



Peregrine

Falco peregrinus

1. INTRODUCTION

The peregrine (peregrine falcon) breeds throughout most of Britain and Ireland (Gibbons *et al.*, 1993; Banks *et al.*, 2003; Hardey, 2007). The population is largely sedentary but birds occupying less productive home ranges may move elsewhere in winter. Populations across mainland Europe become progressively more migratory further east and north. Young peregrines in their first year can travel large distances but many remain close to their natal area (Ratcliffe, 2002). Some migrant peregrines from Scandinavia winter in the UK, although the numbers involved are unknown. Female peregrines are about one-third larger than the males but it is often difficult to separate the sexes, even when a pair is seen together. Females may be distinguished by their alarm call, which is generally lower in pitch than that of the male. Fledged young are paler and browner than the adults, with a distinctive pale brown edge to their tails; and immature peregrines in their first year can be recognised by their browner plumage. Peregrines can breed at one year old but most do not breed until the age of two years or more (Ratcliffe, 2002).

For further information on the biology and ecology of this species, Ratcliffe (1993) provides a comprehensive account.

Annual cycle

Breeding Activity	Peak Period	Range	Duration (days)
Site occupation	March to July	All year (for some pairs)	
Courtship display		Early March to late April	
Egg laying	Early April to late April	Mid-March to early May	2 to 12
Incubation	Early April to late May	Mid-March to early June	28 to 35
Hatching	Early May to late May	Late April to early June	
Young in nest	Early May to late June	Late April to late July	35 to 42
Fledging	Late June to early July	Early June to late July	
Juvenile dispersal	August to September	July to January	

2. HABITAT, HOME RANGE, NESTS AND BREEDING

2.1 Habitat

Peregrines need open areas with a plentiful supply of birds to hunt and secure sites for breeding (Ratcliffe, 1993). A highly adaptable species, peregrines nest in a wide range of habitats, including cities. In winter, peregrines may occur in areas where they do not breed, often frequenting estuaries and other areas with large concentrations of suitable prey, although they can be seen almost anywhere.

2.2 Home range

Peregrines do not hold exclusive home ranges (Newton, 1979; Ratcliffe, 1993); their hunting ranges are extensive and overlap with those of neighbouring pairs. Most large prey is taken within 2 km of the eyrie and few birds are captured beyond 6 km (Hardey, 2007). They defend a nesting territory; with the average nearest neighbour distance between pairs in different districts of Britain varying from 2.1–9 km (Ratcliffe, 1993). Peregrines may occupy their home range throughout the year but, during adverse weather, birds in less productive habitats may move away for short periods. Non-breeders and immature birds range widely and can be found away from breeding areas.

2.3 Nest sites

In Britain and Ireland, most eyries are on cliffs or crags. Peregrines tend to use the largest suitable cliffs available, although the quality of ledges for breeding is important and large cliffs will be ignored if they do not provide adequate ledges. The cliffs may be broken, a series of small rock faces, a single sheer crag or a rocky gully (Ratcliffe, 1993). Inland breeding cliffs are often above or overlooking a river or a loch. Treleavan (1998) notes that coastal eyries are often set back from the sea, in a bay or inlet, with the breeding ledge two-thirds of the way down the cliff; on the Berwickshire coast, however, most breeding ledges are on the upper third of the cliffs. The selection of the breeding ledge is made by the female (Treleavan, 1977; Ratcliffe, 1993). A cliff ledge used for breeding is usually at least 50 cm long and 50 cm wide (Ratcliffe, 1993) but ledges as small as 30 cm by 40 cm are used. The ledge will frequently be under an overhang. Aspect generally appears to have no effect on the suitability of a cliff for breeding (Ratcliffe, 1993), although Treleavan (1998) found that preferred breeding ledges on coastal cliffs gave shelter from the midday sun and were above the height reached by spray during storms; in Berwickshire most sites are oriented to the east, sheltered from the prevailing westerly winds. Peregrines will frequently re-use breeding ledges. In the absence of cliffs, Peregrines will breed on the ground, for example on steep sand banks above burns or on heathery slopes. They occasionally breed in trees (Ratcliffe, 1984), using the old nests of other species, such as raven. Eyries on man-made structures such as power stations, bridges, quarry machinery, churches and electricity pylons are becoming more common (Ratcliffe, 1993; Harwood, 2000). The extent to which altitude limits nesting sites in the UK is unclear. Several pairs breed regularly at well over 850 m in the Grampians but these may be the exception; breeding at higher altitude may result from a lack of suitable crags at lower altitude (Ratcliffe, 1993). The presence of breeding golden eagles may have a greater effect than altitude, with peregrines tending to avoid areas with active eagle nests (Fielding *et al.*, 2003b).

