



Raven

Corvus corax

1. INTRODUCTION

The raven (northern raven) is abundant in the north and west of Britain and widespread across Ireland, except for the central region (Gibbons *et al.*, 1993; Mearns, 2007). Ravens used to breed in almost every county in Britain but were eliminated from most lowland areas in the 19th century (Ratcliffe, 1997). An increase in numbers and range has occurred in Scotland and parts of England in recent years. British and Irish ravens are largely sedentary, and once established in a home range, they seldom leave it. Immature birds may form large flocks, which can roam over large areas. Ravens breeding in the north of their range in mainland Europe (Fennoscandia) are medium-distance migrants (Cross, 2002). A regular presence of continental birds in Britain and Ireland in the winter is not suspected, however, although a larger number of single birds has been found wintering in southeast England in recent years; perhaps originating from the successful reintroduction programme in the Netherlands (Cross, 2002). Adult ravens generally cannot be sexed in the field unless a pair is seen together when the slightly larger male can sometimes be distinguished from the female. Immatures can be separated from adults only in the year of hatching by their duller, often browner plumage, shorter, squarer tails, red internal mouthparts and shriller calls. Ravens may breed at two years of age but most do not start breeding until they are three or four years old.

For further information on the biology and ecology of this species, Ratcliffe (1997) provides a comprehensive account.

Annual cycle

Breeding Activity	Peak Period	Range*	Duration (days)
Occupation of home range		All year	
Territorial display		All year	
Courtship		January to April	
Egg laying	Varies by region; late February to late March	Late January to May	3 to 7
Incubation	Early March to mid-April	February to June	20 to 25
Hatching	Late March to mid-April	March to June	
Young in nest	Mid-April to late May	March to July	35 to 50
Fledging		Mid-April to July	
Juvenile dispersal		August to December	

* Later dates are probably repeat clutches; most juveniles will have separated from their parents by three months after fledging (i.e. by the end of October; Ratcliffe, 1997).

2. HABITAT, HOME RANGE, NESTS AND BREEDING

2.1 Habitat

Ravens are found in mountainous areas and along rugged coasts. They will also breed in lowland farmland, forest and parkland (Cross, 2002). They avoid large forests and areas of intensive farmland, where there is a lack of foraging habitat or carrion. Breeding densities vary between different regions of Britain and Ireland depending on the availability of nest sites and food (Newton *et al.*, 1982; Dare, 1986; Ewins *et al.*, 1986; Ellis *et al.*, 1994). Many areas with an abundance of suitable crags or trees for breeding are not occupied, as the population is apparently limited by lack of food (the availability of carrion) or absent due to the historical or current influence of persecution by game-keeping and farming interests; Gibbons *et al.* (1993) found low densities in upland areas with grouse moors.

2.2 Home range

Ravens occupy their home range throughout the year (Dare, 1986; Davis & Davis, 1986; Madders & Leckie, 1999). The home range is probably not exclusive (Ratcliffe, 1997) but a pair actively defend a nesting territory, excluding other ravens, apart from their recently fledged young or flocks of immature birds. Raven nesting ranges can be regularly spaced with average nearest neighbour distances (between adjacent pairs) of 2.2–7.2 km in Britain and Ireland; but there are records of simultaneously occupied eyries as close as 350 m in high density areas (Ratcliffe, 1997). A pair is generally faithful to its nesting range from one year to the next.

2.3 Nest sites

Within a raven nesting range, there may be up to 14 alternative nest sites; these may be up to 1 km or more apart, although they are normally closer, often on the same crag (Ratcliffe, 1997). Ravens may use one particular nest site for several years or change site each year, to some extent dependent on the number of alternative sites available within the nesting range and sometimes on harassment by peregrines or golden eagles. Some sites are known to have been used for a long time (Ratcliffe, 1997). Nests are built on crags, in gorges, in trees, or on man-made structures, including buildings, dams, bridges, pylons and masts (Ratcliffe, 1997). Crags are preferred if available (Ratcliffe, 1997) and nests are generally found on the largest available rock-face, usually under an overhang to give shelter. The crags used range in height from under 5 m to over 100 m. On sea cliffs, nests tend to be on the upper third (Ewins *et al.*, 1986), well away from storm waves. Most inland crag nests are located at 200–500 m ASL, although nesting at up to 890 m ASL has been recorded in Perthshire; tree nests are located mostly on lower ground (30–300 m ASL; Ratcliffe, 1997). Ravens use a wide variety of trees for nesting but, depending on availability, they appear to prefer conifers (Ratcliffe, 1997). Large woods are avoided because ravens need open ground for foraging. Ravens prefer to use tall trees and the nest is often placed high in the crown, 15–30 m above the ground. Nests may also be built at the base of a limb next to the trunk or towards the end of a lateral branch. In secluded hill country, small trees may be used and nests may be placed only 3–5 m above the ground. Quarries and man-made structures are commonly used for nesting where there is a lack of natural sites, for example, in hills in central Wales and southern Scotland, ruined farms and cottages are used when crags and trees are not available. Ravens will nest on buildings that are in use (e.g. a pair bred on Chester Town Hall in 1996; Ratcliffe, 1997).

