Scottish Raptor Monitoring Scheme Annual Report 2017

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Front cover image: Juvenile Kestrel in Fife (Robin Mason).
Back cover image: Short-eared Owl in Perthshire (Keith Brockie).

Contents

Foreword

Welcome to the 2017 report - I hope you enjoy it. Looking back at the breeding season it was clearly a bit mixed. In some areas good vole numbers helped productivity of Hen Harriers and some owls yet in others the prolonged rainfall in midsummer during chick rearing had impacts regionally on both Buzzards and Goshawks. It is good to see that records submitted again topped 6,000. After a run of three years of national raptor surveys there was a risk that these extensive surveys may have exhausted some observers who put in extra effort during these years!

Speaking of national surveys, the 2016 Hen Harrier paper has very recently been published. The next raptor survey under the SCARABBS programme is Merlin in 2020. The Merlin article in this report provides an update of ongoing RSPB research into potential drivers of Merlin population change ahead of that survey.

The SRMS continues to develop with significant progress made on finalising an improved data sharing policy and the near completion of the online data submission system. The latter will be operational from the 2019 breeding season. However, we will continue to accept submissions via the SRMS spreadsheet whilst the online system 'beds in'. The online system will make data input (and checking and reporting) more efficient and I would strongly encourage people to use it once it is available.

With these other developments taking priority the piloting of Raptor Patch has been reviewed, again covered in the report. It is clearly a way of encouraging new people into raptor monitoring and raises the bigger issue that many recording schemes have, that of getting new, and dare I say it, younger people, involved. I think it is incumbent on all of us to encourage people to take an interest in monitoring our spectacular raptors and owls.

Thanks are due once again to partner representatives on the SRMG and their organisations for continuing support of the SRMS and in particular to Amy as the SRMS Coordinator who is working extremely hard to further the aims of the Scheme.

Andrew Stevenson (Chair of the Scottish Raptor Monitoring Scheme)
on behalf of the Scottish Raptor Monitoring Group.

Regular readers of the SRMS annual report will note that in this new format, which we initiated for the 2015 Annual Report, we present fewer data tables than in previous editions. Species-specific and regional breakdowns showing the results of monitored breeding attempts can be found on the species-specific pages of the SRMS website: http://raptormonitoring.org/

1 ROUND-UP OF RAPTOR MONITORING SEASON IN 2017

The Scottish Raptor Monitoring Scheme received more than 6,300 records of checked raptor home ranges in 2017. This represents a tremendous effort from SRMS contributors to whom we are extremely grateful. This section provides an overview of the 2017 season, setting the scene for the weather conditions and prey situation that Scottish raptors experienced. Here we also provide a summary of the records received from each region of Scotland in 2017, along with some species highlights, and provide links to more detailed breakdowns on the SRMS website.

WEATHER

Overall the winter of 2016-2017 was dry and mild relative to the 1981-2010 average and this weather continued into the spring. These drier than average conditions boded well for raptor species that principally rely on a diet of voles as the seasonal abundance of voles can be negatively impacted by wet winters.

It was a particularly wet June, the second wettest since 1910, with 172% average rainfall. Southern and eastern Scotland exceeded twice their average rainfall. This was followed by a wetter than average July, with the south-west being particularly wet. Such wet conditions at this time in the breeding season are likely to have impacted ground nesting raptors, such as Hen Harrier and Merlin in particular, through chicks in the nest suffering from exposure.

VOLE ABUNDANCE

Cyclic changes in the annual and seasonal abundance of voles can have a profound effect on the number of pairs and breeding success of a number of raptor and owl species (e.g. Petty *et al.* 2000; Lambin *et al.* 2000), particularly affecting Kestrel (Figure 1), Barn Owl and Short-eared Owl (Village 1990; Korpimäki & Norrdahl 1991, Taylor 1994). If vole populations reach a peak during the spring, these predators can respond with an increase in the number of pairs settling to breed and a corresponding increase in brood size, nesting success and productivity. Conversely, when vole numbers are low, the reverse can occur. Vole numbers in many areas of Scotland were high and this was reflected by high occupancy and breeding productivity for all owl species in 2017.

Figure 1: Kestrel breeding success is heavily influenced by vole abundance. (Photo: Robin Manson, Tayside RSG).

MONITORING

In general, raptor workers try to visit known home ranges and other suitable habitat several times before and during the breeding season, with the aim of establishing whether ranges are occupied or not. In 2017, a total of 6,362 raptor home ranges in Scotland received at least one visit to check for occupancy (Table 1). Figure 2 shows a summary of raptor monitoring coverage in 2017, depicting 10 km squares that received at least one visit to check for occupancy. Not all of these home ranges held pairs: some had only single birds and others were apparently vacant. The regional breakdown of home ranges checked in 2017 can be seen in Table 1.

