



## 1. INTRODUCTION

In Britain and Ireland, native red kites survive only in Wales (Cross & Davis, 1998), where the population has expanded considerably in recent years (Wotton *et al.*, 2002; Holling & RBBP, 2012). The Welsh population has been augmented recently by reintroduction programmes at several locations in Scotland and England (Evans *et al.*, 1997; Minns & Gilbert, 2001; Carter *et al.*, 2003; Orr-Ewing, 2007), using stock from mainland Europe. A failed nest in County Antrim in 2002 was the first recorded breeding attempt in Ireland since the early 1800s (Scott & McHaffie, 2002). Reintroduction programmes for red kites are now underway in Northern Ireland ([www.rspb.org.uk/ourwork/conservation/projects/details/272999-northern-ireland-red-kites](http://www.rspb.org.uk/ourwork/conservation/projects/details/272999-northern-ireland-red-kites)) and the Republic of Ireland ([www.goldeneagle.ie](http://www.goldeneagle.ie)) using red kite chicks from Wales.

British adults are sedentary. The young often disperse from their natal area, the pattern of dispersal varying between populations (Evans *et al.*, 2002). Young from Scotland tend to disperse in a southerly or southwesterly direction, while birds from England and Wales do not show a directional preference. Northern European birds are partial migrants: some over-winter in breeding areas, while others move into southern Europe. Populations breeding in southern Europe are sedentary, apart from juvenile dispersal (Evans *et al.*, 2002). A small number of ringed birds from Continental breeding populations have been recorded in England in winter.

## Annual cycle

Breeding Activity	Peak Period	Range	Duration (days)
Occupation of home range		All year (some pairs January to October)	
Territorial display	March to April	Can be seen all year	
Courtship		March to early April	
Nest building		Mid-March to late April	
Egg laying	Early to late April	Late March to early May	3 to 9
Incubation	Early April to late May	Late March to early June	31 to 32
Hatching	Early to late May	Late April to early June	
Young in nest	Early May to early July	Late April to early August	47 to 78
Fledging	Late June to early July	Early June to mid-August	
Juvenile dispersal		August to September	c. 21 to 28 after fledging

Male red kites tend to be smaller than females but there is considerable overlap, and the sexes are difficult to distinguish in the field. Immature birds can be separated from adults until the completion of their first full moult in the autumn of their second calendar year; they are paler than adults, with pale tips to the wing coverts, a dark iris and a less pronounced fork in the tail (Carter & Grice, 2000; Carter, 2007). Red kites usually start to breed at 2–3 years old (Davis *et al.*, 2001) although some birds in reintroduction areas in Britain have begun breeding at one year old (Evans *et al.*, 1998, 1999; Orr-Ewing, 2007). Immature red kites may hold non-breeding territories in their first summer prior to breeding elsewhere in later years, up to 30 km away (Newton *et al.*, 1989).

For further information on the biology and ecology of this species, Carter (2007) provides a comprehensive account.

## 2. HABITAT, HOME RANGE, NESTS AND BREEDING

### 2.1 Habitat

Red kites utilise mature woodland for breeding and roosting and forage over extensive areas of open ground (preferably areas with livestock and rough grazing, although some arable land may be used). They tend to occupy well-wooded farmland below 600 m ASL (Minns & Gilbert, 2001). A study in Germany (Nachtigal, 1999) has shown that the species avoids areas of deep vegetation (e.g. winter cereals) during the breeding season because prey cannot be found. Red kites were formerly widespread in Britain and it is considered that this species should be able to find suitable nesting habitat and an adequate food supply in almost all areas of lowland Britain (Evans *et al.*, 1997, Carter & Grice, 2000). The current Scottish and English populations are associated with the habitats identified for the reintroduction programmes. The upland valleys traditionally occupied by the relict population in Wales appear not to be preferred habitat but rather a last refuge from human persecution (Evans *et al.* 1997), and the increasing population has expanded into more productive habitats (Newton *et al.*, 1994; Wotton *et al.*, 2002).