2.4 Nests

Both adults build the nest, which has a number of distinct layers. The outer layer (about 20 cm thick) is made from larger sticks or woody stems 25–150 cm long and 0.5–3.0 cm

thick, which are woven together, and may be lined by a layer of thinner twigs. The twigs are in turn lined by clay, earth, roots or sometimes dung and the deep bowl formed by these layers is then lined with grass and other plant material, before a thick layer of animal hair, often sheep's wool, is added. Nests are about 0.5 m in height and 0.5–1 m across when complete. They become larger as they are used in successive years, reaching up to 3 m in height and over 2 m across. Such nests will persist for many years, even if the ravens abandon them. They are frequently used by falcons for breeding (gyr falcon, Steen, 1999; peregrine, Ratcliffe, 1993; hobby, Sergio *et al.*, 2001; merlin, Tommeraas, 1993; kestrel, Village, 1990).

2.5 Clutch size and incubation

Ravens usually lay 4–6 eggs (mean 4.8 eggs), with occasional clutches of one, two, three or seven eggs. Regional variation is not significant (Ratcliffe, 1997). The BTO Nest Record Scheme gives an average clutch size of 4.7 ($n=427$). Eggs are laid in the morning, at intervals of one or sometimes two days (Goodwin, 1986). Incubation normally starts with the penultimate or last egg, although some ravens may begin to incubate earlier. The adults sit on the eggs to cover them before full incubation starts. Most incubation is carried out by the female, fed by the male (an average of seven times a day at a filmed nest in central Wales; Ratcliffe, 1997). She may leave the nest for short periods (usually 5–10 minutes; an average of 11 times per day at the same nest; Ratcliffe, 1997). Raven eggs are relatively small for the size of the bird and the incubation period usually lasts 20–25 days (Cramp & Perrins, 1994; Boarman & Heinrick, 1999), considerably less than that of most birds of prey. Shorter times have been recorded (17–19 days) probably for pairs that started to incubate early in the laying period (Ratcliffe, 1997). Ravens can lay a second clutch if the first is lost early in incubation. These repeat clutches are generally smaller (mean 4.2 eggs) than the first (Ratcliffe, 1997). Ravens are one of the earliest nesting birds in Britain and Ireland, and may lay eggs from late January to early May. Within any one region, individual pairs may lay the first egg at widely differing times. Occasional early laying can occur in late January (or even late December), especially in coastal regions. On Fetlar in Shetland, first-egg dates vary from 24th February to 5th May (Ewins *et al.*, 1986). Ratcliffe (1997) cites an overall range of late February to late March. In any given region, Ravens tend to begin laying later at higher altitudes (a delay of one day for every 50 m increase in altitude in northern England, Ratcliffe, 1997), although there is still a wide spread of laying dates at each altitude.

2.6 Brood size and fledging

The chicks usually hatch over two or three days (Ratcliffe, 1997). The female broods newly hatched young intensely for the first 7–10 days and less intensely for a further 10 days (Cramp & Perrins, 1994; Ratcliffe, 1997). The male may cover the nest in the absence of the female (for periods up to one hour in duration). Both adults feed the chicks; the male provides all the food initially but the female leaves the nest to collect food as the young grow larger. Observations reported in Ratcliffe (1997) have indicated that provisioning of young is most intense from dawn until 11:00h and between 15:00h and dusk; during these periods, the young may be fed frequently (an average of 64 visits per day, of which 70% are for delivering food; range 102 visits per day at 13 days old to 36 visits per day at 35 days old). The young fledge on average after 45 days (range 35–50 days). They then forage in a family group with their parents for 2–6 months. In late spring and early summer, these family groups can be distinguished from flocks of non-breeding birds, as the full plumage (lack of moulted primary feathers) of the young contrasts with that of the moulting adults (see also Section 1 above). Following this, the young join flocks of immature birds (1–3 years old) which move around in response to local variation in food abundance. Pair bonds are formed in these sub-adult flocks and distinct pairs may be discerned within flocks.

