



White-tailed Eagle

Haliaeetus albicilla

1. INTRODUCTION

White-tailed eagles became extinct in Britain and Ireland by the 1920s, having been formerly widespread in the north and west of Britain and in Ireland (Love, 1983; Brown & Grice, 2005; Holloway, 1996). There have been a number of reintroduction programmes in Scotland, ultimately resulting in the successful re-establishment of the species in the west (Bainbridge *et al.*, 2003). A new phase of reintroductions to the east coast of Scotland began in 2007. A release programme in the southwest of Ireland was also begun in 2007 (www.goldeneagle.ie).

Adult white-tailed eagles are predominantly sedentary, remaining in their home ranges all year round. Young birds disperse during their first year. In Scotland, there is a tendency towards natal philopatry, and elsewhere young birds may wander widely but tend to move back closer to their natal areas in spring (Nygård *et al.*, 2000). Vagrants from Scandinavia and eastern Europe may reach Britain occasionally (Gibbons *et al.*, 1993). The sexes have similar plumage but the female is noticeably larger than the male. Juvenile and immature birds generally lack the white tail of the adult, but the ages can be differentiated more rigorously using a combination of head, neck, bill and overall plumage colour (see Helander *et al.*, 1989); immatures gradually moult into adult plumage by the age of 4–5 years (Cramp & Simmons, 1980; Love, 1983). White-tailed eagles usually breed for the first time at five years of age, although this can vary from three to 7+ years (Helander & Stjernberg, 2002; RSPB unpublished data). Bainbridge *et al.* (2003) noted that Scottish white-tailed eagles bred first at earlier ages than those in Norway and Sweden, and that this appears to be a feature of reintroduced or naturally re-establishing raptor populations.

1.1 Annual cycle

Breeding Activity	Peak Period	Range	Duration (days)
Occupation of home range		All year	
Courtship		January to April	
Laying	Mid-March	Late Feb to late April	1 to 10
Incubation	Mid-March to late April	Late Feb to late May	34 to 46
Hatching	Late April	Mid-April to late May	
Young in nest	Late April to early July	Mid-April to August	70 to 84
Fledging		Early July to August	
Juvenile dispersal		September to January	

2. HABITAT, HOME RANGE, NESTS AND BREEDING

2.1 Habitat

Home ranges are located near open water, either coastal or fresh. The Scottish population is found on or near the coast in the West Highlands and Hebrides.

2.2 Home range

White-tailed eagles defend their nesting territories. Some birds are very aggressive to intruders, while others are more tolerant (Love, 1983). The extent to which they defend the rest of their home range is not clear, and this probably varies between individual pairs. In winter, some birds congregate, while others maintain a defined home range (Cramp & Simmons, 1980). In favourable habitats in mainland Europe, separate pairs may nest only 1–2 km apart. The Scottish population is still increasing and population density is low in most areas. On Mull, one of the most densely populated areas, the average distance between the nests of neighbouring pairs is 8.6 km (range 3.2–14 km; RSPB, unpublished data).

2.3 Nest sites

White-tailed eagles build their eyries in a wide variety of locations, generally below 300 m a.s.l., and typically below 150 m a.s.l.. In Scotland, nests may be located in trees or on large and small crags; trees, where available, seem to be used in preference. Nest trees are generally 10–30 m in height (usually the largest available in an area), broadleaved or coniferous (including forestry plantations), and within or at the edge of woodland, although isolated trees may be used occasionally. Nests are normally located about three-quarters of the way up the tree (3–25 m from the ground); they may be built in the crown, against the trunk or on a branch or branches away from the trunk, but are nearly always sheltered from above by part of the tree. Cliffs used for nesting vary greatly in height and may be on the coast or a short distance inland. Nesting on the ground occurs in Norway (on small knolls on offshore skerries, or in areas where abundant food results in very high breeding densities) and in Iceland (Waterston, 1964). Such nests may be little more than scrapes in the ground, lined with grass and moss. A pair of eagles may have 1–11 nest sites within their nesting range, varying from 2–3,000 m (mean 480 m) apart (Cramp & Simmons, 1980). Exceptionally, inexperienced birds have moved breeding locations by more than 10 km between years before becoming settled on a nesting territory.

2.4 Nests

Tree nests tend to be large (>1.5 m in diameter) and shallow when first built, becoming deeper as they are used in successive seasons. In Norway, one nest was approximately 3 m in height. The nest is built from branches (which may be over 1.5 m long and 5 cm thick), twigs, heather, seaweed and driftwood. The cup is generally shallow and is lined with grass, mosses or lichens. On Mull, unlike golden eagles, white-tailed eagles tend not to use woodrush for lining the nest and they tend to use larger sticks than golden eagles. Cliff nests can also be large but may start off as little more than decorated, lined scrapes.

