

# Aspects of the breeding biology of Hen Harriers *Circus cyaneus* in Ireland



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Hen Harriers are a species of great conservation concern in Ireland at present and efforts are being made to protect the habitats they require. Knowledge of breeding biology is crucial in formulating effective conservation management plans, yet to date no targeted research has been conducted on breeding Hen Harriers in Ireland. The aim of this study is to present the preliminary findings of a long-term study of the breeding biology of Hen Harriers at four strongholds in Ireland, using data collected during the 2007 and 2008 breeding seasons. During these two years, 105 breeding pairs were located in these areas. Peak egg-laying occurred during May and clutch size ranged from two to six. Survival was similar through the egg and chick stages of the breeding season with eggs hatching in more than 80% of nests, and more than 70% of these nests fledging young. The average success rate of nests was 64% in 2007 and 62% in 2008 with each successful nest fledging an average of 2.6 ( $\pm 0.1$  se) young.

## Introduction

The Hen Harrier is a territorial raptor that breeds in the upland areas of Ireland. The breeding population is concentrated in the southwest, and recent population estimates suggest that as many as 150 breeding pairs may be located in

this country (Barton *et al.* 2006). During the last century, their distribution in Ireland has been linked with fluctuations of available young forestry (O'Flynn 1983); Hen Harriers nest in

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**Plate 89.** Hen Harrier (Richard T. Mills).

plantation forests only during the early stages of the forest cycle when secure nest sites and prey are abundant (Picozzi 1978). Populations of this species have suffered an historical decline throughout Europe related to habitat loss and persecution, and it is now a Species of European Conservation Concern (SPEC) (Burfield & von Bommel 2004) included in Annex 1 of the Birds Directive (European Council Directive 79/409/EEC). Ireland is therefore obliged to take measures to protect Hen Harrier populations, including establishing Special Protection Areas (SPAs) that provide suitable habitats. Although their biology and conservation have attracted considerable interest in Europe during the last decade, and increasing attention has provided substantial information on the conservation status of European Hen Harriers, detailed information on the breeding biology of this species in Ireland remains scarce. Information on both breeding biology and breeding performance is essential in identifying effective conservation measures for declining species (Sutherland *et al.* 2004). This study examines some aspects of the breeding biology of Hen Harriers in Ireland and provides an insight into the behaviour of breeding birds. The research was conducted as part of an ongoing study of Hen Harrier populations in Ireland.

## Methods

Study areas were selected following their identification as areas with high densities of Hen Harriers during breeding surveys of this species in 1998-2000 and 2005 (Norriss *et al.* 2002, Barton *et al.* 2006). The four discrete study areas (West Clare, Kerry, Ballyhouras and Slieve Aughties) incorporate a matrix of different habitat types including first and second rotation conifer plantations. Slieve Aughties and the area of Kerry included in this study are both designated SPAs for Hen Harriers in Ireland and are considered two of the best sites in the country for this species ([www.npws.ie/en/SPA](http://www.npws.ie/en/SPA)).

Fieldwork was conducted from March to August during 2007 and 2008. Territorial pairs were located by surveying suitable sites during April and noting behaviour such as sky-dancing, nuptial flights, food passes etc. When a territorial pair was confirmed at a location, observation continued until a nesting attempt was verified and a nest site located. The result of each nesting attempt was recorded by monitoring the nest. Information concerning nest location, numbers of eggs and nestlings was obtained, where possible, during visits to the nests. Nest cameras were deployed at a number of nests during the 2008 breeding season to collect information on adult provisioning behaviour and chick development. At nests that were deemed suitable for visiting, chicks were ringed and wing-tagged where possible at around 25 days after hatching. Nestlings were sexed by eye colour and tarsus measurements (Picozzi 1981).

Data on breeding biology was estimated from nest visits undertaken at a sub-set of nests during this study, using only data from nests found before fledging. Timing of breeding was characterised using the earliest laying date at each nest. This was calculated by subtraction of 34 days from the day of first hatching where available; this being the typical incubation period of the Hen Harrier (Etheridge *et al.* 1997, [www.bto.org/birdfacts](http://www.bto.org/birdfacts)). Where necessary, hatch dates were estimated from fledge dates or from wing measurements. Breeding success was calculated as the number of young fledged per total number of nests. For nests where the outcome was known, success rate was calculated as the percentage of nests that fledged at least one young. This method commonly overestimates success due to the greater chance of including successful nests, which are by their nature longer-lived. In order to avoid this, Mayfield's method was also used to calculate daily survival rates and estimated success rates of nests (Mayfield 1975).

