

# The status and ecology of a remnant population of Ring Ouzel *Turdus torquatus* in the MacGillycuddy's Reeks, Kerry

**Allan Mee**

Golden Eagle Trust, Ardpatrick, Kilmallock, Co. Limerick

Corresponding author: kerryeagle@gmail.com

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The Ring Ouzel *Turdus torquatus* is one of the most poorly studied and threatened bird species in Ireland. The species has suffered a precipitous decline in population size and range with breeding now apparently largely confined to just two counties, Kerry and Donegal. Population changes in Ireland appear to mirror widespread declines across the species' range in Britain. A study of Ring Ouzels in the MacGillycuddy's Reeks was initiated in 2008 to determine the status of the ouzel population in Kerry. Potential breeding habitat was identified and efforts made to visit all sites to locate birds. Where birds were detected and visually located, habitat characteristics were assessed. The number of apparently



occupied sites declined from eleven in 2008 to four by 2011 although some early singing males in 2008 may have been passage migrants. At least three 'core' sites remained occupied between 2012-2017. Ouzels were largely confined to high elevation sites (400-850m a.s.l.) on steep-vertical slopes with extensive rock and boulders. Song peaked in early morning (0610-0930hrs) and declined thereafter. Males sang from arrival up until at least late June suggesting that some pairs may be double-brooded. Observations suggest a possible association with wet flushes as foraging sites within short distances of nests. Ring Ouzels are at risk of extinction in Ireland. A comprehensive survey of core areas in Kerry and Donegal is urgently needed. Habitat management to restore or maintain heather-grass mosaics at key sites should be an important and urgent conservation measure for Ring Ouzels in Ireland.

## Introduction

The Ring Ouzel *Turdus torquatus* is one of the most poorly studied and understood breeding species in Ireland. The species breeds generally above 300m across northern and central Europe from Ireland to Fenno-Scandinavia and north-western Russia and Spain east to Turkmenistan and Iran (Cramp & Simmons 1998, del Hoyo *et al.* 2005). In continental Europe Ring Ouzels are birds of mountain steppe, including open coniferous forest, conifer-beech woodland, alpine scrub,

heath and subalpine meadows above the tree line (del Hoyo *et al.* 2005). The nominate northern Fenno-Scandia subspecies *T. torquatus torquatus* (including the Irish and British populations) is believed to winter mainly in the Atlas Mountains of north-west Africa (del Hoyo *et al.* 2005). In Ireland and Britain, Ring Ouzels typically inhabit uplands up to 1,200m but also down to near sea level in parts of North

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**Plate 5.** Ring Ouzel (Peter Curran).

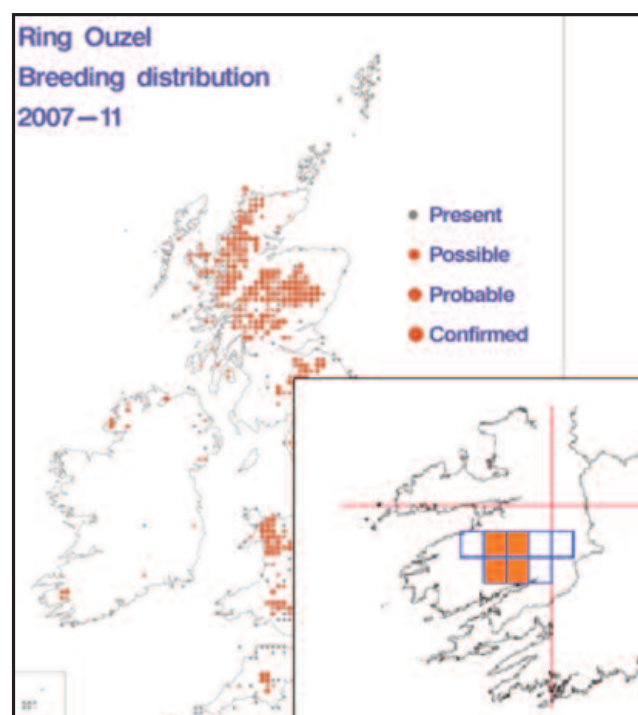
Scotland and North-west Ireland (Ussher & Warren 1900, Sim *et al.* 2010). In Ireland as in Britain, at least in recent times, Ring Ouzels have been birds of steep crags, scree slopes and ravines in mountainous areas with varying degrees of heather cover (Sim *et al.* 2010). Migrants tend to arrive back from their wintering grounds at the end of March and early April. A small number of birds overwinter although this is apparently rare (Balmer *et al.* 2013).

