



Breeding Marsh Harriers in the United Kingdom, 1983-95

John Underhill-Day

ABSTRACT Marsh Harriers *Circus aeruginosus* became extinct as breeding birds in Britain in 1899. There were just three isolated nesting attempts (two successful) between then and recolonisation from 1927 onwards, and none outside Norfolk until 1945. From a peak of 15 nests in 1958, the population declined again, to a single pair in 1971, and the species seemed doomed yet again. A dramatic recovery occurred, however, and by the 1990s the population had outgrown routine annual monitoring. This paper analyses recent nesting habitat and breeding success and describes a national census in 1995 which revealed approximately 148 breeding males and 156 breeding females rearing 350 young.

Marsh Harriers *Circus aeruginosus* have been rare breeding birds in the United Kingdom for at least the last 150 years. The destruction of nesting habitat through land drainage and, increasingly, persecution, limited nesting in England to East Anglia, Lincolnshire and Northumberland by the middle of the nineteenth century. By 1880, breeding was confined to the Norfolk Broads, and the last known nesting pair was trapped there in 1899 (Riviere 1930).

Many early records for Ireland and Wales seem more likely to refer to Hen Harriers *C. cyaneus*, but Marsh Harriers probably nested in both countries until the third quarter of the nineteenth century. There are no reliable early records of Marsh Harriers nesting in Scotland.

The first breeding record in England this century was in 1911, on the Norfolk Broads (the eggs were taken), and there were further attempts in 1915 and 1921, both of which were successful. From 1927, Marsh Harriers have nested, with one or more pairs successful in every year to date, except in 1927, 1937 and 1940. Despite this successful recolonisation, during 1927-47 there were no more than five nests recorded in any one year, and the highest number of young fledged in any year was 15, in 1943 (Underhill-Day 1984).

Until 1944, no reliable breeding records were reported outside Norfolk, but in 1945 pairs bred successfully in Anglesey and Suffolk. Numbers then increased to a maximum of 15 nests with 15 young fledged in 1958, and first breeding was reported from Kent (1946), Dorset (1949) and Hampshire (1957) (Harrison 1953; Chapman 1977; R. Dennis verbally).

Between the wars (i.e. 1919-38), numbers were probably limited by the small size of the only area where breeding birds were protected and by heavy persecution elsewhere. After 1945, a reduction in kept estates, changes in public attitudes, establishment of nature reserves and the passing of the Protection of Birds Act in 1954 probably all contributed to a rising population.

The number of breeding Marsh Harriers then went into a steady and sustained decline until 1971, when only a single pair bred in Britain. The evidence suggested that, as with a number of other raptors (Prent 1965; Newton 1979; Ratcliffe 1980), Marsh Harrier numbers were affected by organochlorine pesticides. Following the progressive withdrawal of these compounds and an apparent decline in persecution, the population recovered and has continued to rise to the present day.

The population over the period 1911-82 and aspects of the breeding biology of Marsh Harriers were described in detail by Underhill-Day (1984, 1988, 1990), and the purpose of this paper is to update these figures to 1995, when a national breeding census was undertaken.

Although the number of breeding Marsh Harriers in the United Kingdom is small when compared with those in continental Europe (Hagemeijer & Blair 1997), the species is of high conservation concern as numbers are still historically low, and it has therefore been categorised as a red-listed species in the revised red data list (Gibbons *et al.* 1996). Apart from Montagu's Harrier *C. pygargus* and, in some areas, the re-established Red Kite *Milvus milvus*, this is the only large British raptor with a high proportion of its population breeding in areas of intensive arable farmland.

Methods

Data were gathered through contacts with key workers and recorders, and by visits to less-well-recorded areas each year during 1983-90. By 1990, numbers had increased to the point where detailed annual monitoring was no longer practical, so a national survey was organised in 1995. Information was supplied by reserve wardens, ringers, harrier-watchers and county recorders in all years, with county organisers in those counties with larger populations of harriers in 1995. Until 1990, most recorders had been giving information on breeding success, fledged-brood sizes, reasons for failure if known, and the type of habitat in which the nest was located. In some cases, clutch sizes

were also known, when the nest had been visited under licence for other purposes.