Equally important to checking occupancy are follow-up visits to confirm the findings of the first visit and to monitor the nesting success of birds present. The nesting success, normally expressed as the percentage of monitored breeding pairs producing fledged young, together with the mean brood size, provides

one measure of the health of the population. In 2017, 3,122 potential breeding pairs received further visits, enabling their nest success to be determined.

Species-specific and regional breakdowns showing the results of monitored breeding attempts can be found on the SRMS website, http://raptormonitoring.org/.

It is important to recognise that, for the majority of species, not all breeding pairs were monitored, thus the numbers presented do not represent entire populations or provide a complete picture of breeding productivity, at either regional or national scales. Table 1 provides the most recent population estimates available for each species to help contextualise the SRMS data.

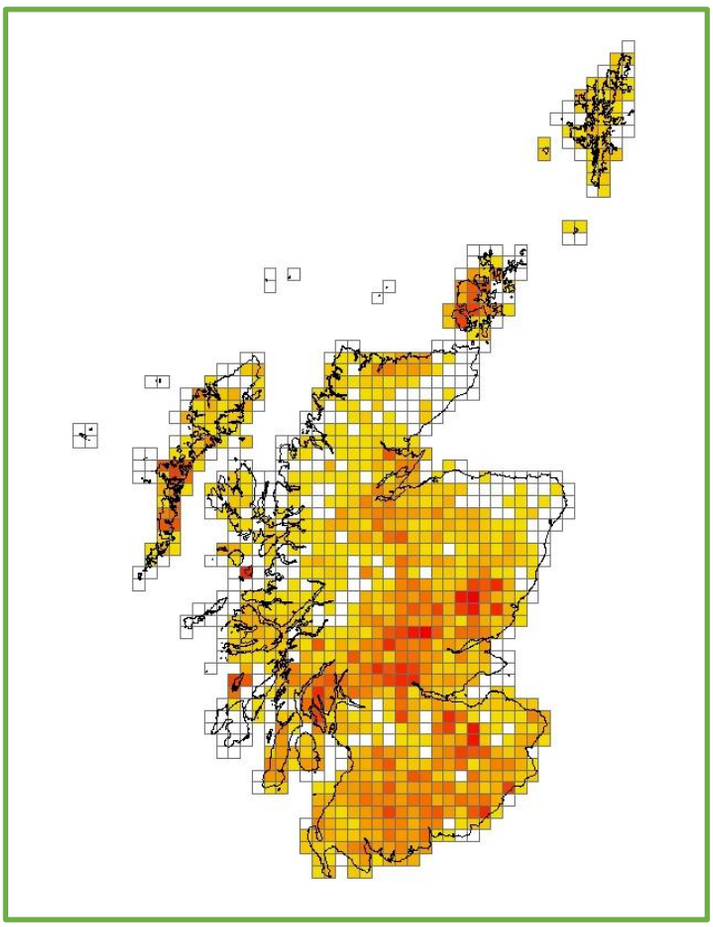

Figure 2: Raptor, owl and Raven monitoring coverage in Scotland in 2017. For each 10 km square, this map illustrates the number of SRMS species for which occupancy (or absence) was recorded. The redder the square, the more species were covered. The maximum number of species checked for occupancy in a single square in 2017 was 11. White squares indicate no monitoring records for 2017. N.B. This figure masks variation in coverage at finer geographic scales and work is ongoing to improve our knowledge of coverage.

All SRMS fieldworkers are asked to follow best practice guidance for raptor monitoring set out in Hardey *et al*. (2013). For more information about what raptor monitoring entails please visit: http://raptormonitoring.org/raptor-monitoring

Table 1. The number of home ranges of raptors, owls and Raven checked in 2017 that were submitted to the Scottish Raptor Monitoring Scheme. For a given region and species combination a "-" indicates that the SRMS does not hold any previous records and "0" indicates that no records were provided for 2017 (but that SRMS does hold records from previous years). The most recent population estimates available for each species are also presented for context, where possible for Scotland, otherwise for a broader geographic region.