In Britain birds typically nest from mid-April with egg laying peaking in late April-early May (Sim *et al.* 2010, 2012). Birds may relay following nest failure or have second nests after initial broods fledge: >50% of pairs in the North York Moors, England (Hutchinson & Fairbrother 2017) and 70% of females in Glen Clunie, Scotland (Sim *et al.* 2012). Nests in Ireland and Britain appear to be almost always on the ground in cliffs, crags and gullies, but are often found in trees in Europe (del Hoyo 2005, Sim *et al.* 2010) The diet of nestlings in Britain is dominated by invertebrates especially earthworms (Lumbricidae), but also adult and larval ground beetle (Carabidae) leatherjacket larvae (Tipulidae) and other insects (Burfield 2002, Buchanan *et al.* 2006). In contrast, adults and fledged juveniles switch to foraging on berries, especially Bilberry *Vaccinium myrtillus* and Crowberry *Empetrum nigrum*, once available in Scotland (Sim *et al.* 2012) and Rowan *Sorbus aucuparia* elsewhere in Europe (del Hoyo 2005). Juniper *Juniperus communis* berries appear to be the predominant diet of wintering birds in the Atlas Mountains in Morocco and elsewhere in N Africa (del Hoyo *et al.* 2005, Ryall & Briggs 2006).

Ring Ouzels were thought to be a widespread and reasonably common breeding bird in appropriate habitat in Ireland in recent historical times. Thompson (1849) cites records of the species from the hills west of Belfast, “every one (glens or ravines) of which boasted a pair or more of these birds”, the Glens of Antrim, Donegal, Down (especially the Mournes), Carlingford Mountain in Louth, Achill Head in Mayo, the Clare hills, the Dublin and Wicklow mountains, the Slieve Aughties in Galway, Connemara, Slievenamon in Tipperary and the Comeraghs in Waterford. Thompson (1949) also noted that the Ring Ouzel “is common in the most rocky parts of the mountains of Kerry... in the same haunts with choughs and eagles”. Ussher & Warren (1900) remark that the bird was found in all counties except Meath, Westmeath, Longford and Armagh but most notably “the higher mountains of Kerry, Waterford, Tipperary, Wicklow, Galway, Mayo, Sligo, Leitrim, Donegal and Down”. A considerable decline was noted by the mid-20th century with the species having disappeared from many former haunts as well as being scarce at sites where it was still present (Kennedy *et al.* 1954). Declines in the Irish and British Ring Ouzel population were evident by the time of the first *Breeding Atlas* in 1968-72 (Sharrock 1976) and continued during the next four decades

(Gibbons *et al.* 1993, Wotton *et al.* 2002, Sim *et al.* 2010). The most recent 2007-11 *Breeding Atlas* (Balmer *et al.* 2013) revealed a 57% decline in the species breeding range in Ireland since 1968-72 with breeding confirmed in Donegal and Kerry only, mirroring declines (-47%) in Britain (Figure 1). At least one and possibly up to three pairs of Ring Ouzel still bred in the Mourne Mountains in the period 1986-95 (A. McGeehan pers. comm). Wotton *et al.* (2002) considered the species was likely extinct as a breeding bird in Northern Ireland by 1999 although a pair was since recorded at a site in Derry and birds were reported from the same area in the early 1980s. A survey for the species in Donegal in 2002 located birds at 10 sites with possibly up to 15 pairs breeding (Cox *et al.* 2002). However, upland bird surveys in Sligo, Leitrim, north-west Cavan and north Mayo in 2003 did not locate any Ring Ouzels although a pair was located in Donegal (Cummins *et al.* 2003).

The Ring Ouzel has been listed as a species of high conservation concern in Ireland due to its severely declining national population (>80%) and an extremely restricted and evidently contracting range (Colhoun & Cummins 2013). Habitat change, loss of heather cover, low adult and juvenile



**Figure 1.** Distribution and breeding status of Ring Ouzel in Ireland in 2007-2011 (Balmer *et al.* 2013). Inset shows range of the MacGillycuddy's Reeks breeding population (filled 10km squares) and previous breeding range (unfilled 10km squares) in the 1988-91 breeding Atlas (Gibbons *et al.* 1993). Map reproduced from *Bird Atlas 2007-11*, which is a joint project between BTO, BirdWatch Ireland and the Scottish Ornithologists' Club. Map reproduced with permission from the British Trust for Ornithology.