2.4 Nests

Peregrines do not build a nest but scrape a shallow bowl with their feet in any nesting substrate (such as soil on a cliff ledge). A typical scrape will be 17–22 cm in diameter and 3–5 cm deep (Ratcliffe, 1993); scrapes in softer soils tend to be deeper. In Britain and Ireland, the old cliff nests of grey heron, golden eagle, buzzard, raven, hooded and carrion crow have been used by peregrines for breeding, while tree nests have been found in the old nests of raven, buzzard and crow. When old nests are used for breeding, peregrines may scrape out the lining.

2.5 Clutch size and incubation

Peregrines lay from mid-March until the beginning of May. Coastal birds tend to lay earlier (late March) than inland birds, and those breeding at higher altitudes lay later (early May). Laying can be delayed for 1–2 weeks if spring weather is exceptionally cold and wet (Horne

& Fielding, 2002). Eggs are usually laid at 2-day intervals. Clutch size varies from 2–6, with most containing three or four eggs. The BTO Nest Record Scheme gives an average clutch size of 3.3 (n=511). The eggs are covered by the adult female before incubation starts, especially in cold or wet weather and at night. Incubation is mainly by the female, with the male's contribution varying between pairs and the female always carrying out the night shift (Ratcliffe, 1993). Courtship feeding of the female by the male begins several weeks before egg laying, and the male provides food for the female during laying and incubation. The eggs are incubated for 28–35 days; this variation has been attributed to differences in ambient temperature and possibly to the size of individual eggs (Ratcliffe, 1993). Incubation starts with the laying of the last or penultimate egg.

Peregrines will lay repeat clutches if the first clutch is lost or deserted early on, although birds tend not to relay if the clutch is lost towards the end of the incubation period or if the home range is on less productive ground. A second clutch is usually completed 24–25 days after the loss of the first (Ratcliffe, 1993) and relaying has been recorded in late June. Repeat clutches tend to be smaller than first clutches.

2.6 Brood size and fledging

Hatching is fairly synchronous, the first and last eggs usually hatching within 48 hours. The female broods small young with occasional help from the male (Martin, 1980). The amount of brooding decreases as the young grow but is essential for the first 8–10 days, as the small chicks are very vulnerable to adverse weather (Mearns & Newton, 1988; Ratcliffe, 1993; Norris, 1995; Horne & Fielding, 2002). During the first 8–10 days, the male does all of the hunting and brings food to the eyrie for the female to feed the young. Later, both parents hunt. The young receive 4–11 feeding visits per day (at intervals of 10 minutes to 6 hours), with most provisioning taking place early in the morning (starting at dawn) and in the evening (Ratcliffe, 1993). The young fledge at 5–6 weeks, with the (smaller) males fledging before the females (Parker, 1979). Weir (1978) recorded fledging at an average of 40 days in the central Highlands. Fledged young disperse from their nesting territories after a further two or more months (Cramp & Simmons 1980).

3. SURVEY TECHNIQUES

CAUTION *Safe observation of eyries, without disturbing the falcons, depends on the individual pair. Eyries should be observed from a distance which does not cause distress to the birds. In general, to minimise the risk of disturbance, nesting areas should be viewed from distances of 500–750 m (Ruddock & Whitfield 2007, Whitfield et al. 2008b). Pairs in remote locations may be more sensitive to human activity whereas birds in urban areas, quarries or frequently visited sites may be more tolerant of disturbance. Activities above a nest are more likely to cause disturbance than those below (Ruddock & Whitfield, 2007). If a peregrine is flushed from eggs or small chicks, it is important to allow it to return quickly as eggs or small chicks can become chilled if the adult is kept off the eyrie, especially in cold, wet weather. Visits to measure and ring chicks should be made before young are 25 days old because after this disturbance to a nest may cause premature fledging. If eyrie inspection visits require climbing, then appropriate health and safety precautions should be taken (see Section 7.10 of Introduction).*

3.1 Visit schedule

The species is listed on Schedule 1 in Great Britain, Northern Ireland and the Isle of Man, and Schedule II in the Republic of Ireland (see Section 7.1.1 of Introduction). To establish

occupancy and the presence of a breeding pair, it is recommended that all four visits are made (as detailed below). However, if time is limited and a home range appears to be unoccupied on the basis of the first two visits, then further visits to that home range can be omitted.