Species	Argyll	Central Scotland	Dumfries & Galloway	Highland	Lewis & Harris	Lothian & Borders	North-east Scotland	Orkney	Shetland	South Strathclyde	Tayside	Uist	TOTAL	Estimated population size (pairs)	Region estimate relates to	Year estimate relates to
Honey-buzzard	-	-	3	2	-	-	-	-	-	-	2	0	**7**	< 10	Scotland	2003-2015[1]
Red Kite	-	41	131	9	-	2	32	-	-	0	85	0	**300**	≥ 273	Scotland	2015[1]
White-tailed Eagle	34	-	-	53	25	-	1	1	-	-	3	10	**127**	≥ 91	Scotland	2015[1]
Marsh Harrier	0	1	-	0	-	0	1	0	-	-	9	0	**11**	< 10	Scotland	2003-2015[1]
Hen Harrier	74	7	17	63	1	16	12	241	-	104	70	30	**635**	460	Scotland	2016[2]
Goshawk	-	8	35	10	-	46	0	-	-	12	26	0	**137**	705	UK	2016[3]
Sparrowhawk	22	51	2	9	0	11	1	28	-	10	23	5	**162**	35,000	UK	2009[4]
Buzzard	118	57	58	134	4	59	6	17	-	22	295	23	**793**	57,000–77,000	UK	2009[4]
Golden Eagle	54	8	2	170	30	3	0	-	-	0	36	23	**326**	508	Scotland	2015[5]
Osprey	25	46	15	101	-	15	42	-	-	2	80	0	**326**	250	UK	2016[3]
Barn Owl	117	174	274	29	-	74	1	-	-	61	21	0	**751**	500–1000	Scotland	post 2004[6]
Little Owl	-	-	-	-	-	3	-	-	-	-	-	0	**3**	<10	Scotland	2015[1]
Tawny Owl	91	121	61	49	-	60	1	-	-	2	29	0	**414**	50,000	UK	2015[4]
Long-eared Owl	7	20	0	13	-	16	0	4	-	0	19	13	**92**	1,800–6,000	UK	2007-2011[4]
Short-eared Owl	6	14	22	8	-	8	0	82	1	12	21	9	**183**	620–2,180	UK	2007-2011[4]
Kestrel	33	41	26	20	2	47	0	42	-	33	59	15	**318**	2,750–5,500	Scotland	2013[7]
Merlin	2	3	10	112	6	40	106	81	78	14	64	9	**525**	733	Scotland	2008[8]
Hobby	-	-	-	1	-	0	-	-	-	-	5	0	**6**	689	UK	2016[3]
Peregrine	33	44	117	54	5	142	20	32	20	82	110	6	**665**	523 (479-592)	Scotland	2014[9]
Raven	73	62	84	42	10	45	1	28	46	61	97	32	**581**	7,400	UK & IOM	2009[4]
TOTAL:	**689**	**698**	**857**	**879**	**83**	**587**	**224**	**556**	**145**	**415**	**1054**	**175**	**6362**			

Sources of estimated population sizes: [1]Challis *et al*. 2016; [2]Wotton *et al*. 2018; [3]Holling *et al*. 2018; [4]Musgrove *et al*. 2013; [5]Hayhow *et al*. 2017; [6]Shaw 2007; [7] Wilson *et al*. 2015; [8]Ewing *et al*. 2011; [9]Wilson *et al*. 2018.

SPECIES SUMMARIES

Throughout this report the names of birds follow the SOC list of English vernacular names (http://www.the-soc.org.uk/bird-recording/the-scottish-list/).

The following species accounts principally draw on the information presented in our SRMS summary tables which can be accessed on the SRMS website. The tables summarise the records which the SRMS has received in standard SRMS format and have therefore passed through our quality assurance processes set out in the SRMS Data Sharing & Use Policy.

Honey-buzzard

Only seven records for checked home ranges were reported to the SRMS in 2017 – three in Dumfries & Galloway, two in Inverness-shire and two in Angus.

Honey-buzzard has remained an overlooked species in Scotland though the SRMS was pleased to hear of a couple of studies that have become established in Tayside & Central Scotland (McInerny *et al*. 2017; Shaw *et al*. 2017 and McInerny *et al*. 2018). A team of around 20 observers are involved monitoring these birds across both the study areas. Full details are not available to the SRMS (hence the data do not appear in our summary tables) though we hope that in future the data might be shared fully with us so that the data can be used effectively for routine SRMS work including annual reporting.

Red Kite

In 2017, 228 of 300 home ranges checked were occupied by pairs. There was a significant drop in the number of pairs monitored compared to last year, from 215 pairs to 155 pairs, which can largely be accounted for by the Dumfries & Galloway SRSG branch shifting the focus of their fieldwork. In Dumfries & Galloway the continued growth of the population, means those monitoring Red Kite cannot not cover all established pairs and search for new peripheral ones, and are now targeting monitoring at a large sample of established pairs and monitoring any new peripheral pairs in new areas (George Christie, pers. comm.). Since the RSPB's monitoring of Red Kites from the reintroduced Black Isle population ended in 2015, unfortunately only a small sample of the population is receiving full monitoring coverage, with only seven pairs monitored in 2017. Of 155 pairs that were monitored across Scotland as a whole, 153 were confirmed to lay eggs. A total of 129 pairs went on to fledge a minimum of 216 young. Two pairs of Red Kite successfully bred in the Scottish Borders for the first time since they became extinct in Scotland in the late 19th Century (Lothian & Borders Raptor Study Group 2017 report).

White tailed-Eagle

In 2017, 122 of 127 home ranges checked were occupied by pairs. A total of 65 pairs fledged a minimum of 86 young.