**Figure 2.** Ring Ouzel survey areas in the MacGillycuddy's Reeks and Mangerton Mountain, Kerry. Occupied sites are indicated by green triangles. No occupied sites were located in the Mangerton area. Inset shows the location of the survey area in Ireland.

survival rates, inter-specific competition with resident thrush species, habitat loss on wintering grounds, hunting pressure on migration and climate change have all been cited as driving declines (Burfield 2002, Buchanan *et al.* 2003, Beale *et al.* 2006, Ryall & Briggs 2006, Sim *et al.* 2010, 2011, Wotton *et al.* 2002). The main aim of this study was to locate potentially breeding Ring Ouzel in the MacGillycuddy's Reeks, County Kerry, in order to obtain an accurate estimate of the population size and range. As relatively little is known about the behaviour and habitat preferences of Irish Ring Ouzels, apart from the historical information (e.g. Thompson 1850, Ussher & Warren 1900) and some more recent survey work (Carruthers 1998, Cox *et al.* 2002), an additional aspect of the survey work was to investigate the ecology of the ouzel population and aspects of its breeding biology.

## Methods

The study area was the MacGillycuddy's Reeks range and outlying mountains in the Mangerton area, situated south and west of Killarney, County Kerry (Figure 2). Ring Ouzels were surveyed during the breeding season (April-July) from 2008 to 2017. All sites occupied in previous years were revisited at

least twice annually in years 2009 to 2011. Not all sites were visited in all years between 2012 and 2017. The Reeks study area covered some 52km<sup>2</sup> in area with much of the range over 800 m.a.s.l including Ireland's highest peak Corrán Tuathail (1,039 m). The main summit ridge is composed of a series of sharp arêtes and a broad summit plateau, with the north side of the Reeks marked by a series of coums (corries), small lakes and moraines. On the east side, the peaks of Purple Mountain (832 m) and Tomies (735 m) rise steeply from the of the Gap of Dunloe with extensive scree and boulder slopes. The Mangerton area is a broad plateau with its highest point at 839m. Much of the Reeks is dominated by upland grassland, heath and blanket bog.

Potential Ring Ouzel habitat was identified from aerial imagery and Ordnance Survey maps. Survey routes were designed to cover the entire study area and give the best chance of detecting singing birds. As Ring Ouzels are highly vocal their presence is best detected by song given suitable weather conditions. The survey followed recommended, previously described methods (Gilbert *et al.* 1998, Wotton *et al.* 2002) but were adapted because of the extremely steep nature of the terrain in the main Reeks study area. Conventional methods specify the use of transects 500 m apart



**Plate 6.** Male Ring Ouzel in flight near breeding site (site 10) in the MacGillycuddy's Reeks, Co. Kerry (Anthony McGeehan).

so that all areas within a tetrad ( $2 \text{ km}^2$ ) are covered to within 250 m. As Ring Ouzels are known to be especially vocal in the morning, each survey transect was completed within four hours of sunrise (e.g. 0550-0950hrs on 1 May) although additional time was spent observing occupied sites and nest sites after this time during the breeding season. Some of the more accessible sites where birds were recorded were revisited late in the day, within two hours of sunset, as thrushes, including Ring Ouzels, are known to be vocal at dusk (Cramp & Simmons 1998).

Transects were walked on both side of the main ridge with the aim of covering all areas within a tetrad to within 500m. The location of start, finish, and points along survey routes were plotted using a hand-held Global Positioning Systems (GPS) device. Every 500 m along the survey route, beginning with the initial start point, Ring Ouzel song was listened for over a minimum 10-minute period. After the first 5 minutes, if no bird was heard, a recording of ouzel song and calls was played for 20 – 30 seconds and repeated three times (Gilbert *et al.* 1998, Wotton *et al.* 2002). Following this a response (song or calls) was listened for over a five-minute period. Although playback of Ring Ouzel song was used on

transect routes during initial surveys in 2008, no audible responses were detected and playback was not used subsequently (NPWS licence required under 35 1(d) of Wildlife Act). When Ring Ouzel presence was detected (song, calls or direct observation) every effort was made to locate individuals visually and plot their location (Irish grid) as accurately as possible on a map (OSI MacGillycuddy's Reeks 1:25,000) and/or using a GPS device where observation at close range was possible. This was often difficult for birds singing at a distance from steep cliffs. Ring Ouzel often move or change position between song bursts making accurate location difficult if birds are not located visually. Ring Ouzel nest sites, where located, were observed from a minimum distance of 500m to minimise any potential disturbance or affect behaviour.

Where Ring Ouzels were located at least 30 minutes was spent at each point observing birds (usually singing males), recording their behaviour and the habitat type used (Fossitt 2000). As well as the vegetation types where ouzels were located, habitat variables were quantified visually within 50 m and 500 m of the birds to give an estimate of the habitat characteristics used by ouzels (50 m) and those habitat types available in the wider area (500 m). Habitat characteristics included percentage cover of heather, grasses, boulder, scree, rock, and open water; distance to open water; number of trees; and distance to nearest tree. Slope and aspect were also recorded as well as the number of sheep within 50/500m as an index of grazing pressure (Fuller & Gough 1999).