2.5 Clutch size and incubation

In Scotland, white-tailed eagles normally lay 1–3 eggs (mean of 12 clutches = 2.0; note that few data are available because clutch size is not normally monitored to avoid disturbance to incubating birds). The average clutch size in Norway was 2.1 eggs (Cramp & Simmons, 1980). Eggs are laid at intervals of 2–5 days and incubation, which begins with the first egg, lasts 34–46 days per egg, but is usually 38 days. Both adults incubate, with the female generally taking the greater share (at least 70%) and incubating at night. Incubation changeovers

generally take place every 3–4 hours during the day (Gilbert *et al.*, 1998). Pairs may lay a repeat clutch if the first is lost, but this is rare.

2.6 Brood size and fledging

The young hatch asynchronously and are brooded by both adults almost continuously for 14–21 days, after which brooding gradually decreases. Both adults bring food to the nest and feed the chicks, with the male doing more of the hunting earlier in the nestling period, and the female feeding the chicks. Food deliveries are most frequent in the morning and evening, although they can take place at any time of the day. The overall delivery rate is about one per 10 hours of observation, ranging from one every five to one every 13 hours over the whole nesting period, and varying between pairs (RSPB, unpublished data). There may also be day-to-day variation, depending on weather conditions. The young fledge at 70–84 days old (exceptionally 98 days). Initially, they remain close to the nest, and continue to be fed by their parents, gradually becoming independent over a period of some 35–40 days (Cramp & Simmons, 1980). On Mull, some young have been observed to be dependent for longer. Young begin to disperse from the natal area in September, although some may remain in its vicinity through the winter.

3. SURVEY TECHNIQUES

CAUTION *White-tailed eagles should not be disturbed from eyries with eggs or small young unless there is a specific need to record clutch or brood size. Eyries should be observed from a safe distance until young are 3–4 weeks old (and capable of thermo-regulation) and again after the age of eight weeks, when disturbance may cause premature fledging. A distance of 500–1000 m is recommended (Ruddock & Whitfield, 2007; Whitfield *et al.*, 2008b), although it is recognised that different pairs or sites may have different sensitivity to disturbance; for example a hide for public viewing of a nest on Mull, situated at 300 m from the nest, is clearly not problematic (Ruddock & Whitfield, 2007). 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, Northern Ireland and the Isle of Man. In addition, the white-tailed eagle is listed on two new Schedules created by the Nature Conservation (Scotland) Act 2004, which respectively provide birds with protection from harassment and give year-round protection to habitually used nest sites in Scotland. The Natural Environment and Rural Communities Act 2006 (Schedule ZA1), which applies to England and Wales, also gives year round protection to nest sites (see Section 7.1.1 of introduction). To establish occupancy and the presence of a breeding pair, it is recommended that each home range is visited on at least four occasions (as detailed below). If time for fieldwork is limited and an observer believes a home range to be vacant on the basis of the first two visits, however, then subsequent visits can be omitted.

Visit 1	January to March (*November onwards)	To check for occupancy and locate 'built-up' eyries
Visit 2	Mid-March to mid-April	To locate active nests
Visit 3	Late June to July	To check for young
Visit 4	August	To check for fledged young

* Ideally, visit known nesting ranges or new areas at least monthly, from November to mid-February, to develop an understanding of bird activity prior to laying and to look for signs of nest refurbishment.

At the time of writing, because the population is still small, monitoring programmes for white-tailed eagles in Scotland, carried out by RSPB, involve weekly checks at most known nests from early March (Gilbert *et al.*, 1998).

3.2 Signs of occupancy

3.2.1 Locating home ranges

When surveying a new area, local advice should first be sought on the locations of any nesting ranges. However, as nests of adjacent pairs may be 3 km (or less) apart, fieldworkers should carry out systematic searches of all suitable nesting habitat within the study area to look for occupied nesting ranges; it should not be assumed that any recorded sightings of birds refer only to a single pair. Plumage characteristics may allow individuals to be recognised for periods of time (e.g. if a bird has not fully attained adult plumage or has missing or damaged feathers) and can be used to help establish the numbers of birds present and the individuals occupying a particular nesting range. Where release programmes are ongoing, fieldworkers should also check for wing tags (e.g. about 50% of the Scottish population is tagged). Nesting ranges should then be watched between January and March to locate the nest site, which may be close to an established roost. Watches of up to 3–4 hours duration can be carried out from suitable vantage points at any time of day, although until mid-February visiting all potential nest sites in the study area might prove more productive.