In Tayside a male White-tailed Eagle provisioned two nests approximately 48 km apart – one in Fife and one in Angus. While twins hatched at each nest only one young successfully fledged from each nest (Owen Selly, RSPB). On Mull an infertile pair was found incubating three Greylag Goose eggs on the ground, a previously unrecorded behaviour for this species (Dave Sexton, RSPB). The eggs were eventually predated by crows.

Marsh Harrier

In 2017, eight pairs were located across Scotland. Six of these were at the Tay reed beds which form part of the Firth of Tay & Eden Estuary SPA, the only site in Scotland for which this species is a qualifying feature. For the first time since the SRMS was established we received a record of a breeding pair in Clackmannanshire, Central Scotland. Of eight pairs that were monitored all were successful fledging a minimum of 18 young.

Hen Harrier

In 2017, 284 of 635 home ranges checked were occupied by pairs with a further 59 ranges occupied by single birds. Of 252 pairs that were monitored, 175 were confirmed to lay eggs. A

total of 119 pairs went on to fledge a minimum of 354 young. Productivity was relatively high, with 3.0 young per successful pair, which likely reflects the high vole abundance in many areas of Scotland. This compares with 2.5 young per successful pair reported during the 2016 national survey.

Goshawk

In 2017, 96 of 137 home ranges checked were occupied by pairs, with a further 14 home ranges in use (either single birds or fresh signs were reported). Of 88 pairs that were monitored, 76 were confirmed to lay eggs. A total of 64 pairs went on to fledge a minimum of 134 young. Some summary information provided for a long-term study in North-east Scotland (N.B. excluded from our summary tables as unfortunately full data were not provided to the SRMS) suggested that Goshawks had a particularly poor year here with low productivity (1.53 young per breeding attempt) and an average fledged brood size of 2.00 (Mick Marquiss, pers. comm.). Heavy rain in part of the nestling period was believed to be responsible for high nestling mortality.

Sparrowhawk

In 2017, 89 of the 162 home ranges checked were occupied by pairs. Of 81 pairs that were monitored, 77 were confirmed to lay eggs. A total of 67 pairs went on to fledge a minimum of 211 young. Disappointingly, the survey effort within the long-term study in Edinburgh has declined over the last two years. More Edinburgh-based volunteers wishing to take up a *Raptor Patch* within this urban setting would be extremely valuable to help keep this run of monitoring data going into the future. To find out more about getting involved with *Raptor Patch* please see: http://raptormonitoring.org/getting-involved/raptor-patch.

Buzzard

In 2017, 558 of 793 home ranges checked were occupied by pairs, with a further 37 ranges occupied by single birds. Of 440 pairs that were monitored, 417 were confirmed to lay eggs. A total of 392 pairs went on to fledge a minimum of 681 young. Breeding productivity varied across Scotland from 1.4 young fledged per successful pair in North-east Scotland, South Strathclyde and Tayside to 2.3 in Central Scotland. In a long-term study area in Easter Ross breeding performance was the third worst lowest since monitoring began in 1991 (Highland Raptor Study Group Annual Report 2017).

Golden Eagle

In 2017, 288 of 326 home ranges checked were occupied by pairs, with a further 18 home ranges in use (either single birds or fresh signs were reported). Of 214 pairs that were monitored, 164 were confirmed to lay eggs. A total of 120 pairs went on to fledge a minimum of 143 young. The increase in number of occupied territories reported in Highland in 2016 has continued into 2017, with some territories being reoccupied after many years of being vacant and a small number of new territories that have not known to have held Golden Eagle previously have been occupied for the first time (Stuart Benn, pers. comm.).

Osprey

In 2017, 226 of 326 home ranges checked were occupied by pairs. A further 14 home ranges were occupied by single birds. Of 207 pairs that were monitored, 187 were confirmed to lay eggs. A total of 158 pairs went on to fledge a minimum of 303 young.

The Roy Dennis Wildlife Foundation reported late arrival of many birds and a higher number of failed returns of older breeders than usual due to poor weather conditions in the Iberian Peninsula during migration.

Barn Owl

In 2017, 389 of 751 home ranges checked were occupied by pairs with a further 57 sites occupied by single birds. Of 346 pairs that were monitored, 342 were confirmed to lay eggs. A total of 330 pairs went on to fledge a minimum of 1,175 young. Productivity was 3.4 young per

laying pair, which is the second highest (after 2014) since the SRMS began reporting in 2003.

Little Owl

This species continues to be a very scarce breeder in Scotland, with a third newly located site reported in the Scottish Borders in 2017.

Tawny Owl

In 2017, 233 of 414 home ranges checked were occupied by pairs. A total of 197 pairs went on to fledge a minimum of 447 young. Productivity was 2.3 young fledged per pair occupied home range monitored, which is the highest since the SRMS began reporting in 2003. The high vole abundance caused this high occupancy rate and breeding productivity.

Figure 3: Tawny Owl brood in Perthshire. (Photo: Keith Brockie, Tayside RSG).