## Results

### Occupancy

The number of occupied sites in the core Reeks survey area, based on the number of singing males, declined from 11 sites in 2008 to just four sites in 2011 (Table 1). However, all sites were visited just once in 2008, thus it is not known if all birds were resident breeders, at least two visits are required to determine occupancy. Only two sites were occupied consistently in all years although a third site (site 9) was occupied in most years and may have been missed in 2009. Active nests were located at only two sites (sites 10, 11 in Figure 2) and birds appeared to use the same nest sites in subsequent years. No ouzels were located at sites in the Mangerton area or at other sites outside the core Reeks area known to have held ouzels in the past (Table 1).

Ring Ouzels were detected between April and July although sites were not visited before or after those dates (Table 2). Males used boulders or rock outcrops on prominent ridges as song perches. Males sang in the early morning from at least 06.10 hrs (time of first arrival on transect route). Birds were most vocal in the early morning (06.10-09.30hrs) with only very intermittent song after 09.30-10.00 hrs. No birds were detected by song after 11.45 hrs. Although few sites were visited systematically in the pre-dusk period, Ring Ouzels were recorded singing at three sites up to dark (20.00-21.30 hrs).

Singing males and/or nesting pairs were located between 400-850 m a.s.l. Mean elevation of sites did not appear to vary significantly over the study period although the elevational range of site contracted with sites at low and high elevation becoming unoccupied (Table 2). Likewise, the apparent 'density' of Ring Ouzel as measured by 'nearest neighbour

**Table 1.** Ring Ouzel occupancy at sites in the Reeks in 2008-2011, and 2012-2017 (not all sites visited in each year). Shaded sites were not visited in that year. Note that O = Occupied, X = not occupied.

Year	2008	2009	2010	2011	2012-2017
<b>Reeks (core sites)</b>					
1	O	X	X	X	X
2	O	O	X	X	X
3	O	O	O	X	X
4	O	X	X	X	X
5	O	O	X	X	X
6	O	X	X	X	X
7	O				
8	X	O	X	O	X
9	O	X	O	O	O
10	O	O	O	O	O
11	O	O	O	O	O
12	O	O	X	X	X
<b>Ex Reeks sites</b>					
Mangerton area			X		
Other sites*			X	X	X
<b>Sites occupied</b> (breeding pair estimate)	<b>11</b> (6-10)	<b>6/7</b> (5-7)	<b>4</b> (4-6)	<b>4</b> (3-5)	<b>3</b> (3) (minimum)

\*Sites (n=3) on the Iveragh peninsula known to have been occupied in the past (Carruthers 1998).

**Table 2.** Behavioural and ecological data for Ring Ouzels in the Reeks in 2008-2011. Elevation was based on singing males or nests. Nearest neighbour distance (NND) was the mean distance between neighbouring males/nests.

Year	Sites checked	Sites occupied	No. of visits	Survey period (dd/m)	Song detection range (hrs)	Elevation range (m) $\bar{x}$ = mean	NND (km)
2008	12	11	1	02/5-27/5	0700-1058	450-820 ( $\bar{x}$ = 657)	2.03
2009	15	6/7	2	21/4-03/6	0640-1145	400-800 ( $\bar{x}$ = 624)	2.37
2010	17	4	1-4	21/4-23/7	0700-1130	400-850 ( $\bar{x}$ = 650)	1.50
2011	14	3+	1-2	29/4-18/5	0610-1115	500-850 ( $\bar{x}$ = 675)	2.24



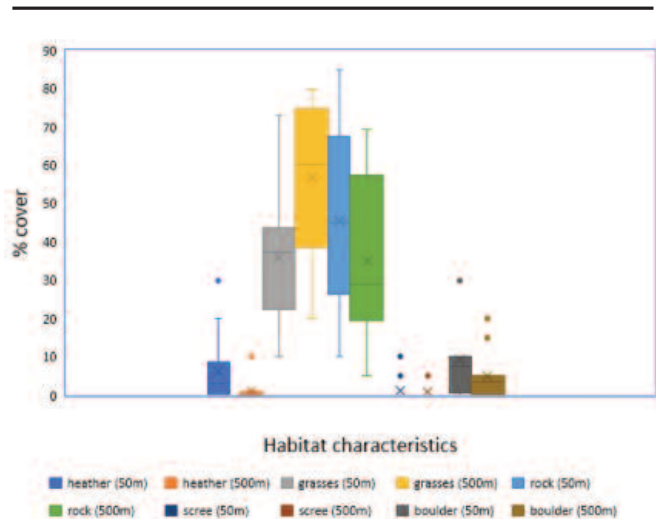
**Plate 7.** Ring Ouzel breeding habitat in the MacGillycuddy's Reeks, Co. Kerry (A. Mee).

distance' (the distance between neighbouring singing males or nest sites) varied little between years except in 2010 when one site (site 8) was unoccupied (Table 2). Instead there was an apparent consolidation of sites with the loss of birds at 'peripheral' sites with the population contracting to three 'core' sites, i.e. sites that remained occupied in most or all years.