3. SURVEY TECHNIQUES

CAUTION Ravens should not be disturbed from nests in bad weather, particularly early in the season or when they have small young. If nest inspection visits require climbing, then appropriate health and safety precautions should be taken (see Section 7.10 of Introduction).

3.1 Breeding season visit schedule

To establish occupancy and the presence of a breeding pair, it is recommended that all four visits detailed below are made. However, if time is limited and a nesting range appears to be unoccupied on the basis of the first two visits, then further visits to that range can be omitted. Broods that have fledged early may start to disperse by early August.

Visit 1	January to March	To check for occupancy
Visit 2	March	To locate active nests
Visit 3	Early April to May	To check for young
Visit 4	Early May to early June*	To check for fledged young

* Young from early broods may be feeding well away from the nest site by early June and may be difficult to locate or count accurately.

3.2 Signs of occupancy

3.2.1 Locating home ranges

Where there are known traditional nesting ranges, fieldworkers should visit areas where ravens have been seen during January to March and search for pairs or single birds near possible nesting sites. If ravens are found, a search of the area should reveal a nest or an active roost (faecal droppings, pellets and moulted feathers, normally in a sheltered place). Early in the season, adult pairs display over the nest site, and resident birds will alarm when a nesting range is approached.

The aerial display thought to be most associated with territoriality is the 'unison flight', in which the pair drift around together in synchronised flight, usually high in the sky, for around 15 minutes, with wings almost touching at times (Ratcliffe, 1997). 'Flight-rolls' are also common but may be given at any time of year and can also be given by single birds and birds in flocks. Ravens commonly soar in thermals, both when in flocks but also over nesting areas during the breeding season, which may help to locate pairs initially. All of this behaviour can occur throughout the year so that territories can also be located in autumn and/or winter.

In areas in which there is no prior knowledge of traditional nesting ranges, or where the population is expanding, systematic searches of the survey area must be made. Observations of pairs of ravens and their behaviour should be noted and all suitable crags, trees, ruined buildings, pylons or other suitable man-made structures within that area should be checked for nests or potential roosts.

3.2.2 Locating roosts

Roosts can be found on crags and in woodland. Roosts are often located near to nests, even in winter, and new nests are often built near a roost site selected by a newly established pair.

The accumulation of fresh faecal droppings (usually larger quantities than any raptor roost), associated with pellets and moulted feathers, are obvious when on crags. Fieldworkers should return in the evening, however, to confirm by observation that ravens are using the roost. While the female is incubating, the male usually has a favourite roosting place within 100 m; and when night-brooding stops the adults will roost together (Ratcliffe, 1997).

3.2.3 *Recognition of signs*

Raven pellets are variable in size (usually 5–8 cm long by 2–3 cm thick; Ratcliffe, 1997). Their contents can be quite different from those of most raptor species nesting in similar habitat, particularly in upland areas where raven pellets tend to contain wool, rabbit, hare or vole fur, bones and often also insects. In spring, raven pellets often contain small rubber castration rings from lambs, although these are sometimes also found in pellets of kites and eagles. Occasionally, pigeon rings are found in raven pellets, especially near occupied peregrine sites. Raven pellets also have the characteristic 'musty' smell associated with corvids (Ratcliffe, 1997). In some situations, particularly in the lowlands, the pellets may not be distinctive enough to be distinguished from those of other predatory birds (e.g. buzzard, crows) unless associated with other signs, particularly moulted feathers.

3.2.4 *Evidence of occupancy*

A nesting range is occupied if a single raven or pair is seen on at least two occasions during the breeding season.

3.3 Evidence of breeding

3.3.1 *Locating active nests*

Searches should be made for active nests during March but could begin from late January. In open country, ravens flying to and from their nests can often be detected by watching over an area from a suitable vantage point. Ravens can be observed nest building in fine weather. They have an extremely strong pair bond and an established pair is seldom separated. Therefore, if a single raven is seen in an area between January and April, it is a probable indication of a nest nearby. The behaviour of such birds should be studied in an effort to determine a nest's location. A single guard bird, usually the male, will often alert his mate to any intruder with a single resonant 'cronk', which develops into a series of agitated barks and 'pruks' with increasingly agitated flying, as an observer nears a nest. Prolonged, agitated calling can mean that a fieldworker is causing disturbance to an active nest and should withdraw unless a nest visit is planned.