Long-eared Owl

This secretive nature of this owl makes it a challenging species to monitor and Long-eared Owl remains one of our most unreported SRMS species in Scotland. 56 pairs were located in 2017. All 50 pairs that were monitored were successful, fledging a minimum of 133 young.

Short-eared Owl

Following the very poor year in 2016, 2017 was a very good season for Short-eared Owl with 95 of 183 home ranges checked occupied by pairs and a further 42 home ranges occupied by single birds. In Perthshire a pair laid a clutch of ten eggs (Neil Morrison, pers. comm.). Across Scotland average productivity was 3.1 young fledged per successful pair, the highest since the SRMS began reporting in 2003.

Kestrel

In 2017, 180 of 318 home ranges checked were occupied by pairs. Of 143 pairs that were monitored, 125 were confirmed to lay eggs. A total of 118 pairs went on to fledge a minimum of 412 young.

SRMG is supporting the production of an objective scientific review of the current drivers of decline in the Scottish Kestrel population, a piece of work led by Staffan Roos (formerly of RSPB) and Gordon Riddle (South Strathclyde RSG & SOC).

Merlin

In 2017, 174 of 521 home ranges checked were occupied by pairs. Of 142 pairs that were monitored, 126 were confirmed to lay eggs. A total of 102 pairs went on to fledge a minimum of 288 young. Data from several long-term Merlin studies in Scotland are being used in an RSPB project investigating the drivers of regional Merlin declines. Read more about this work in Chapter 3: *How has SRMS data been used over the last year?*

Figure 4: Short-eared Owl brood in Perthshire. (Photo: Keith Brockie, Tayside RSG)

Hobby

This is a scarce breeding raptor in Scotland. In 2017, two of six home ranges (known to have been used in recent years) checked were occupied by pairs. Two monitored pairs in Angus both successfully fledged a minimum of one young each.

Peregrine

In 2017, 306 of 668 home ranges checked were occupied by pairs, with a further 38 home ranges in use (either single birds or where fresh signs were reported). Of 270 pairs that were monitored, 225 were confirmed to lay eggs. A total of 194 pairs went on to fledge a minimum of 411 young.

Raven

In 2017, 430 of 581 home ranges checked were occupied by pairs. Of 338 monitored pairs, 300 were confirmed to lay eggs. A total of 278 pairs went on to fledge a minimum of 738 young.

Scarcer species

When the SRMS receives data on breeding attempts by irregular breeders such as Snowy Owl, Pallid Harrier and Montagu's Harrier we will include them in the annual report. No such records were supplied to the SRMS for the 2017 breeding season.

2 KEEPING IT LOCAL

The Scottish Raptor Monitoring Scheme (SRMS) relies on the breadth of knowledge and skills of its existing contributors to produce high quality information on raptors in Scotland. The Scottish Raptor Monitoring Group (SRMG), which oversees the work of the SRMS, recognises the importance of fostering these skills and also motivating a new generation to take up raptor monitoring.

In this issue, we take a look back at the pilot two years of our *Raptor Patch* survey to see what we have learned and how we might develop *Raptor Patch* in the future.

WHAT DOES RAPTOR PATCH INVOLVE?

The *Raptor Patch* survey involves individuals or groups of individuals taking on the monitoring of raptors within a discrete geographic area, or "patch".

The species that *Raptor Patch* is targeting include Buzzard, Kestrel, Sparrowhawk and Raven. All these species are considered appropriate species for new volunteers to monitor as they are less rare, threatened or vulnerable relative to some of our other raptors and therefore a special licence is not required to monitor them.

The emphasis of *Raptor Patch* is to achieve complete coverage of the whole patch, i.e. checking it thoroughly to attempt to locate every breeding pair of at least one of the *Raptor Patch* species. Volunteers are asked to identify at the outset which species or multiple species they are focussing on. Monitoring in this way ensures that the data are as useful to the SRMS as possible when it comes to producing robust trends in numbers and productivity.

In order to ensure that complete coverage is possible the SRMS recommends that the ideal size for a *Raptor Patch* is about a tetrad (2 km x 2 km square) to keep it manageable. *Raptor Patch*es do not, however, have to strictly follow the Ordnance Survey grid and can, for example, follow physical features within the landscape that are easier to follow on the ground such as roads and water courses. *Raptor Patches* should also be representative of the wider landscape in which they sit. In most landscapes this will likely involve incorporating several habitat types within the *Raptor Patch* rather than just a single habitat. Figure 5 shows some examples of suitable versus unsuitable patches.

WHY DID THE SRMS DEVELOP RAPTOR PATCH IN THE FIRST PLACE?

The rationale behind the SRMS developing *Raptor Patch* was:

- To provide additional information for the more widespread raptor species in Scotland that can be used to generate population trends, and to provide a basis for measuring breeding success.
- To provide an opportunity to fill gaps (species/regionally/habitats) in current raptor monitoring in Scotland.
- To engage additional volunteers new to raptor monitoring, and give them the skills and confidence to make important contributions to Scottish raptor monitoring. This will over time enhance the overall available information on Scottish raptors, particularly the widespread species.
- To complement the training and mentoring being carried out by the Scottish Raptor Study Group.