Even though Ring Ouzels are highly territorial, interactions between neighbouring birds were rarely recorded. However, a male observed singing and preening over a 10-15 minute period, from the usual perch of the 'resident' male above a nest site (site 10) in June 2010, was subsequently chased off by the presumed resident male to more than 1km east towards the neighbouring territory (site 9) before returning a short time later. Some males at nest sites on the north side of the main ridge of the Reeks were observed to apparently cross the highest ridges to sing on the south side of the ridge although usually within 0.5km of nest sites. Males were seen with females during periods off nests, apparently acting as 'lookouts' while the female actively foraged rather than actively engaging in foraging themselves. Such close 'guarding' could be interpreted as anti-predator vigilance or possibly mate guarding early in the breeding attempt where intruding males may attempt to copulate with the female.

## Habitat

Ring Ouzels were mainly observed on very steep cliffs and ridges in largely grass dominated habitats with a high

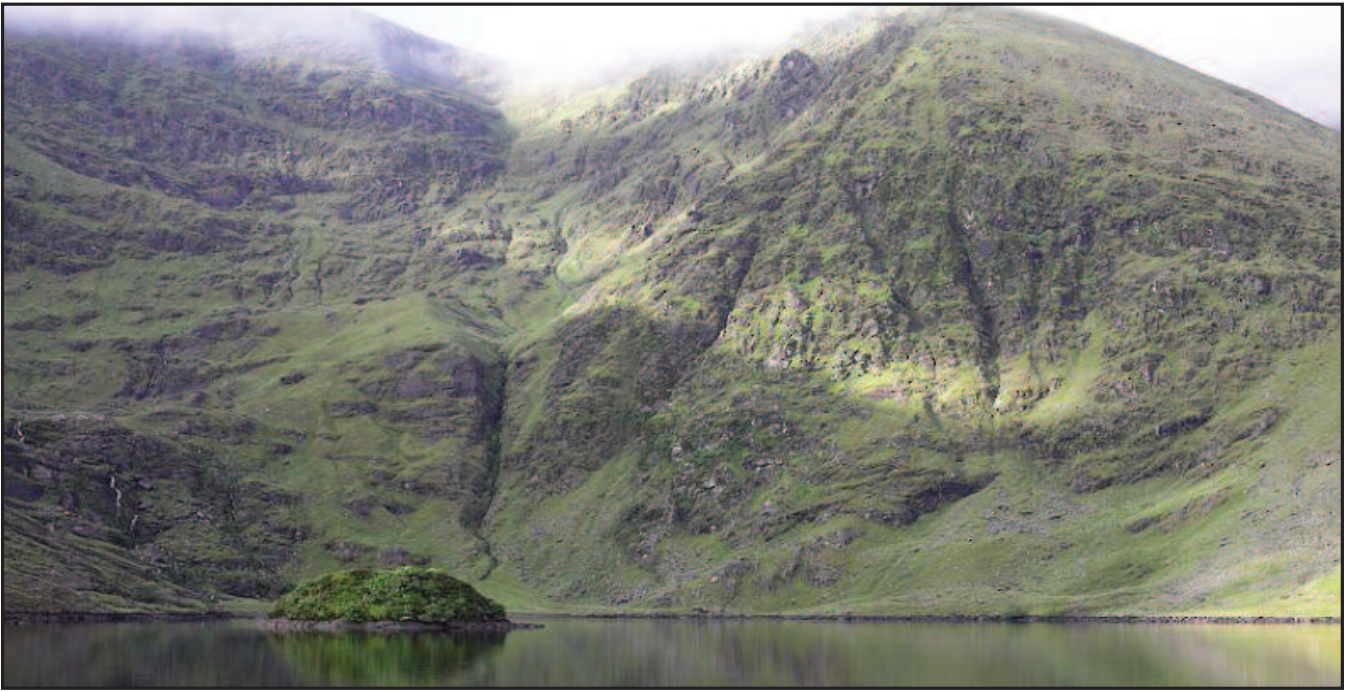


**Figure 3.** Habitat characteristic of Ring Ouzel sites at 50m and 500m radii of nests and/or singing males. Boxplots show the 50% quantiles (box), median (horizontal bar), range and outliers (dots). There were too few values for scree (values shown as dots).

proportion of exposed rock (Figure 3). The few nest sites located were on largely inaccessible steep-vertical cliffs with heather and Greater Woodrush *Luzula sylvatica* on ledges and crevices. Cliff nest sites appeared to support a greater vegetation cover (heather, woodrush) than apparently suitable but unoccupied cliffs nearby.