Visit 1	March to early April	To check for occupancy. If information from previous year(s) is available nesting territories where peregrines lay earlier or have poor breeding success should be visited first
Visit 2	Late March to early May	To locate active eyries (incubating birds). Peregrines in montane nesting territories and may not lay until early May
Visit 3	Late May to mid-June	To check for young and/or for evidence of breeding if no signs were seen on previous visits
Visit 4	Mid-June to early July	To check for fledged young

3.2 Signs of occupancy

3.2.1 Locating home ranges

As peregrines do not hold exclusive home ranges, they are surveyed by locating occupied nesting territories. Many territories are well known because they have been used for many years (Ratcliffe, 1993). When searching a new area, data on the location of any known nest sites should be sought from other fieldworkers, ornithological literature and local people. This will provide a starting point for survey work. As the population has expanded in Britain and Ireland, peregrines have occupied new home ranges, including those with unusual non-cliff sites. Potential new nesting territories should now also be identified by cold searching the survey area. Checks should include any steep bank, buildings and man-made structures, the old tree nests of other bird species, and areas of deep heather (for ground nests). Nesting territories, known or potential, should be visited and checked for occupation in March or early April. Visits should be made in reasonable weather, as peregrines will be less obvious if they are sheltering from adverse conditions. When checking known nesting territories, priority could be given to sites with a history of failure, as these may be deserted by the birds early in the season. It may necessary to delay first visits for montane territories (above 600 m) if there is late snow-lie. These territories should be visited when the weather conditions permit a safe search.

Fieldworkers should look both for birds and for other signs of occupation including active roosts, fresh kills (several should be present if the nesting territory is occupied) and moulted peregrine feathers (section 3.2.4). A suspected nesting territory should be scanned from a distance before it is approached, from below if possible as peregrines will sit on prominent perches, often high on a cliff, and may be located by their white breasts. They may be elusive, however, and slip off a cliff unseen, especially at coastal sites. For large cliffs, watches from vantage points can be used. These should be below the skyline (for example if the vantage point is on another cliff), at least 250 m away from but with a view of the potential nesting cliff site, and ideally with the sun behind the fieldworker (Treleven, 1998). The response of a pair of peregrines to intrusion at an active nesting territory can vary. Most will fly above the eyrie giving the loud 'cacking' alarm call. Some will, however, remain silent during a site visit. A few will leave the area and may watch from a distance (Ratcliffe, 1993). Peregrines can be particularly tricky to locate at coastal sites especially on extensive cliff systems and in the proximity of seabird colonies. Noise from seabirds and strong winds, and the presence of large numbers of seabirds on the wing, can affect the detectability of peregrines. As a general rule, peregrines are more demonstrative later in incubation or when they have young, but assumptions cannot be made about the nesting stage based on behaviour alone.

Peregrines make display flights, particularly early in the spring, and usually in the immediate vicinity of the nesting territory (Cramp & Simmons, 1980). Solo birds (mainly males) perform high-circling, undulating flights (including a characteristic 'Z-flight', in which the bird high-circles, flies level, banks over onto one side, descends sharply, levels off again and either lands or high-circles again) and figure-of-eight flights (in which the bird generally flies from the eyrie with vibrating wings, makes a figure-of-eight circuit in the horizontal plane, often close to the rock face, and lands back at the eyrie, calling). Pairs also high-circle and flight-play (including diving at each other, steep climbs, plunging and swooping together, chasing and brief flight-rolls). During flight-rolls, partners may 'talon-grasp', touch momentarily breast-to-breast or even bill-to-bill (the 'aerial kiss'). Intense displays may be facilitated by strong wind (Cramp & Simmons, 1980). Food passes between male and female may take place in the air or while perched (e.g. on a cliff ledge or tree).