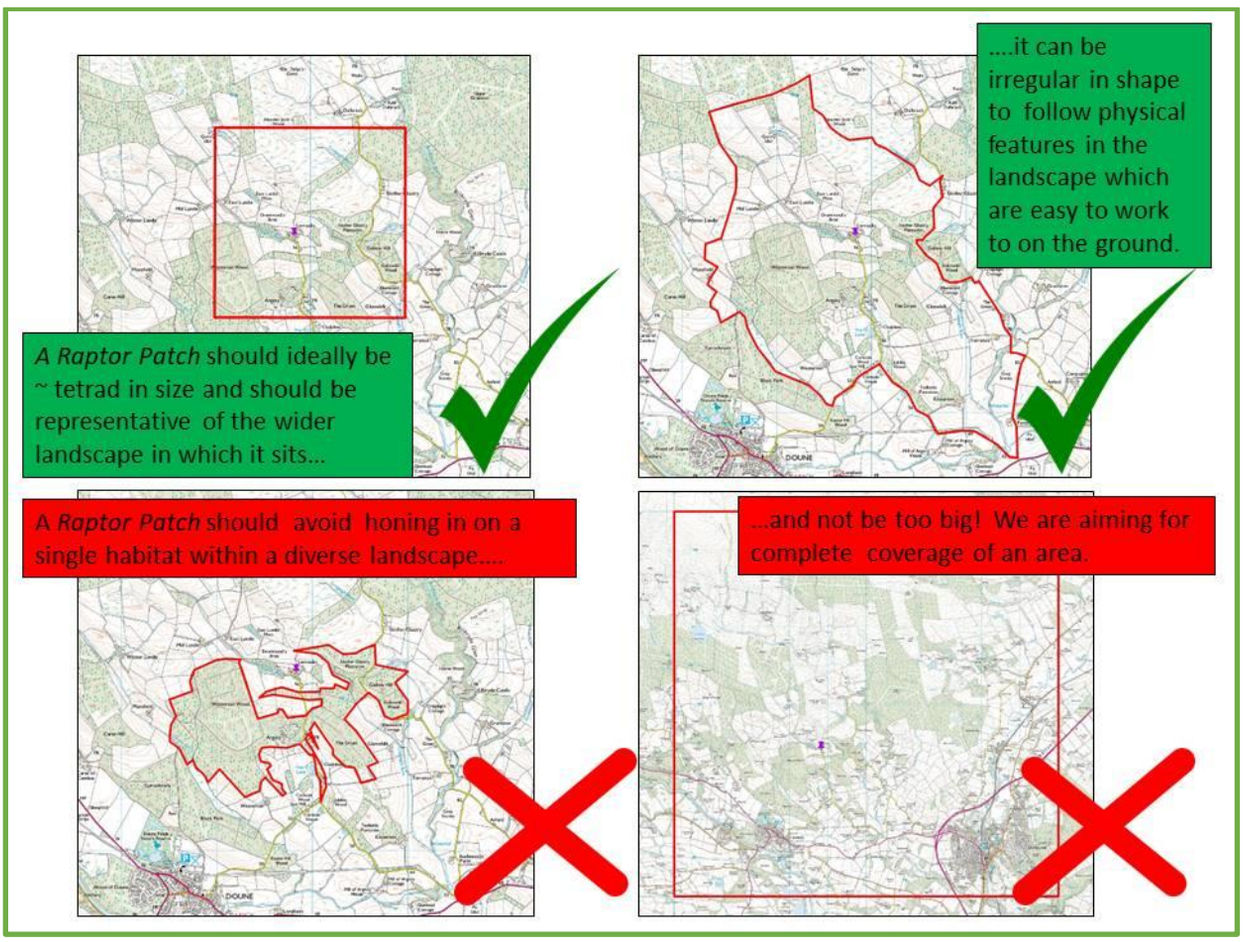

Figure 5: *Examples of suitable and unsuitable Raptor Patches.*

Table 2 shows the estimated relative proportion of the Scottish population of each SRMS species monitored by SRMS contributors. In general, scarcer species have been surveyed more widely by many raptor workers because of the way the SRMS has evolved from the personal interests of these volunteers. A number of the more widespread species such as Kestrel, Raven, Common Buzzard, Sparrowhawk and several of the owls could benefit from enhanced monitoring through more raptor workers adopting the *Raptor Patch* approach.

Table 2. The estimated relative proportion of the Scottish population monitored by SRMS contributors. N.B. Species names in bold are considered rare and feature on the list of species reported on by the Rare Breeding Birds Panel.