If a nesting range on a crag is suggested by the behaviour of a pair, nests can be found by scanning the crag from a suitable vantage point. If the nest is not visible, the behaviour of the adult birds should indicate the part of the crag on which it is situated. Traditional nest sites on crags can be located by looking for white or lime green patches beneath them where droppings have splashed onto the rock face. Ravens may share crags with peregrines and both species may be very vocal at nest sites when they are in close proximity. Tree nests can be found by searching all of the trees in the area where the adults have been seen; pellets and droppings at the base of trees give extra clues as to the location of an active nest. Man-made structures should be checked in the same way.

As nest cleaning by the adults declines and larger young eject their faces over the edge of the nest, the outer structure becomes covered in white droppings. The degree of 'white-wash' gives an indication of brood size and development stage (Ratcliffe, 1997).

3.3.2 Evidence for fledging

Large, fully feathered young can be counted in the nest just before fledging, or just after they have fledged when they remain close to the nest. Later they join their parents to form family groups that forage within the home range. The adults and young can be separated by plumage (Sections 1 and 2.6 above), allowing a count to be made.

3.4 Evidence for non-breeding

In a study in central Wales, occupancy of known breeding territories varied from 80–89% across years, and 12% of territorial pairs failed to lay eggs, although many of these pairs built or started to repair nests (Davis & Davis, 1986). If a pair of ravens occupies a nesting range but there is no evidence of an active nest or recently fledged young after the appropriate visits, this suggests non-breeding (or early nest failure).

3.5 Ageing and sexing young

More data are required to allow reliable ageing of young. Young ravens can be aged approximately by their stage of feather development. They hatch with small patches of down on an otherwise featherless body and with eyes closed. The primary feathers first emerge at around 11 days of age; by three weeks, a thin covering of feathers has developed and the characteristic heavy bill has formed; by four weeks of age the young are well-feathered although plumage development continues for a further two weeks (Ratcliffe, 1997). The eyes begin to open at 12–14 days (Boarman & Heinrich, 1999). Body mass of 6 chicks (2 wild, 4 captive) from New England increased slowly from about 25 g at day 1 to a mean of 268 g (standard deviation 87.7) at day 9, then more rapidly to 1,093 g (standard deviation 95.7) at day 24, before levelling off at 1,179 g (standard deviation 148.4) by day 30 (Boarman & Heinrich, 1999). Male ravens are generally larger than females but, as there is considerable overlap between the sexes and chicks in a brood vary in age, it is impossible to sex the young reliably.

4. SURVEYS OUTSIDE THE BREEDING SEASON

Ravens can form large flocks of non-breeding birds (Coombes, 1948). They are believed to consist of birds not holding territory, including juveniles and older paired birds, and to be indicative of a population surplus (Mearns, 2007). Such flocks may be seen throughout the year close to areas containing breeding home ranges but they generally forage well away from occupied nesting ranges. Flocks move in response to variation in the abundance of food and may contain sub-adults that will colonise an area subsequently. On Islay, large raven flocks were associated with improved grassland and the municipal refuse tip (Madders & Leckie, 1999). Ravens will also flock to scavenge on carcasses (Ewins & Dymond, 1984; Ratcliffe, 1997). The numbers of birds in flocks can be counted as they go to roost or as they feed on the open hill.

Ravens form communal roosts, either on crags or in woods (coniferous and broadleaved). Crag roosts can be obvious, as the faecal droppings accumulate on the rock face and pellets and feathers are found on the ground below. Such roosts are used throughout the year but the numbers of ravens present tend to be lower during the breeding season than in the winter. Roosts are thought to contain mainly non-breeding birds. Established pairs of ravens roost during the winter at or close to one of their alternative nest sites; whether any join communal roosts outside the breeding season is still the subject of debate. Ravens may forage more than 20 km from roost sites (Cramp & Perrins, 1994). Roosts can be found by

watching raven flocks in the late afternoon and noting where they go as dusk falls. Counts at roosts should be made from a suitable vantage point overlooking the roost, beginning two hours before dusk and continuing until dark. Ravens may enter a roost after dark, however, especially on moonlit nights. In Perthshire, Scotland, ravens appear to move between several large traditional roosts (10–30 km apart). Any given roost may be used for up to five years and then vacated. Smaller roosts develop for shorter time periods (days to months), particularly where there is a good food source.