### 2.2 Home Range

Red kites do not defend their home range but they defend a nesting territory, centred on the active nest, against other kites, raptors and corvids. Territorial disputes between red kites are seen frequently. Red kites usually forage within 3 km, occasionally up to 6 km, from the nest (Carter, 2007; Davis *et al.*, 2001). In winter, most adult birds remain close to their home range, where they may roost together as a pair or with a small number of other adult birds that are presumably close neighbours (Davis *et al.*, 2001). Some birds may move to a local or regional communal roost. About 20% of first-year Scottish kites from the two established reintroduction sites disperse from early August to early November. These birds tend to move in a south-westerly direction and some have reached Cornwall and Ireland. More females than males disperse. Early in the season, red kite pairs that are apparently settled in a nesting territory may move to an alternative territory, which can be several kilometres away. It is believed that disturbance (from people or other potential predators) may be responsible for such behaviour.

As populations in England, Wales and Scotland increase, the pattern is for gradual range expansion and increasing density within the core breeding areas, with birds forming loose colonies or clusters of breeding pairs. Based on the national survey in 2000 (Wotton *et al.*, 2002) the highest recorded densities per 10 km square were 0.58 pairs km<sup>-2</sup> in the Chilterns, 0.18 pairs km<sup>-2</sup> in Wales and 0.09 pairs km<sup>-2</sup> in northern Scotland. Active nests have been found within 70 m of each other although this is exceptional.

## 2.3 Nest sites

Red kites nest in trees, at heights of 4–30 m from the ground, usually between 12–15 m. In northern Scotland, they prefer mature coniferous woodland and Scots pine is the most commonly recorded tree. In the Chilterns, most nest sites are in beech trees, and in the Midlands, pedunculate oak (Carter & Grice, 2000). In Wales, most nests are in sessile oak and larch, with a range of other tree species used including beech, sycamore, Scots pine and birch. The size of woodland used for nesting varies from extensive areas to small clumps of mature trees or narrow shelterbelts. In larger areas of woodland, nests are usually located close to the edge of a wood or a clearing or ride, to allow easy aerial access.

## 2.4 Nests

Some Welsh pairs refurbish the same nest in successive years, while others habitually build a new nest every year, which may be just a few metres from the previous one (Davis *et al.*, 2001). Other pairs frequently move between different nest sites, up to a few kilometres apart (Davis *et al.*, 2001). In northern Scotland, pairs that breed successfully invariably re-use the same nest. A new one is normally built only after a previous breeding failure or disturbance in early spring (such as tree felling in the nesting wood), and may be from 500 m to more than 1 km from the previous nest. In broadleaf trees, the nest is often built in a substantial fork, either next to the trunk or on a lateral branch within the canopy. In conifers, the nest is usually against the trunk but, unlike those of buzzards, red kite nests are sometimes built at the end of a thin lateral branch and appear very unstable. New nests are untidy, flattish affairs, larger than those of crows but of a similar shape. They are about 30 cm in height and up to 100 cm in diameter, with a deep cup. Occasionally they are built on the remains of another bird's nest (buzzard, raven, crow) or a squirrel's drey. The nests are built from dead twigs (mostly 30–50 cm long) and lined with dried grass, other dead vegetation and sheep's wool. They may also be decorated with 'rubbish' (e.g. pieces of plastic, paper or rags), which may be incorporated into the nest lining. All nests in northern Scotland were lined with sheep's wool, which may hang in festoons from the nest and nearby branches. In contrast, buzzards and goshawks never use sheep's wool or 'rubbish' for their nests. Crows may use wool but their nests are smaller. Kite nests are never 'greened up' by adding fresh vegetation, unlike honey-buzzard, buzzard and goshawk nests. Both sexes are involved in nest building: the male brings material, which the female uses to build the nest. The nests become increasingly messy as the young grow and faecal droppings build up.

## 2.5 Clutch size and incubation

In Britain, red kites lay 1–4 eggs. Clutches of two and three are most common in the Welsh population (Davis *et al.*, 2001), whereas in lowland England and Scotland, clutches of three are normal (Carter, 2007). Eggs are laid at intervals of 1–3 days and both sexes incubate, with the female taking the greater part (at least 80%). The male feeds the female during incubation, although she may make very short foraging flights while the male covers the eggs. Incubation lasts for 31–32 days per egg and often starts with the second egg. Kites can lay repeat clutches if the first fails early in incubation but this is rare. Replacement clutches tend to produce fewer young than first clutches (Carter, 2007).