% Scottish population monitored by SRMS	Species
> 50%	Red Kite, **White-tailed Eagle**, **Marsh Harrier**, **Hen Harrier**, **Osprey**, Barn Owl, **Peregrine**
10-50%	**Goshawk**, **Golden Eagle**, **Short-eared Owl**, **Merlin**
<10%	Kestrel, **Long-eared Owl**, Raven
< 1%	Sparrowhawk, Buzzard, Tawny Owl
Unknown	**Honey-buzzard**, Little Owl, **Hobby**

When you consider the geographic spread of existing monitoring at a regional level it is possible to see that many of the widespread species are receiving very little or no monitoring coverage in some SRMS regions. This will mean that without enhanced coverage and survey effort producing regional trends in numbers and productivity will not be possible, let alone producing national trends. Some habitats, particularly more urban and suburban ones, will also be severely overlooked in terms of being represented in the sample.

The most useful data for the SRMS will come through those patches which receive consistent survey effort and monitoring coverage over a long time series. Mark Wilson (BTO Research Ecologist) advises that around 30-40 tetrad-sized patches distributed across representative areas and habitats across Scotland may be a suitable number from which to start achieving valuable information on changes in breeding numbers.

What did the Raptor Patch Pilot involve?

Promotion of the survey

The SRMC promoted *Raptor Patch* at a range of events between 23rd May 2015 and 1st December 2016. This resulted in 66 individuals or teams of people (i.e. family groups, colleagues, volunteer groups) registering an interest in getting involved with *Raptor Patch*. *Raptor Patch* has been promoted on a dedicated page on the SRMS website (http://raptormonitoring.org/getting-involved/raptor-patch) and a further ten individuals got in touch via the Contact Us page on the SRMS website expressing an interest in getting involved. Six individuals contacted the SRMC having been recommended by SRSG members, some of these individuals were new SRSG members. Four individuals contacted the SRMC having heard about *Raptor Patch* via other existing/potential participants.

We produced a series of three promotional leaflets which were published on the SRMS website and hard copies were disseminated to interested individuals at events attended by the SRMC.

Training of new volunteers

We held *Raptor Patch* training days at Argaty Red Kite centre in Central Scotland in March 2016 and 2017. These events attracted 31 and 16 participants respectively. Both events involved SRSG members[1] and BTO training staff[2] as lead experts, though SRSG involvement in 2017 was less.

Figure 6: Brian Etheridge (HRSG) showing new volunteers field signs on our 2017 *Raptor Patch* training event. (Photo: Amy Challis, SRMC).

On both occasions the training days followed similar formats. Following an introduction to raptor monitoring and to *Raptor Patch* in the classroom in the morning, the rest of the day was spent outdoors, considering the area centred on Argaty as a theoretical *Raptor Patch*.

[1] In 2016 five SRSG members supported the event – Brian Etheridge (Highland), Tony Lightley (Lothian & Borders, Dumfries & Galloway), Clive McKay (Tayside), Mike Thornton (Lothian & Borders) and Dave Anderson (Argyll, Central Scotland). In 2017 Brian Etheridge (Highland) provided support at the event once again.

[2] In 2016 Ben Darvill from BTO Scotland provided training advice and also provided support on the day along with Chris Wernham. In 2017 Ben Darvill & David Jarett from BTO Scotland provided support at the event.

The purpose of the afternoon session was to discuss and experience how to go about ensuring complete coverage of a *Raptor Patch* area. Four "walks" were pre-selected around Argaty and an expert trainer took a small group out on one of these walks.

Figure 7: Clive McKay (TRSG) leading an outdoor session at out 2016 *Raptor Patch* training event. (Photo: Amy Challis, SRMC).

Leaders were asked to incorporate the following activities/discussion points during the session which were consolidated back in the classroom afterwards:

- Incorporate a vantage point watch and discuss the value of this for detecting birds over large areas.
- Name and describe the behaviour/activity of any raptors seen and the extent to which it might be suggesting occupation.
- Give participants the experience of searching for field signs.
- Give participants the experience of discovering nests. Discuss the structure and position of the nests and the extent to which this can vary. Discuss that some species use the same nest year after year whereas others re-build every year. Discuss that some species will adopt nests of other species.
- Seeing Schedule 1 birds is inevitable at Argaty so discuss the sensitivity of these species and reiterate the requirement for a Schedule 1 licence to be able to monitor such species.
- Seeing nest boxes for Kestrels and owls is also inevitable so discuss the benefits of nest box studies. The SRMS is supportive of next box studies provided that volunteers are committed to maintaining and monitoring them for the foreseeable future.
- Discuss the weather and how it might impact what you see and how you should avoid disturbance in extreme weather conditions.

Developing resources

Over the course of the pilot year we developed a number of specific guidance and training materials which were made available on the SRMS website. A series of species-specific guidance documents[3] were designed to guide new volunteers through the raptor monitoring year highlighting some of the things to be doing and to be looking out for. We produced a number of documents to help guide new volunteers in how they should be capturing and reporting their data[4].

