started contained one or more young on day 24. No eggs were laid in about one third of the failed nests. The remaining two thirds failed when either eggs or young were present: in most cases the stage of failure (eggs or young) could be identified from the date on which the inspection was made, but in most instances the actual cause of failure itself could not be determined, i.e. the contents of the nests were simply missing. There was also a seasonal decline in nesting success (Table 7).

DISCUSSION

The mean dates of laying of Magpies on Anglesey were closely similar to those for urban birds in Manchester (Tatner 1980),

TABLE 4

Variation in nestling weight with size of brood in the Magpie *Pica pica* on Anglesey

Final brood-size[1]	N	Nestling wt.[2] $\bar{x}$	s.d.
1	54	199.2	27.4
2	66	202.7	21.2
3	80	199.5	25.7
4	44	201.3	22.8
5	9	193.7	19.9
6	2	201.5	5.0
All broods	255	200.3	24.2

Notes. 1. Most of the clutches of eggs giving rise to these broods were reduced in size by having 1-2 eggs collected from them during laying-incubation. The brood-sizes given in the Table were those occurring on nestling day 24.

2. 1-3 randomly chosen sample nestlings in each nest were weighed: from these a mean value was derived for the brood. These brood means were used to calculate mean values (given in this Table) for all broods of the respective sizes.

TABLE 5

Seasonal variation in mean nestling weight in the Magpie *Pica pica* on Anglesey.

	Date of 1st egg					
	March		April			May
	11-20	21-31	1-10	11-20	21-30	1-10
No. of broods[1]	2	16	118	94	23	3
Nestling weight: $\bar{x}$	188.5	194.2	201.9	201.5	194.9	178.0
s.d.	47.4	27.7	24.5	24.3	15.2	26.3

Notes. 1. All brood-sizes

2. See Table 4, Notes 1-2.

TABLE 6

Incidence and apparent causes of failure of nests of the Magpie *Pica pica* on Anglesey.

Stage of failure[1]	Apparent cause of failure: no. of examples						N	%	
	Not known	Nest damaged by weather	Nest damaged by man	Predation of eggs[4]	Predation of adults[5]	Adults killed by man[6]			
None	-	-	-	-	-	-	265	57	
No eggs laid	47	1	-	-	-	-	48	31	
Eggs	47	1	2	8	1	5	64	41	43
Nestlings[2]	42	-	2	-	-	-	44	28	
Eggs or nestlings[3]	35	2	4	-	1		42	-	
Total	171	4	8	8	2	5			

Notes. 1. Nests thought to have failed through disturbance by the observer are omitted.
2. Eggs were also present in some instances.
3. In these instances it was not known for certain what stage the nests had reached.
4. Broken shells were present.
5. Fragments of adults were present.
6. Whole adults present, apparently shot.

TABLE 7

Seasonal variation in breeding success of the Magpie *Pica pica* on Anglesey.

Outcome of nest		Date of 1st egg in each nest		
		11 March-10 April	11-20 April	21 April-20 May
Nests with young on N.D. 24	no	137	95	26
	%	71	59	53
Nests without young on N.D. 24	no	57	67	23
	%	29	41	47
Total no. of nests		194	162	49

Note. 54 nests in which the date of laying was quite unknown (eggs may not have been laid at all) are omitted from this Table.

though appreciably earlier than those calculated for various regions of Britain and Ireland (Holyoak 1967). The difference between Anglesey and Britain and Ireland as a whole is likely to be due to the maritime climate of Anglesey, and hence locally warmer spring-time temperatures. The early laying dates for Tatner's (*loc cit.*) study may be due to special effects, viz. higher temperatures and extra food resources, associated with the urban environment.

Particular features of interest in the present survey are the three seasonal trends in, respectively, clutch-size, nestling weight and nesting success.

The Magpie is single-brooded, but will lay a further clutch in the event of failure of the original clutch or its replacement (Tatner 1980). Hogstedt (1980) has indicated that a high proportion (>80%) of within-year variation in clutch-size is due to differences in the quality of the territories of the adults. As the present sample is based essentially on first clutches, the seasonal decline in clutch-size is attributable to smaller clutches, on average, laid by later-laying birds. Tatner (1980) suggests that small, late clutches may arise through an increasing proportion of pairs on poor-quality territories and/or inexperienced (i.e. young) hens - some females breed at one year old (Seel 1976).

The seasonal decline in nesting success was probably due to the same features, namely, the later use of poorer quality

territories and the activities of inexperienced hens. However, the mid-season peak in nestling weight suggests that the food resources were at their peak in the middle of the season; hence the seasonal pattern of nesting failure cannot be connected primarily with this influence.

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SUMMARY

1. Data on the breeding of the Magpie *Pica pica* were collected in 1977, 1979 and 1981 on Anglesey, North Wales, in relation to a study of the occurrence of fluoride in the species.
2. Egg-laying occurred in late-March to early-May; the mean date of laying was 12 April.
3. Mean clutch-size was 5.76 eggs. A seasonal decline was evident but annual and local variations were slight.
4. Nestling weight showed no variation with final brood-size, but suggested a seasonal variation having a mid-season peak.
5. Young were reared in only 57% of nests started. Nesting success showed a seasonal decline.

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