## 2.6 Brood size and fledging

The eggs hatch asynchronously. The young are brooded by the female for the first 14–21 days (Carter, 2007), with the male bringing all of the food during this time (Cramp & Simmons, 1980). Nest failure is most likely to occur soon after hatching (Walters Davies & Davis, 1973), especially in cold, wet weather. In Wales, older siblings will attack and kill smaller ones when

there is a food shortage (Lovegrove *et al.*, 1990). CCTV observations over several years at the nest of a Scottish pair have frequently shown the oldest chick in a brood attacking the youngest whenever prey arrived at the nest, despite an apparent abundance of food. This aggression started within a few days of hatching and continued until chicks were 3–4 weeks old. Only when the eldest chick was satiated was the youngest able to feed. This behaviour did not affect survival and all young fledged successfully. Young fledge when 47–78 days old (mean of 55 days). The marked variation in fledging dates is linked to differences in growth rate caused by variation in food provisioning by the adults (Bustamante, 1993). The fledged young become independent and disperse from the nesting territory about 3–4 weeks after their first flight (Carter, 2007).

### 3. SURVEY TECHNIQUES

**CAUTION** Searches for nests in woodland should not be carried out between mid-March and mid-April (once kites start to display) as disturbance at this stage of breeding may cause the pair to move elsewhere. Fieldworkers should carry out watches outside woodland at this time. Red kites are also sensitive to disturbance when laying and incubating; birds should not be flushed from nests unless there is a specific requirement to record clutch size. To minimise the risk of disturbance it is recommended that nests are viewed from distances of 150–300 m (Ruddock & Whitfield, 2007; Whitfield *et al.*, 2008b). 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

The species is listed on Schedule 1 in Great Britain and the Isle of Man; in Scotland, it is listed on Schedule 1A (see Section 7.1.1 of Introduction). To establish occupancy and the presence of a breeding pair, it is recommended that four visits are made as detailed below. If time is limited, however, and a nesting territory appears to be unoccupied on the basis of the first two visits, then further visits to that territory can be omitted. A more intensive survey methodology, including an early-season visit to map potential nesting habitat in the study area and visits to record clutch size and brood size throughout the nesting period, is described by Gilbert *et al.* (1998).

Visit 1	March to early April	To check for occupancy
Visit 2	Late April to mid-May	To visit known nests and locate new active nests (incubating birds should not be flushed from the nest unless there is a specific need to record clutch size)
Visit 3	Late May to late June	To check for young
Visit 4	July and August	To check for fledged young

#### 3.2 Signs of occupancy

##### 3.2.1 Locating home ranges

As red kites do not defend exclusive home ranges, they are surveyed by locating occupied nesting territories. In the spring, red kites become more obvious once they begin to display over their breeding woods, and nesting territories can be found by scanning suitable woodland areas for territorial pairs in March. A high vantage point should be chosen, if possible, to give a clear view over the area. Display flights usually involve the pair following one another and flying in an almost synchronised fashion; they may chase each other through the canopy of the wood in which they intend to nest. Birds may sit on prominent perches and call loudly to the other member of the pair, who may be soaring or perched out of sight. They will also

chase other raptors (buzzard, osprey), crows and other kites away from the chosen nesting territory. Repeated high soaring over an area often represents territorial behaviour by an unpaired bird. Any kites seen should be checked for wing tags. The colour and position (left or right wing) of any tag should be recorded, along with any letters or numbers (these can be difficult to read if a bird is seen at a distance) and the location.

Deciduous woodland can also be checked for red kite nests in the late autumn and winter, while the leaves are off the trees, but searches for nests in woodland should not be carried out between mid-March and mid-April (once kites start to display), as disturbance at this stage of breeding may cause the pair to move elsewhere. At this time, watches should be carried out from outside woodland.

### 3.2.2 *Locating roosts*

No attempt should be made to locate the roosts of breeding red kites, as this causes excessive disturbance.

### 3.2.3 *Recognition of signs*

Breeding red kites commence their annual moult in May, and this continues until late summer or early autumn. The presence of moulted wing and tail feathers is usually indicative of an occupied nesting territory. Red kite pellets and faeces are similar to those of buzzard, and the presence of other signs (moulted feathers, active nests) is needed to confirm identification.