In 1995, recorders were asked to submit this information on a survey form, together with additional information on the characteristics of the breeding site.

A breeding attempt has been recorded here only when observations were made of food being delivered to a nest site, eggs were known to have been laid, young were fledged, or breeding took place in the opinion of an experienced observer. Evidence of nest-building or courtship-feeding alone were not considered sufficient to indicate a breeding attempt.

This may have led to underestimates of the number of breeding attempts where some of these failed early on (at the egg stage), although in some cases harriers which were disturbed at an early stage in the nesting cycle were known to have moved elsewhere to breed. For some pairs, observers were uncertain of the number of fledged young or gave no figure, although they believed the nest to have been successful. The minimum figures are used in all tables and analyses.

Not all recorders were able to supply the full information asked for, so that, in the analyses which follow, there are different sample sizes depending on the available data.

It is possible that Marsh Harriers have been recorded breeding outside the known areas during this period and, in an effort to minimise the possibility of missing these records, all rumours of breeding have been followed up. Invariably, these have proved to refer to summering birds, with no proof of breeding. Some records of breeding in earlier years have come to light subsequently in existing breeding areas, but these have been few.

Results

Numbers of breeding male and female Marsh Harriers during 1983-90 and in 1995, together with total numbers of fledged young, mean number per nest and per successful nest, are shown in table 1. The number of nests which failed, percentage failure rates and nests for which no result was known are also shown. As this species can be polygynous, males and females are shown separately and number of females equals number of nests except in 1986 (1 re-nest) and 1989 (2 re-nests), when the number of nests were 35 and 70 respectively. Figures for 1991-94, taken from the Rare Breeding Birds Panel's reports (Ogilvie *et al.* 1994-96), are also shown. The incidence of polygyny was uncertain for nests in some areas in 1995, so the number of males is estimated for that year.

During all years, at least 98 pairings were bigynous and 15 trigynous, collectively 21% of all pairings. There was no significant difference in nesting success (as measured by production of at least one fledged young) between monogynous and polygynous pairings for all nests during 1983-90 & 1995¹. Nor was there a significant difference in mean fledged-brood size between nests of monogynous (mean 3.11) and polygynous males (mean 3.05) at the same sites in years when both were present².

Population growth during the period was 17.3% per annum for breeding adults. For the period 1983-90 & 1995, productivity was at least 2.43 fledglings per nest started (n=542 nests), and, for the whole period, a

¹ $\chi^2=1.65$, n=542 ² t=0.19, n=75

Table 1. Data concerning breeding male and female Marsh Harriers *Circus aeruginosus* in the United Kingdom in 1983-90 & 1995 (this study) and 1991-94 (Rare Breeding Birds Panel). * one re-nest included; ** two re-nests included.

Year	Breeding ♂♂	Breeding ♀♀	Young reared	Mean young fledged per known nest	Mean young fledged per successful nest	Failed nests	% failed of known nests	Nests for which no result known
1983	21	28	73	2.61	2.92	3	10.7	-
1984	22	28	66	2.36	2.75	4	14.3	-
1985	28	31	86	2.97	3.18	2	6.6	2
1986	28	35*	81	2.38	3.00	7	20.0	1
1987	39	46	122	2.65	3.12	7	15.2	-
1988	55	62	145	2.46	3.09	12	21.8	3
1989	59	70**	181	2.66	3.18	11	16.2	2
1990	73	86	213	2.66	3.09	11	13.6	6
1991	83	91	198					
1992	101	112	229					
1993	84	110	244					
1994	114	129	255					
1995	148?	156	350	2.30	2.94	33	21.7	4
TOTAL								
1983-90								
& 1995	473	542	1,317	2.43	3.03	90	16.6	18

minimum of 2,243 young harriers fledged from 984 nests. Of 542 nests started during 1983-90 & in 1995, 90 (16.6%) failed, but there was no significant trend towards higher or lower failure rates in later years³.

Mean clutch size from 19 nests was 4.4⁴, and there was no significant difference in failure rates between visited (36.8%) and unvisited (19.4%) nests⁵, although failures were higher in the former.