Of the 12 sites holding singing or breeding Ring Ouzel only three had 10% or more heather cover (0-30%) at the 50 m scale but only one (site 1) had >5% heather cover (10%) at the 500 m scale (Figure 3). All territories had extensive grass cover (30-80%) and exposed rock (15-70%) at 500 m, most with boulders on the lower slopes. Only three sites held any scree cover although extensive scree slopes exist in many parts of the Reeks. All were located on very steep-vertical slopes 150-580 m from open water (lakes or streams), although several sites held less discernible or ephemeral water sources (e. g. non-calcareous springs, temporary streams after heavy rain).

Habitat use by Ring Ouzels away from prominent song perches or nest sites was difficult to quantify as prolonged observations of birds were rare except for singing males. However, at one site both male and female were observed flying out from the nest to feed in moss-dominated non-calcareous springs (wet flushes). Birds turned over clumps of moss when foraging, presumably to find invertebrate prey. At other sites, females apparently left nests to forage on occasion in nearby flushes before returning to incubate or brood young. Foraging females away from nests seemed to favour such wet flushes, comprising moss covered areas at the base of steep slopes within 0.5 km of nest sites.



## Discussion

The MacGillycuddy's Reeks held a small population of Ring Ouzel during the main study period 2008-2011. However, the most easily accessible and regularly occupied sites (10, 11) were checked every year from 2008 to 2017 and held potential breeding Ring Ouzels (singing males or pairs) in all years. The population of Ring Ouzels monitored in the Reeks appeared to decline during the period of study, from a high of 11 apparently occupied sites in 2008 to just four by 2011. However, only one visit was made to all sites in 2008. Ring Ouzels are known to sing on migration (Cramp & Simmons 1998). Thus, some of the birds detected may have been migrants *en route* to breeding sites further north, in the UK or Scandinavia. At least two visits are required to accurately determine occupancy and thus the size of the breeding population (Gilbert *et al.* 1998). Further, while only three sites were occupied between 2012 and 2017, coverage was not as comprehensive in those years and not all sites were surveyed in all years (Table 1).

Despite these caveats it is evident that the observed Ring Ouzel population in the Reeks has declined in recent years. Only two sites (sites 10 & 11 in Figure 2, Table 1) have been occupied consistently over the study period and along with a third site (site 9), appear to form the 'core' of the small remnant population. All three sites are immediately adjacent to each other and located in north facing coums. This may be important in itself as higher summer temperatures resulting from climate change have been suggested as one of the drivers of population decline in Britain (Beale *et al.* 2006). One possibility is that warming results in drier soils and reduced earthworm availability (Sim *et al.* 2010). If this is true, then ouzels nesting in the locally cooler and more moist conditions

**Plate 8.** Ring Ouzel breeding habitat in the MacGillycuddy's Reeks, Co. Kerry. The foreground shows the contrast between the lush vegetation cover on the lake island and the steep slopes in the background (A. Mee).

in north-facing sites may be better able to persist at least in the short-term. However, an intensive check of this area (sites 10, 11) on one date in 2018 failed to locate any singing birds (Alan McCarthy pers. comm.). Regardless, the population is very small and vulnerable to local extinction (Purvis *et al.* 2000).

It is likely that the Reeks population has been in decline for some considerable time, in tandem with the significant declines in the species range in Ireland during the 20th century (Ussher & Warren 1900, Kennedy *et al.* 1954, Balmer *et al.* 2013). The Ring Ouzel range declined by 57% in Ireland in the 40 years between the first *Breeding Atlas* in 1968-72 and the most recent in 2007-11 (Balmer *et al.* 2013). However, there were no confirmed or probable breeding records for Ring Ouzel in the Reeks in the 1968-72 *Breeding Atlas* (Sharrock 1976). In contrast to continued declines elsewhere in Ireland, the second *Breeding Atlas* in 1988-91 (Gibbons *et al.* 1993) found that "there has been an interesting colonisation of Co. Kerry." However, a much more likely explanation for this apparent increase is that much or all of the breeding population went undetected in the 1968-72 survey (Hutchinson 1989). Much of the terrain occupied by Ring Ouzels in the Reeks is difficult to access and, as this study suggests, survey work after 09.30hrs would have likely missed most singing males. Moreover, the second *Breeding Atlas* coincided with the first serious survey of the species in Kerry (Carruthers 1998). Carruthers (1998) estimated the breeding



population in Kerry to be probably no more than 10 to 15 pairs, located mainly in the Reeks, but also the Mangerton area and at a site on the Dingle peninsula. Evidently Ring Ouzels have further declined in both range and population size since the early 1990s. This study failed to locate birds in the Mangerton area despite the apparent suitability of much of the habitat in that area. Likewise, there have been no recent records of Ring Ouzel in the breeding season in the Dingle peninsula despite some dedicated efforts to locate singing males (Michael O'Clery pers. comm.). Thus, it appears likely that the population has contracted to a tiny core area in the central Reeks.