If a nesting territory is apparently unoccupied, the fieldworker should look for other possible breeding sites nearby. In moorland or hill country, all crags and steep banks in the area should be searched for a scrape. If a territory is unoccupied on the coast, the fieldworker should look at all cliffs or steep slopes within 2 km on either side of the usual nesting territory. Eyries on man-made structures are more challenging. The fieldworker should visit all potential sites in the area and check for birds or fresh signs (at least two of the following: fresh prey remains; pellets; or an active roost with fresh faeces, down and moulted feathers).

3.2.2 *Locating roosts*

Active roosting sites will have fresh faecal droppings, down and possibly moulted feathers. On crags, they offer the roosting bird shelter and are frequently under an overhang; they may be difficult to observe unless there is a clear view of the crag. Rocks beneath roosts (and eyries) often become discoloured (lime green to white) and can be very distinctive. Peregrines may roost away from the breeding site if a sheltered, safe roost is not available nearby.

3.2.3 *Recognition of signs*

Peregrine plucks are frequently found on knolls or prominent rocks or ridges on the breeding cliff and tend to feature medium-sized birds such as pigeons, waders and grouse (Brown *et al.*, 2003; Ratcliffe, 1993). The leg bones are often left attached to the pelvis and the keel bone may be notched, with pieces removed as the peregrine feeds. In Ireland, measurements of almost 400 pellets produced a mean length of 39.5 mm (range 15.8–87.4 mm) and a mean width of 18.2 mm (range 10.5–30.1 mm), with colour varying markedly from grey/white to dark brown/black (Marc Ruddock, unpublished data). Peregrine pellets, however, are not distinctive enough to be used alone as evidence of occupancy and, in common with plucks and roosts, are best used in conjunction with other evidence (sightings of birds or moulted feathers).

Racing pigeon rings are commonly found at Peregrine breeding territories, especially in and below eyrie ledges and under frequently used perch sites. These rings can remain on the ground or under the surface for many years and they can be recovered using metal detectors in non-breeding season searches. They can be used to locate old breeding sites which are not in current use. Dates of occupation can be estimated from the year of registration on racing pigeon rings, which is useful for determining long-term occupancy and population trends (Dixon *et al.*, 2006). Registration details can also be used to identify the origin of racing pigeons killed (Dixon, 2005) and to estimate the numbers of racing pigeons taken (Dixon & Richards, 2003).

3.2.4 Evidence for occupancy

The minimum criteria are the presence of a single bird or a pair, or of fresh signs of occupation (fresh plucks, active roost site, pellets, moulted feathers) that can definitely be attributed to peregrine(s), in a known or potential nesting territory during the breeding season.

3.3 Evidence of breeding

3.3.1 Locating active nests

A second visit should be made to occupied nesting territories between late March and early May, by which time the birds may have laid. If fresh signs are found or birds are flushed, it can be assumed that the area is still occupied and a nest watch should be carried out. Peregrines that are flushed should be watched to see if they return promptly to the eyrie or nest. If they do, this suggests strongly that it is active, as peregrines flushed from empty eyries or daylight resting sites generally do not return quickly. If birds have not been flushed, the eyrie can be found by direct searching or by observation from a suitable vantage point. The fieldworker should watch for a change-over at the nest site, which may be preceded by a food pass. Watches from vantage points should be of at least 3–4 hours' duration.

A later visit should then be made in late May or June, after any eggs should have hatched. If not located previously, active eyries containing young will be easier to find by searching or observation, or listening for the calls of the young. At this stage there will be considerably more signs on the breeding ledge, especially faecal droppings and down, and the adults will be more demonstrative. At many sites, particularly coastal cliffs, it is impossible to see eggs or chicks in the scrape unless it is feasible to climb or abseil to the eyrie (see Section 7.10 of Introduction for health and safety considerations). If there is a need to record clutch size, incubating peregrines can be flushed from the eyrie during good weather by loud noises (clapping, shouting). Despite such disturbance, some birds may not leave their eggs until the eyrie is reached (Nethersole-Thompson, 1931). If climbing to nests to count eggs or ring chicks, fieldworkers should ensure that they are not being watched by other people and that their actions will not reveal the position of the eyrie.