### 3.2.4 *Evidence of occupancy*

During the 2000 national survey of Britain, the following behaviours were used to identify birds potentially occupying territories (Wotton *et al.*, 2002):

- Aggression towards crows, buzzards or another kite;
- A calling adult kite;
- Circling by an adult kite over the same area of wood for more than two minutes (only for kites circling from a low height above tree level; Viñuela *et al.*, 1999);
- 'Curl' flights (as described by Viñuela *et al.*, 1999), where a hunting female returns to circle above the nest every 4-15 minutes;
- Courtship flights;
- A kite diving into a wood or flying within a wood below the canopy. A kite entering a wood usually performs a circling flight above the nest and often a final 'cork-screw' dive into the nest site;
- Agitated, wing-flicking display (deep, angular wing beats with a lot of carpal flexing and an erratic zigzag flight): often undertaken when an intruder is near the nest;
- A kite carrying food, but only into a likely nest site;
- An adult leaving a nest site. When a kite leaves the nest, it usually appears circling over the wood from below the tree canopy;
- An adult kite carrying nest material; and
- High perching by a single adult, particularly in the top of a conifer or dead tree, although non-breeding birds may also perch high up.

Sightings on more than one occasion provide stronger evidence.

## 3.3 Evidence of breeding

For the national survey of Britain in 2000, breeding was considered to have taken place if an adult was seen sitting on the nest or if young were seen in a nest (Wotton *et al.*, 2002).

### 3.3.1 Locating active nests

In deciduous woodland it may be possible to see nests from outside the wood in March and April, before trees are in leaf, without the need to access the wood. Kite nests can also be located by searching woods or groups of trees of a suitable height when the birds are incubating. Resident birds will generally soar overhead, with characteristic fast wing beats, and alarm when the nest area is approached. If a nest is found, it is often possible to leave the wood without flushing the incubating bird. Occupied nests contain fresh material in the spring and become increasingly dirty as the season progresses. Nests containing young are 'decorated' (Section 2.4 above) and have faecal droppings below the tree. The area of 'splash' around the base of the tree can give an approximate indication of the age of the young. Nest contents may be viewed with a mirror attached at a 45° angle on a long (up to 20 m) extendable pole. Use of such a pole should be practised away from an active nest (Gilbert *et al.*, 1998). Successful nests can be located after fledging as the young can generally be heard calling from outside the wood.

### 3.3.2 Evidence for fledging

The number of fledged young can be estimated from the number of large, fully feathered young (of at least 40 days old) in or near the nest. The approximate age of the chicks (Section 3.5 below) should be noted when recording brood size. Young can also be counted soon after fledging in more open sites.

## 3.4 Evidence of non-breeding

If a single kite or a pair occupies a nesting territory but an active nest or fledged young are not found after the appropriate visits, this provides evidence for non-breeding. Recording the length of time for which adult(s) are present in a particular territory during the breeding season can help in identifying those which may have moved elsewhere to breed. Immature birds may form non-breeding pairs in their first year, at locations where they may breed in later years. Stick carrying and the building of rudimentary nests can occur in these circumstances.