In table 2, the reasons for nest failure are given, where known, for this study and for the period 1971 (when there was only one nest in Britain) to 1982. There was no significant difference in the proportion of nests failing through human intervention between the two periods⁶. About 24% of failures during 1983-90 & 1995 were caused by human persecution or disturbance. Of eight incidents of flooding, seven were caused by tidal inundation of coastal reedbeds and one by heavy rain. Where nests were preyed on, the suspected predator in all cases was the Red Fox *Vulpes vulpes*. Other causes of failure were infertile eggs (2), crop fall (1) and fire (1). Where the timing was known, 13 (60%) of failures were during incubation and nine (40%) during the nestling stage.

Nesting habitat was recorded for 513 out of 542 nests during 1983-90 & in 1995 (table 3). Of these, 86% were in beds of Common Reed *Phragmites australis*, 6% in Oil-seed Rape *Brassica napus* and 7% in winter cereals. All the cereal nests were in winter Wheat, except two in winter Barley and one in winter Oats. In addition, one nest was recorded in rough grass and one in a bed of Sea Club-rush *Scirpus maritimus*.

In 1995, additional details of the hydrology of the reedbeds were sought (table 4), and, of 112 recorded reedbed nests, 65% were in wet, 12% in dry

³ Test for linear trend in proportions, $Z = 1.51$, $p = 0.13$, ns

⁴ SE=0.14 ⁵ $\chi^2 = 2.98$, ns ⁶ $\chi^2 = 4.64$, n=120

Table 2. Causes of Marsh Harrier *Circus aeruginosus* nest failures in the United Kingdom during 1983-90 & 1995 compared with 1971-82.

Cause	NUMBER		PERCENTAGE	
	1971-82	1983-90 & 1995	1971-82	1983-90 & 1995
Unknown	7	41	23.3	45.5
Human persecution	6	15	20.0	16.7
Predation	2	8	6.7	8.9
Nest flooded	4	8	13.3	8.9
Human disturbance	4	7	13.3	7.8
Desertion/disappearance of adult	5	7	16.7	7.8
Other	2	4	6.7	4.4
TOTAL	30	90		

Table 3. Marsh Harrier *Circus aeruginosus* nesting habitat in United Kingdom during 1983-90 & 1995.

Habitat	Successful nests		Failed nests		Total nests
	Number	%	Number	%	
Reedbed	367	83.4	73	16.6	440
Crops	56	76.7	17	23.3	73
TOTAL	423	82.4	90	17.6	513

Table 4. Marsh Harrier *Circus aeruginosus* nesting habitat in the United Kingdom in 1995.

Habitat	SUCCESSFUL NESTS		FAILED NESTS		TOTAL NESTS
	Number	%	Number	%	
Reed:					
Wet	60	82.2	13	17.8	73
Dry	8	57.1	6	42.9	14
Tidal	17	85.0	3	15.0	20
Unspecified	2	40.0	3	60.0	5
TOTAL	87	77.7	25	22.3	112
Crops:					
Oil-seed Rape	5	55.6	4	44.4	9
Winter Wheat	18	85.7	3	14.3	21
Winter Barley	0	0.0	1	100.0	1
TOTAL	23	74.2	8	25.8	31
Other:					
Sea Club-rush	1	100.0	0	0.0	1
Not known	12				12
TOTAL	13				13

and 18% in tidal reedbeds. There was no significant difference in success rates between reedbed and crop nests. Sample sizes for failures in dry and tidal reedbeds were too small to permit analysis. Sample sizes within crops were also too small for analysis in 1995, but, combined with data from 1983-90, there was a significantly higher success rate for nests in winter Wheat (89%, $n=38$) than in Oil-seed Rape (66%, $n=32$)⁷. The highest success rate was in wet/tidal reedbeds and winter Wheat and the lowest in dry reedbeds and Oil-seed Rape. The causes of six failures in dry reedbed in 1995 were predation