If no intermediate visits can be made after confirming occupation, or if it is not possible to observe or climb to an eyrie, the nesting territory should be visited between mid-June and early July to locate fledged young and confirm whether breeding has been successful.

3.3.2 Evidence of fledging

Ideally, a visit should be timed so that the young have left the eyrie recently and are capable of flying. The minimum number of young observed should then be recorded, ensuring that the mobile juveniles are not double-counted (i.e. record the maximum number seen at any one time, or that are definitely different individuals) and that care is taken to distinguish young from adults.

Counts of fully feathered young in the eyrie may also be used as an estimate of the number likely to fledge. Young at this stage must not be approached in the eyrie, as this may cause premature fledging (Grier & Fyffe, 1987). This can occur with chicks as young as three and a half weeks that are not even fully feathered, so visits to eyries to ring and measure chicks should be made before they reach this age and eyries likely to contain large young should be viewed from a safe distance and not approached. In the event of accidental disturbance, an attempt should be made to return prematurely fledged young to the eyrie or its proximity, if it is safe for the fieldworker to do so. Adults will usually find and feed a chick that has survived a fall but such young may be more vulnerable to predators (Ratcliffe, 1993).

3.4 Evidence for non-breeding

Peregrines sometimes do not lay, especially in cold, wet springs. They may be recorded occupying a nesting territory during early visits or throughout the season but kills will not be brought to an eyrie. The birds may still alarm during a visit but will generally be less concerned by the presence of the fieldworker. The possibility that such birds laid and failed early in incubation cannot be ruled out unless several visits are made to the nesting territory during the appropriate stage of the nesting cycle (Visit 2 period above) or the habitat is such that all potential sites for active eyries can be checked.

3.5 Ageing and sexing young

Many peregrine chicks can be sexed from their relative size from the age of about 16 days (primary feathers well out of pins) because the females are substantially larger. Cramp & Simmons (1980) give the mean tarsus length for male peregrines as 46.9 mm, with a range of 45–49 mm, and for females as 53.5 mm, with a range of 52–56 mm, but few data are available to indicate whether these differences are already present when nestlings are young enough to be approached and handled without risk of premature fledging. Information from a sample of 82 Irish chicks of ringing age (c. 16–25 days; Table 7) indicates that tarsus lengths for this population are larger than those described by Cramp & Simmons (1980; see above) and also that, at this stage of growth at least, there is considerable overlap between males and females in a variety of body measurements. The data suggest, however, that a combination of mass and body size measurements might be used to sex some chicks (Table 7). Further work is required on this species to establish firm criteria for accurate ageing and sexing of chicks in the wild. Clum *et al.* (1996) provide photographs and detailed notes on the feather development of captive-bred peregrine chicks and White *et al.* (2002) provide a formula for estimating age based on wing length.

Table 7. Sex differences in measurements of 82 Irish peregrine chicks of ringing age (c. 16–25 days). Means and ranges are shown for each sex. (Source: M. Ruddock, unpublished data).

	Male	Female
Mass (g)	695.7 (576–886)	977.3 (820–1,120)
Tarsus length (mm)	55.8 (40.2–62.4)	61.2 (46.4–71.0)
Hind claw length (mm)	19.7 (16.2–19.1)	20.5 (18.2–22.2)
Bill length (mm)	19.0 (15.5–19.0)	20.4 (18.3–23.4)
Middle toe length (mm)	52.5 (45.4–52.7)	53.4 (47.7–58.7)

4. SURVEYS OUTSIDE THE BREEDING SEASON

After the breeding season, peregrines may continue to occupy their nesting territory but may use different crags from those used for breeding. Such birds can be located by direct observations or checking cliffs within the home range for active roosts or fresh signs. It is often difficult to locate both members of a pair and it may be easier to record the number of occupied territories than the number of birds. Peregrines that do not occupy nesting territories in winter, especially young birds or non-breeders, cannot be surveyed effectively. They may occupy temporary home ranges but are often nomadic. Some birds breeding in the far north of Scotland may be local migrants, moving to unknown destinations for the winter (Ratcliffe, 2002).

Methods to provide indices of peregrine abundance in winter (e.g. via foot surveys) are likely to be difficult to implement because sightings are likely to be infrequent.