## 3.5 Ageing and sexing young

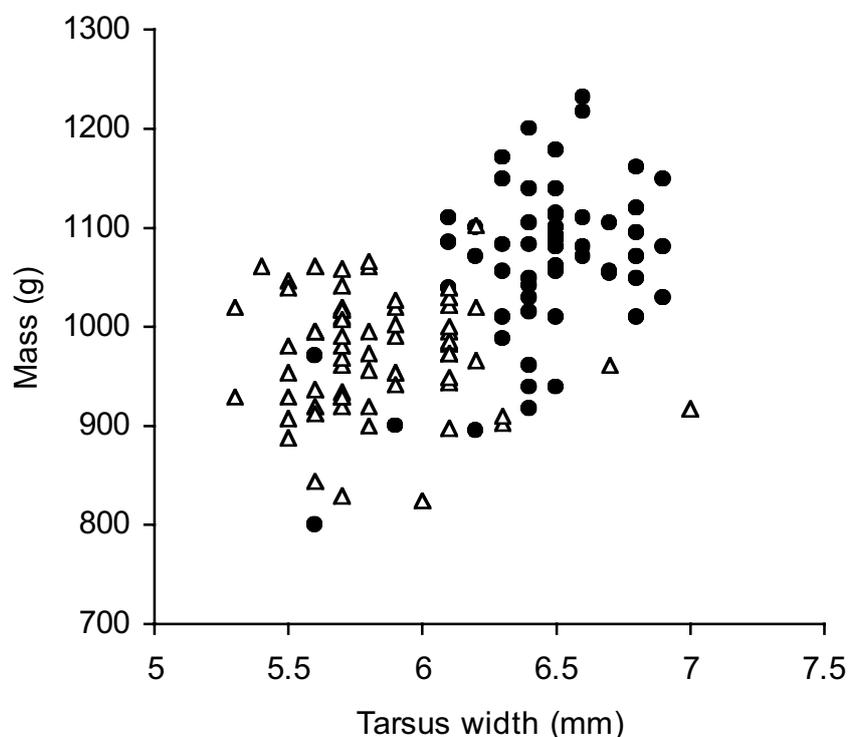
Red kite chicks can be aged approximately using wing length and bill length (Table 3). Many nestlings from the northern Scottish population (of Swedish origin) of four weeks or older (with a wing length (maximum chord) in excess of 250 mm) can be sexed using mass and tarsus width (Figure 9); in this case, tarsus width is a tight measurement with calliper jaws pressed momentarily hard closed to gain a minimum measurement (compared with the usual measurement where the calliper jaws just touch the tarsus scales). There is potential for confusion between runt females and males using this method, however (Figure 9). Red kite populations in other areas may differ in measurements.

## 4. SURVEYS OUTSIDE THE BREEDING SEASON

The social nature of the red kite becomes apparent in winter, when large numbers gather at communal roost sites. Large roosts may contain 50-60 birds, usually comprising immature, non-breeding birds and migrants. Local breeding adults may also join communal roosts but tend to stay close to their nesting areas in winter and may roost together with neighbouring pairs. Roosts are generally in mature woodland (conifer, broadleaved or mixed) and associated with reliable food sources such as refuse tips, abbatoirs and feeding stations (Davis *et al.*, 2001). Communal roosting may facilitate social foraging in kites: because they often scavenge at animal carcasses large enough to feed several birds, there may be advantages to searching for food in groups (Hiraldo *et al.*, 1993). Depending on the time of year, weather, and foraging success, red kites begin arriving at roosts from mid to late afternoon (Carter & Grice, 2000).

**Table 3.** Changes in the wing and bill lengths and feathering of red kite young with age (English translation of information from Robert Schronbrodt; Duncan Orr-Ewing, pers. comm.).

Age (days)	Average wing length (mm)	Average bill length (mm)	Notes
1	21.20	10.50	Grey white to white streaky head and back down.
4	25.00	11.90	Neck beginning to go fox red in colour; brown on shoulders disappears up to 10th day.
6	31.00	13.20	
8	34.50	13.80	
10	42.50	15.20	
12	62.00	16.70	Pins of primaries and secondaries emerge from skin at 13–14 days, as well as pins of tail feathers.
17	105.00	19.60	At 15–18 days tips of feathers emerge from pins in paint brush style. Feathers are emerging from back down.
23	175.00	20.80	Opening of feathers.
26	209.00	22.50	Body feathers begin to cover down on body.
30	249.40	23.70	Ragged incomplete feather coverage.
35	297.00	24.40	Complete feather coverage.
40	343.40	25.10	Move on to branches.
45	375.00	25.50	
48	397.00	26.20	Able to fly.
50	417.00	26.40	



**Figure 9.** Mass plotted against minimum tarsus width for red kite chicks from the northern Scottish population sexed using DNA analysis; for chicks with wing length greater than 250 mm (aged c. four weeks or older). Most females (solid points) are larger and heavier than males (open triangles) by this age. (Source: RSPB, unpublished data).

Roosts can be located by visually following red kites back in the late afternoon or evening, and by collecting information from local farmers, foresters or other estate workers. Roosts should be watched from suitable vantage points from about three hours before dusk and birds counted as they enter. Counts should be made in still weather, as the birds are much more active in windy conditions, increasing the risk of double-counting.

In areas with larger and more dispersed red kite populations, foot or road surveys could be used to provide indices of abundance in winter (see Section 2 of the Introduction). These will also give information on the areas used for foraging in winter.