⁷ $\chi^2=5.74$, $p<0.05$, $n=70$

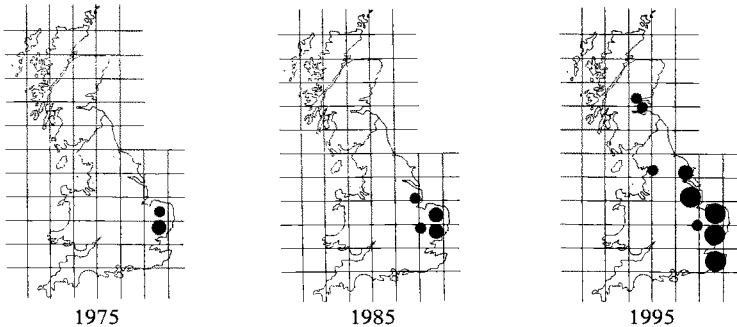


Fig. 1. Breeding distribution of Marsh Harriers *Circus aeruginosus* in Britain in 1975, 1985 and 1995. Three dot sizes represent ● <5 nests, ● 6-15 nests and ● 16+ nests.

(1), human disturbance (1), bad weather (1), and unknown (3). Of ten failed nests in Oil-seed Rape from 1983, three probably resulted from predation by foxes, in one case the male disappeared and in another the eggs were infertile. The cause of the remaining five failures was not known. The proportion of nests in crops increased from 10% in 1983 to over 20% in 1995.

There were no significant differences in 1995 in fledged-brood sizes from successful nests between wet, dry or tidal reed, winter cereals and Oil-seed Rape⁸. The largest mean fledged-brood size was from nests in winter cereals (3.57 ± 0.85), and the smallest from tidal reedbed nests (2.75 ± 0.86). The largest fledged broods, of six young, were from three nests in reed, winter Wheat and Oil-seed Rape, all in 1989.

There were no significant differences in percentage nesting success or mean fledged-brood sizes between successful nests in small (<5 ha), medium (>5-50 ha) and large (>50 ha) reedbeds (small, 24.7%, 3.10; medium 17.6%, 2.84; large 15.1%, 3.12)⁹.

A high proportion of nests in 1995 were close to salt water. Of 156 nests, 73.7% were within 5 km of the coast and a further 7.7% within 5 km of a large estuary. Altogether, 86.5% of nest sites were within 10 km of the sea or a large estuary, and only 13.5% of nest sites were well inland.

It was difficult to define the number of sites in which nesting was recorded because many nests were in fields, fieldside ditches, fleets or small patches of reed. In some areas there were loose aggregations of nests around a block of fields. In 1983, about 11% of all nests were in crops, ditches or small remnant reedbeds in predominantly arable areas; by 1995, 55% of nests were in this habitat. The proportion of nests in large (>50 ha) reedbeds had declined only slightly, from 36% to 28%, but the proportion of nests in small to medium (5-50 ha) reedbeds had dropped from 39% to 17% during the same period.

Of 156 nest sites in 1995, 85 were in Sites of Special Scientific Interest (SSSIs) and 72 were in nature reserves. In a few cases, sites which were SSSIs were not reserves, or reserves were undesignated. In total, 88 sites (56%) were SSSIs or nature reserves, or both.

In 1995, nesting records were received from nine counties in England and Scotland, and breeding was recorded in a further three during 1983-90.

⁸ $F=1.23$, $n=95$ ⁹ $\chi^2=4.31$, $n=501$; $F=2.73$, $n=352$

Table 5. Comparison of nesting success of Marsh Harriers *Circus aeruginosus* from various studies in north and northwest Europe during 1971-95.

Country	Years	MEAN FLEDGED YOUNG FROM:				% successful	Reference
		All nests Mean±SE	(N)	Successful nests Mean±SE	(N)		
Britain	1971-82	2.39±0.13	(142)	3.03±0.11	(112)	78.9	Underhill-Day 1984
Czechoslovakia	1980-82	2.96±0.18	(108)	3.72±0.13	(86)	79.6	Divis 1984
Denmark	1978-83	2.41±0.04	(764)	2.75±0.03	(670)	87.7	Jørgensen 1985
Netherlands	1975-85	2.60±0.13	(130)	3.04±0.11	(109)	83.8	Woets 1986
Poland	1982-84	2.47	(118)	3.10	(95)	80.5	Witkowski 1989
France	1983-88	1.49	(383)	2.50	(370)	96.6	Bavoux <i>et al.</i> 1989
Germany	1988-89	2.00	(128)	3.50	(73)	57.0	Aust & Otto 1990
Britain	1983-90	2.61±0.08	(371)	3.09±0.06	(313)	84.4	This study
Britain	1995	2.32±0.13	(152)	2.97±0.10	(119)	78.3	This study