Recent reports of breeding Ring Ouzel elsewhere in Ireland have been scarce in the last 10-20 years (see Annual Reports of Irish Rare Breeding Birds Panel). However, as in Kerry, a small population continues to persist in south-west Donegal (Cox *et al.* 2002, McGeehan & Wyllie 2012, Balmer *et al.* 2013). Outside of Kerry and Donegal reports of ouzels in breeding habitat in summer are very scarce (Perry & Newton 2014). A pair probably bred at a site in Sligo in 2015 (see Newton 2016) and single birds have been recorded in the Wicklow and Tipperary, although without breeding evidence (eg., see Hillis 2008).

Much of the Reeks is devoid of heather cover apart from the western slopes and a few outlying hills, the Gap of Dunloe and the Tomies-Purple Mountain area. A mosaic of heather patches as cover and open areas to forage appear to be important habitat preferences for Ring Ouzels in Britain and this is also likely to be the case in Ireland. Sim *et al.* (2007) found that ouzel breeding sites in south-east Scotland were composed of heather or grass-heather mosaics within 100m of nests. Moreover, those territories at higher elevation and with greater heather cover were more likely to persist as breeding sites compared to those that became defunct. Likewise, the abundance of Ring Ouzels on a national scale in Scotland was also associated with heather-grass mosaics (Buchanan *et al.* 2003). Cover provided by heather in the vicinity of nests appears to be a key criterion in nest site selection while short grass for foraging nearby appears to be important during the nestling phase (Sim *et al.* 2007). Cover provided by vegetation, especially heather, may also provide protection from potential predators. Anecdotal evidence from observation of Ring Ouzels in song in the Reeks during this study suggest that birds may respond to the presence of potential nest predators such as Common Ravens *Corvus corax* by becoming quiet. Ravens were sometimes attracted into ouzel breeding areas in the Reeks by the presence of sheep carrion, possibly due to falls from steep cliffs. Avian predators can be an important factor in Ring Ouzel breeding success and post-fledging juvenile survival (Smith 2006, Sim *et al.* 2013). This is also likely to be the case in Ireland where the loss of heather cover on many former Ring Ouzel breeding haunts is likely to

increase predation risk for fledged young (Sim *et al.* 2013).

The increasing human footprint as a result of steadily increasing numbers of recreational users in the Reeks (125,000 reported accessing the Reeks in 2017, MacGillycuddy's Reeks Mountain Access Forum) may also impact Ring Ouzels by increasing disturbance at sensitive sites. Nest desertion and failure due to disturbance from walkers and rock climbers has been an important factor in the Peak District, Britain (Melling 2003, Leyland 2016). Additionally, high densities of recreational users and their subsequent food or waste remains may also increase predation pressure by attracting corvids to remote areas. Although most of the known Ring Ouzel sites in the Reeks are unlikely to be directly impacted by disturbance due to their location away from the most popular hiking routes, one of the 'core' sites (site 11) is located within metres of an increasingly busy climbing and walking route. Further, Ravens are a constant presence in the Corrán Tuathail area possibly due to the presence of humans and the associated food waste discarded by hikers.

Nest sites favoured by the remnant Irish population appear to be similar to British populations with the few nest sites located in the Reeks being characterised by some heather and woodrush cover. Heather cover also appears to characterise some of the remaining Ring Ouzel sites elsewhere in Ireland such as in Donegal (Cox *et al.* 2002). It is likely that decades, if not centuries of intensive grazing, principally by sheep, and burning has had a deleterious effect on the extent of heather cover in the Reeks. Loss of heather cover resulting from burning followed by grazing has well documented in other upland mountain areas in recent decades, such as the Galtee Mountains (Tipperary-Limerick), where year-round sheep grazing has replaced the booley system (transhumance) of summer grazing by cattle in the uplands, practiced in the Galtee Mountains up until the latter half of the 19th century (Costello 2016).