## Results

A total of 45 breeding pairs were recorded within the study areas in 2007, with 60 recorded in 2008. A breakdown of the confirmed number of nests in each of the areas is provided in Table 1.

These breeding attempts ( $n=105$ ) were monitored intensively during this study and clutch size was recorded for a total of 25 nests (14 in 2007 and 11 in 2008). Mean clutch size was 4.1 ( $\pm 0.1$  se) eggs and ranged from two to six. 48% of clutches consisted of four eggs and 32% of five eggs. The earliest egg-laying date recorded was 12 April, recorded during the 2008 breeding season, and the mean first egg date across all years and study areas was 2 May. Although egg-laying continued until the first week of June in both years of the study, it was completed during May for more than 97% of nests in both years.

Of the 105 nests in this study, 66 were deemed successful, as they fledged at least one chick. Nest success was very similar in each of the two years with 64% of nests producing fledged young in 2007 and 62% in 2008. The Mayfield estimate of daily survival probability ranged from 0.974 to 0.997 in each of the areas, and the Mayfield estimate of success for nests used in this analysis ranged from 13% to 76% (Table 1). The lowest overall success of nests was recorded in the Slieve Aughties study area during both 2007 and 2008, although an increase from 22% to 42% was seen between the two years. The percentage of nests that were successful was more than 50% in all other study areas. In the analysis, annual nest success rates were similar through egg and chick stages with 89% of clutches hatching in 2007 and 73% of the resulting broods fledging at least one young. Results in 2008 were similar with 83% of clutches hatching and 74% of the resulting broods

**Table 1.** Measure of breeding success in each of the four study areas in 2007 and 2008 (n = number of nests used in calculation of MES; DSP = Daily Survival Probability; MES (%) = Mayfield Estimate of Survival; N = Number of Exposure days used in calculation of MES).

Study Area	Year	Number of nests	Percentage of successful nests	n	DSP	MES (%)	N
West Clare	2007	10	80	10	0.997	76	580
	2008	12	75	10	0.996	74	525
Kerry	2007	15	86	14	0.994	63	339
	2008	22	68	15	0.993	59	737
Ballyhouras	2007	11	6	10	0.993	59	439
	2008	14	57	8	0.995	69	419
Slieve Aughties	2007	9	22	6	0.974	13	155
	2008	12	42	8	0.995	69	424

fledging at least one offspring. In 2007, 77% of nests were visited and in 2008 72% were visited. Available data shows that a success rate of 61% was recorded at these nests during both years (n=77), compared with a success rate of 80% and 61% at nests that remained unvisited during 2007 and 2008 respectively (n=27).

The nests included in the analysis fledged a total of 72 Hen Harrier juveniles in 2007 and 106 in 2008. The mean number of fledglings per successful nest across all study areas during the two years of this study was 2.6 ( $\pm 0.1$  se) and ranged from 1.4 to 2.9, while the average number of fledged young per breeding attempt was 1.6 ( $\pm 0.3$  se) juveniles. Of the juvenile offspring that were tagged during the present study 44% were male (n=116).

The nest cameras installed at a sub-set of nests during the 2008 breeding season provided us with exact timing of hatching, fledging and failure, as well as some detailed behavioural information. One particularly interesting series of observations made with the nest cameras was an incident recorded at a nest in the Ballyhouras. Initial images from the camera confirmed the presence of three chicks of around three weeks old. Following a period of particularly heavy rain, recorded images showed that all three young had perished. Although the female was never observed to visit the nest again, the adult male visited the nest after the chicks had died with an item of prey. Having deposited the prey next to one of the chicks, he stayed for just over two minutes, inspecting the nestlings. Just before leaving he lifted one of the nestlings only to drop it immediately, leaving it at one side of the nest. He then retrieved his prey and flew off. The male returned to the nest three days later without prey. He appeared to be closely inspecting one of the chicks, repeatedly bending down

towards it, a behaviour that was subsequently confirmed as plucking. He then made several apparent attempts to fly with the chick, dropping it near the nest each time. Settling back down on the nest with the chick, he continued to pluck it. After two minutes of plucking, the male flew off taking the chick with him. No further visits to the nest were made to the nest by the adult birds.