Whilst the literature suggests that white-tailed eagles can be very vocal in the spring, which can help in locating nest sites, those in Scotland tend to be quieter and rather unobtrusive. In other breeding locations, adults perform high circling displays near, and up to a few kilometres away from, the nest site, calling frequently and often in duet (Cramp & Simmons, 1980). Such displays often occur by a cliff or other prominent point near the eyrie, with the birds rarely circling higher than 200 m above the ground. White-tailed eagles are also well-known for flight-playing (including talon-interlocking and cartwheeling) but this may be antagonistic rather than a pair displaying, and immature birds also indulge in flight play. To date, in Scotland, these types of display have been observed only rarely, however, and are therefore likely to be less useful in survey work.

3.2.2 Locating roosts

During the breeding season, active roosts may be on crags or in trees and will have fresh faecal droppings, down, feathers and pellets. Roosts can be found by checking all suitable crags and trees within the home range; they may be over a kilometre from the nest, but many adults roost on or right next to the nest.

3.2.3 Recognition of signs

White-tailed eagle pellets are generally large, 90–110 mm long and 35–40 mm in diameter (Brown *et al.*, 2003), although they can be much smaller. Whole feet (e.g. of gulls and buzzard) have been found in pellets in Scotland. White-tailed eagle pellets cannot be easily separated from those of golden eagle, although those containing the remains of fish or seabirds are more likely to originate from the former species. The use of pellets as evidence of occupation should ideally be supported by other signs.

3.2.4 Evidence of occupancy

Sightings of a single bird or a pair of white-tailed eagles, of potential breeding age, between February and August, on more than two occasions, provide evidence of occupancy.

3.3 Evidence of breeding

3.3.1 Locating active nests

White-tailed eagles generally use the same nesting ranges for many years. New nests may be built, or old nests refurbished, at any time between September and March. Visits can be made from November until mid-February to check all known nests for refurbishment. New or refurbished nests can usually be distinguished from old ones not in use by the presence of freshly broken sticks built up into a distinct rim, or the addition of fresh grass or moss lining. Occasionally, more than one nest in a territory is refurbished in this way in any one year. There will usually be signs on the ground in the immediate vicinity of an active nest, including faeces, pellets, down and/or fresh sticks dropped from the nest. If the location of an active nest is not known, all mature woods or trees, crags or steep slopes in an area should be searched systematically, including offshore skerries and small islands. Adults may be secretive before laying, and, if disturbed during incubation, generally slip quietly off the nest and return once the disturbance is over. After hatching, adults are highly vocal if disturbed at the nest and remain in the immediate area alarm calling. Nest sites should not be disturbed from mid-February until mid-May (until young are at least 3–4 weeks old) but they can be viewed with a telescope from a safe distance.

3.3.2 Evidence of fledging

Eyries from which young have fledged successfully are littered with down and prey remains, and appear 'flattened'. Counts of large, feathered young in the eyrie during June and July can be used as a measure of the number fledged. Nests should be viewed from a distance only after the young are eight weeks old, due to the risk of causing premature fledging, especially if young in tree nests have moved into the surrounding branches. After fledging, the young remain in the vicinity of the nest site for over a month but may not be seen together, so that an accurate count of fledged young may not be possible.

3.4 Evidence for non-breeding

In Scotland, a small proportion of pairs do not breed in any one year (Bainbridge *et al.*, 2003). If an active nest or recently fledged young are not found but adult birds have been seen repeatedly within a nesting range, non-breeding may be inferred if new, active eyries have not been found after checking the area carefully.

3.5 Ageing and sexing young

Females are generally larger than males, although there is some overlap (Cramp & Simmons, 1980). Helander (1981) and Helander *et al.* (2007) measured chicks of 4–8 weeks old from the two Swedish populations: a population along the Baltic coast which extends into central and southern Sweden, and an inland population in Lapland (northern Sweden). Each nest was visited once when nestlings were expected to be 4 to 8 weeks of age and the ages of nestlings were estimated based on the stage of development and feathering. In the earlier study (Helander, 1981) the sex of nestlings was assessed visually by size differences, whereas the later study (Helander *et al.*, 2007) used DNA analysis to identify the sex of nestlings.

Between approximately 4 to 8 weeks of age, the wing length of white-tailed eagle nestlings was found to be strongly related to age, such that wing length could be used to estimate age (Figure 10). Wing length was however not found to be of use for sexing chicks.