Ring Ouzel declines in Scotland have also resulted from habitat loss to large-scale afforestation with the negative effects of afforestation also appearing to extend outside the 'forest footprint' perhaps due to habitat fragmentation and increased predation risk (Buchanan *et al.* 2003). Large-scale afforestation commenced in Ireland after declines in Ring Ouzel populations were underway (Kennedy *et al.* 1954) and little afforestation has taken place in the Reeks to date, indicating that afforestation is unlikely to explain declines in the Reeks. However, it is plausible that large scale afforestation in former strongholds such as the Wicklow mountains (see Sharrock 1976) may have accelerated such declines directly due to habitat loss and indirectly due to increased predation risk in the remaining unplanted habitat fragments.

A perhaps neglected area of research has been post-breeding dispersal in the breeding areas (Sim *et al.* 2013). Ring Ouzels are especially dependent on crops of berries of various



plants in the post-fledging dispersal period, most notably Bilberry, Crowberry and Rowan (Burfield 2002, del Hoyo *et al.* 2005). Crowberry is scarce in Ireland except in the North-west where it is at the southern/western edge of its European range, and so is unlikely to have been an important food source for Ring Ouzels in Kerry. Thompson (1849) noted that Ring Ouzels are “stated to appear there (mountains of Dublin and Wicklow) in flocks in spring and autumn, at the latter season to eat the berries of the mountain ash.” Rowan occurs sparsely in the Reeks as does bilberry, probably due to long decades of browsing by livestock, mainly sheep and goats (Hester *et al.* 1998). The latter may be important in that goats can access cliffs and other precipitous slopes that hold remnant rowan. However, there is some anecdotal evidence in the Reeks of small groups of Ring Ouzel, possibly post-fledging family parties, being encountered on the slopes of Mangerton, where there is relatively good growth of berry-bearing shrubs, especially Bilberry. It is likely that family parties of adults and juveniles may disperse locally in late summer to areas with good berry crops. The importance of these ‘post-fledging dispersal’ areas for juvenile survival may be critical but we know little about the extent and continued use, if any, of these areas.

While we know little of the history of grazing in the Reeks, Weld (1807) gives some insight into this on an expedition to Corrán Tuathail in the early 19th century: “On the summit of this mountain (Strickeen Mountain) we found an extensive tract of ground, less encumbered by rocks than the valley below, and covered as far as the eye could see with heath and coarse grass, on which innumerable herds of cattle were fed.” It is possible that a shift from summer grazing on the slopes of the Reeks to year-round sheep grazing has had a detrimental effect on the vegetation, gradually replacing upland heath with grasses. Studies have shown that excluding sheep from heavily degraded and species poor upland blanket bog can have restorative effects including crowberry and heather regeneration (Rawes 1983) but this effect may be negated by increased deer grazing and/or burning (Hope *et al.* 1996). However, ceasing grazing in large-scale grass dominated uplands such as the Reeks is likely to be impractical for social reasons where local communities are largely dependent on extensive sheep grazing. Moreover, the very low base of heather cover is likely to preclude successful regeneration. Experimental light mixed grazing allied to seeding has been shown to be successful (Mitchell *et al.* 2013) and could be trialled in the Reeks. Furthermore, observations, albeit limited, suggest that non-calcareous springs (wet flushes) may be important for foraging Ring Ouzels during the breeding season. Buchanan *et al.* (2006) note that management which creates a mosaic of habitats and the presence of wet flushes associated with spring emergence of

adult insects may increase invertebrate food for birds.

Although the global conservation status of Ring Ouzel is classed as of least concern (del Hoyo *et al.* 2005), populations within Ireland and the UK are in serious decline. Thus, the species is red-listed and at risk of extinction in Ireland (Colhoun & Cummins 2013). Habitat change in the uplands, loss of heather cover, low survival rates, effects on wintering grounds, hunting pressure on migration, predation, and climate change have been cited as driving declines in this enigmatic upland bird species (Burfield 2002, Buchanan *et al.* 2003, Beale *et al.* 2006, Ryall & Briggs 2006, Sim *et al.* 2010, 2011, 2013, Wotton *et al.* 2002). Ring Ouzels lack the protection provided by conservation measures put in place under the EU Birds Directive (2009/147/EC) such as the designation of Special Protection Areas as they are not an Annex 1 species. Moreover, a Species Action Plan has yet to be developed although a number of important targeted actions have been proposed for key upland bird species including Ring Ouzel (BirdWatch Ireland 2010) but these remain to be implemented. Areas of critical importance for the few remaining remnant populations within Ireland should be identified and given high conservation priority. A comprehensive survey of the remnant populations, where they persist, in the Reeks and Donegal is urgently needed. Habitat management to increase heather cover and enhance or maintain suitable heather-grass mosaics at key sites should be an important and urgent conservation measure. This could be the basis of local results-based agri-environment projects or schemes targeted in the immediate term on the few remaining key sites. Further research including determining factors influencing nest success and post-fledging survival rates, identifying important post-fledging foraging areas are also important in understanding the factors underlying population trends.

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