## Discussion

During the 1998-2000 and 2005 surveys of Hen Harrier populations in Ireland, the four areas included in the present study held an estimated 54-59% and 63-65% of the known Irish Hen Harrier population respectively (Norriss *et al.* 2002, Barton *et al.* 2006). Although we did not fully survey all of these areas (the aim of the study was not to assess the number of pairs in each area) we found 45 and 60 nests in 2007 and 2008 respectively. Thus, the number of nests is not representative of the total number of nests in our study areas. However, it provides an indication of minimum numbers in these areas at present, which is particularly encouraging for some areas. The earlier surveys recorded a maximum of two territorial pairs for western Clare in 2000, increasing to five between 2000 and 2005. The present study recorded ten nests in this area in 2007 and 12 in 2008. Part of the reason for this increase may have been increased observer effort, but a real increase in breeding numbers also seems likely. Recent studies have reported an increase in Hen Harrier populations in the UK and the Isle of Man (Sim *et al.* 2007), possibly related to habitat use. Also of note is that, despite holding a high number of breeding pairs in earlier surveys and in the present study, the success rate in the Slieve Aughties study area, although

variable between years, was consistently lower than in all other areas. This phenomenon was previously noted by Barton *et al.* (2006), and suggests that this area may be a sub-optimal 'sink' for nesting Hen Harriers.

Egg-laying took place from mid April until early June, with the exception of one nest where egg-laying was recorded in late March. These findings are similar to those of studies in Hen Harriers in Scotland where egg-laying also commences in April (Etheridge *et al.* 1997). Previous studies have found that earlier nesting attempts produce larger clutch sizes and ultimately have a greater chance of successfully fledging chicks (Picozzi 1984, Etheridge *et al.* 1997). The mean clutch size recorded in the present study was 4.1 ( $\pm 1.0$  se). This is slightly lower than reported clutch sizes for Hen Harriers in the UK, which range from 4.4 to 6.0 (Green & Etheridge 1999, Picozzi 1984, Etheridge *et al.* 1997). The largest clutch recorded in this study was six eggs; this was recorded in northern Kerry in 2008, and went on to produce six fully fledged Hen Harrier juveniles. The modal clutch size was 4 eggs.

More than 60% of nests included in the present study were successful, fledging at least one juvenile. This is at the higher end of reported success rates for Hen Harrier nests (Green & Etheridge 1999, Amar *et al.* 2007). Just 30% of nests fledged at least one young in Orkney during a study in the 1990s where low breeding success was related to habitat characteristics and an overall decline in Hen Harrier population size. However, nest success rates of 50-70% are common in suitable habitat. The daily survival rate compares favourably with reported values for Hen Harrier nests (Etheridge *et al.* 1997).

In the current study, the average number of juveniles fledged per nesting attempt of Hen Harriers was 1.7 ( $\pm 1.5$  se) and ranged from 0.4 to 1.9. Although the annual variation reported for the number of juveniles fledged per nest is considerable, these results are lower than previously reported fledging rates, the lowest of which was 0.68 per nesting attempt (Amar *et al.* 2007). The number of juveniles produced by successful nests in this study ranged from 1.4 to 2.9 with an average for all nests of 2.6 ( $\pm 1.1$  se). This compares favourably with published data for this species in the UK (Picozzi 1984, Green & Etheridge 1999, Amar *et al.* 2007), and also here in Ireland where it was estimated that 1.9 juveniles fledged from successful nests recorded during the 2005 survey (Barton *et al.* 2006).

Nest cameras employed during the present study have provided some interesting behavioural information, detailed analysis of which is beyond the scope of this paper. With regard to the two visits to the failed nest described above, the fact that the first visit was with prey suggests that the visiting bird was the provisioning male at the nest. Instances of nestlings eating their dead siblings have been recorded in this species and in other harriers (Cramp & Simmons 1980). Inter-

brood cannibalism has also been described in the colonial Montagu's Harrier (Brochet & Gizart 1996, Arroyo & Garcia 1997). However, we are not aware of any reported instances of dead harrier nestlings being eaten by a parent.

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