Within broods, some young were sexed visually by the relative sizes of their beaks and feet but not all chicks could be differentiated by this method. Once nestlings were at least 25 days

old, most could be sexed from measurements. The best predictor of sex was found to be the thickness of the tarsus at the thinnest point (tarsus width, see Section 7.8.3 of Introduction) which allowed the correct determination of 95% of females and 98% of males from the Swedish Baltic population based on a cut off of 13.8 mm. Allowing for measurement accuracy, individuals with a tarsus width less than or equal to 13.5 mm were classified as males, and those measuring 14 mm or larger were classed as females (Helander *et al.*, 2007; individuals with tarsus measurements between 13.5 and 14 were presumably not assigned a sex based on this method). An index of tarsus thickness obtained by multiplying tarsus width and tarsus depth (see Section 7.8.3 of Introduction) was also found to be a good discriminator of sex for 91% of females and 96% of males from the Swedish Baltic population. Criteria for sex identification from the Swedish Baltic population were, however, not directly applicable to the population in Swedish Lapland, where nestlings are typically thinner, probably due to a more limited food supply. Many female nestlings from the Lapland population were mistakenly identified as males based on criteria for the Baltic population (Helander *et al.*, 2007). Thus for the tarsus thickness index, threshold values for differentiating between the larger females and males were 215 for birds from the Baltic Coasts, and 200 for birds from Lapland (Helander, 1981).

The Swedish studies reported above indicate that sexing of white-tailed eagle nestlings in the field is feasible with a high degree of accuracy based on a limited number of measurements, but the criteria used to separate sexes may need to be adjusted for each population (Helander *et al.*, 2007).

For a sample of Scottish white-tailed eagles, the mean tarsus thickness index was 228 for males and 288 for females, with a cut-off point of 250 suggested for differentiating between the sexes. Bill depth (at the cere) was found to be a useful supporting measurement for sexing: males had a depth less than 33 mm and females greater than 33 mm (RSPB, unpublished data). Young falling close to the cut-off points should be left unsexed.

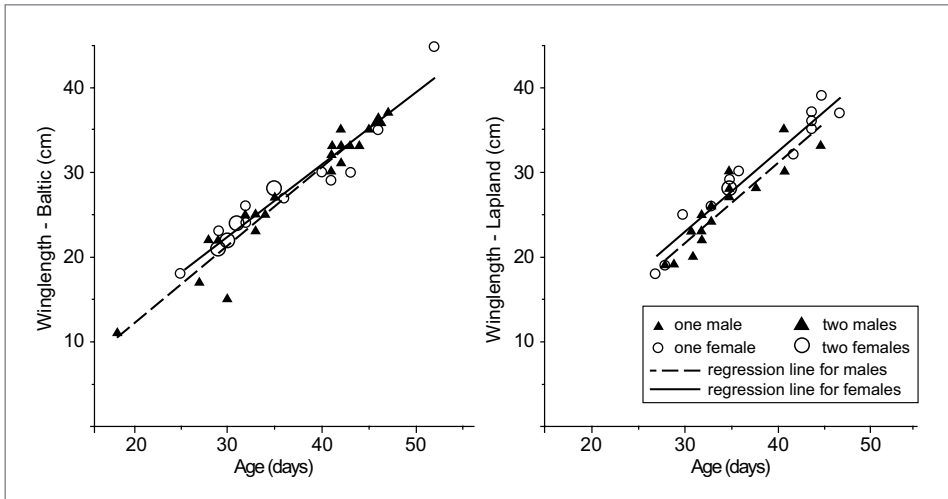


Figure 10. Relationships between wing length and estimated age of 38 male and 32 female nestling white-tailed eagles from two areas of Sweden. Although females tend to have slightly longer wings than males of the same estimated age, the difference is small at this stage of growth; overall for both sexes, $\text{age (days)} = (\text{wing length (cm)} + 5.3) / 0.91$. From Helander (1981); reproduced with kind permission from *Bird Study*.

4. SURVEYS OUTSIDE THE BREEDING SEASON

In some areas of mainland Europe, white-tailed eagles congregate at roosts in winter. These roosts generally contain immatures and some local breeding adults, although most territorial adults roost in their home ranges. Communal roosts may be in mature woodland or on crags. They can be located either by observation of returning eagles, by gaining information from local people, or by cold searching suitable woods and crags for moulted feathers, pellets and faecal droppings. Counts can then be made, from a suitable vantage point overlooking the roost site, for two hours before dusk in the evening or from first light in the morning until two hours after dawn. In Scotland, communal roosts containing large numbers of birds are rare. Despite this, searching for winter roost sites can form a useful component of population monitoring because, in an increasing population, these roosting sites are often close to the eventual breeding sites.