During 1983-90, nearly 97% of all records were in southern/eastern England, with 89% in Norfolk and Suffolk. In 1995, 88% of all records were still in the southeast, but the proportion in Norfolk and Suffolk was down to 60%. Small numbers are now breeding regularly in northwest England, in Scotland and on Humberside, with occasional breeding elsewhere.

Discussion

The mean percentage annual increase of 17.3% in the number of breeding Marsh Harriers since 1983 has been slightly lower than during the period 1971-82, when it was 21.5%, and the incidence of polygyny has also dropped from 32% to 21% (Underhill-Day 1984). If the future population continues to increase at the current rate, it could reach 750 nests by the year 2005. Mean fledged young per nest and per successful nest and success rates since 1983 are within the range recorded in other recent European studies (table 5) and are not significantly different from those in Britain during the previous period. Causes of nest failure have been less well recorded in the much larger population in recent years, but recorded instances of human persecution and disturbance accounted for 24% of nest failures during 1983-90 & in 1995, a reduction from 33% during 1971-82 (table 2). During the earlier period, all incidents recorded under persecution ($n=6$) were from egg-collectors, whereas, during the later period ($n=15$), three clutches were collected and one deliberately smashed, one breeding adult shot and two poisoned, and eight suspected instances of deliberate disturbance followed by desertion. In addition, there were two incidents of poisoning and three of shooting of non-breeding harriers, and one clutch was part-robbed. In 1996, there were two further recorded incidents of poisoning and one of shooting (RSPB data). It seems probable from this limited information that egg-collecting has declined and that persecution has increased, although it remains at low levels.

The first recorded Marsh Harrier nesting in a crop in Britain was in winter Barley in 1982, when the pair reared three young. By 1995, of 144 nests where the surrounding habitat was recorded, 31 (21.5%) were in arable crops, with winter cereals being clearly favoured. All known crop-nesting has taken place in the Southeast, mostly in Norfolk, Kent and Lincolnshire.

The available data suggest that crop-nesting Marsh Harriers are as successful (rearing as many young) as those nesting in reedbeds, with nests in winter Wheat being particularly successful. The lack of human disturbance on arable land, particularly early in spring when harriers are prospecting for nest sites, and the low populations of foxes in some arable areas, combined with the unattractiveness of the centre of cereal fields for wildlife and, therefore, for ground predators, may all have contributed to the success of harrier nests in this habitat. Concentration of potential prey into field-edge habitats and lack of competition from other predators, together with high numbers of prey animals such as Common Starlings *Sturnus vulgaris* feeding on wind-laid crops and stubbles in late summer, when harriers are feeding large young, may also play a part in their success in rearing large broods (Underhill-Day 1985). The longer, narrower-stalked Barley is more susceptible to laying by wind than is Wheat and is also harvested earlier, which may explain the strong preference for Wheat as a nesting habitat.

In the past, when Marsh Harrier numbers have declined, the large reedbed reserves have been the most important habitat, with nesting persisting longest in such sites (Underhill-Day 1984). During the current population expansion, sites associated with arable agriculture have been of central importance.

Marsh Harriers are the only large raptors (apart from very small numbers of Montagu's Harriers and, locally, re-established Red Kites) nesting in intensively farmed arable areas in Britain. Over half of the breeding population is now nesting in crops, ditches or small reedbeds in fleets or borrow dykes associated with arable areas. Very few of these sites are within SSSIs or nature reserves (11 such sites in, or on the edge of, arable areas were in SSSIs, and none in nature reserves, in 1995). The sympathy and concern of arable landowners and farmers is likely to be a critical factor in the future increase and spread of Marsh Harriers in Britain.

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Dr John Underhill-Day, Syldata, Arne, Wareham, Dorset BH20 5Bf