We also started to develop a Scottish Raptor Monitoring Scheme photo gallery - a gallery of tagged reference images to be helpful to new volunteers. The aspiration is to be able to show informative photos on raptor identification, nest sites (close up, local setting and in a wider landscape setting), field signs including plucks, droppings, pellets, moulted feathers and birds exhibiting key behaviours which new volunteers should be looking out for.

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[3] Buzzard *monitoring in your Raptor Patch – a guide to the essentials*; Kestrel *monitoring in your Raptor Patch – a guide to the essentials*.; Sparrowhawk *monitoring in your Raptor Patch – a guide to the essentials*; Raven *monitoring in your Raptor Patch – a guide to the essentials*; *Encountering other raptor species in your Raptor Patch – a guide to the essentials*.

[4] *Recording your observations in your Raptor Patch; Raptor Patch Survey Effort Recording Form*; Raptor Patch Territory Recording Form.

Are a keen photographer?

If you would be willing to supply images to our SRMS photo gallery as reference images for existing and new raptor workers please get in touch with the SRMC.

How has the pilot gone?

For this review, the SRMC emailed 96 individuals, who had had contact with the SRMS about being involved in *Raptor Patch,* to clarify how likely they are to continue with *Raptor Patch* in future years, or if they had not yet registered a *Raptor Patch,* whether they were likely to do so in 2018.

Feedback from volunteers was captured through *Survey Monkey* questionnaires: 23/72 participants responded to a questionnaire at the end of the 2016 pilot year; 8/15 participants responded to a questionnaire immediately following a 2017 *Raptor Patch* training event; and 9/25 participants responded to a questionnaire at the end of the 2017 pilot year (of which five of the latter had also responded to the questionnaire immediately following the 2017 training event).

Understanding our *Raptor Patch* audience

Raptor Patch has appealed to people of a wide range of ages, roughly half under age 55. The interests of these individuals encompass a range of outdoor-focussed hobbies, especially bird watching and natural history. 66% of respondents to our questionnaires indicated that they had prior experience in taking part in bird surveys, while 34% had not. Those individuals that had previous experience had taken part in a range of surveys for different periods of time, with the most frequent being RSPB's Big Garden Birdwatch and the BTO/JNCC/RSPB Breeding Bird Survey. In terms of confidence of identifying the four *focal Raptor Patch* species at the outset, it would appear that potential volunteers are very confident in their ability to identify Buzzard and Kestrel, but they are less confident in their ability to identify Sparrowhawk and Raven.

Some *Raptor Patch* participants are already members of the SRSG, some have been directed to *Raptor Patch* as new SRSG members by their local Chair or another SRSG member. In some cases existing SRSG members have approached the SRMS as they see *Raptor Patch* as a way that they can make a valuable contribution above and beyond any monitoring that they may already be doing for the branch.

The value of training events

A total of 39 individuals or teams of people (i.e. family groups, colleagues, volunteer groups) attended one of our two *Raptor Patch* training days (Table 3). The reduction of participants between the 2016 and 2017 *Raptor Patch* events is most likely to reflect a reduction in the promotion of *Raptor Patch* ahead of the 2017 breeding season relative to the 2016 season. Unfortunately, the 2017 event was publicised to potential volunteers at relatively short notice.

Table 3: The fate of individuals or groups of individuals that have expressed interest in being involved with the SRMS.

	2016	2017	Total
Attended a training event	28	11	39
- Registered a patch	11	7	18
- Returned data	8	2	10
- Continued interest in 2018	12	4	16
Did not attend a training event	37	20	57
- Registered a patch	1	6	7
- Returned data	0	1	1
- Continued interest in 2018	13	7	20

Attendance at a training event appeared to lead to better uptake of a *Raptor Patch* (46%) and submission of data from patches (50%) compared to other means of engagement (12% uptake of patches and 14% submission of data).

Feedback from participants in the *Raptor Patch* training days was been extremely positive with the majority of participants ranking the day highly for (i) Giving participants

the understanding of the value of taking part in *Raptor Patch*, (ii) Giving participants the understanding of the survey methods involved in *Raptor Patch* and (iii) Giving participants the confidence to take part in *Raptor Patch*. Over the two years, only one out of 24 (4%) people still had low confidence in their ability to take part in *Raptor Patch* having attended the event.

The positive feedback from volunteers would indicate that the SRMS is very good at delivering training events and participants leave our training days feeling confident about taking part. The format of the days appears to work well, basing the whole day around a theoretical raptor patch, that participants can engage with in theory in the classroom and then in practice in an outdoor session.

Raptor Patch data

Over the two pilot years 25 patches were registered with the SRMS. By far the greatest number of patches were in the Central Belt SRMS regions of Scotland (Table 4), which is not surprising given that this is where most promotional activity was concentrated.

Table 4: The geographic distribution of registered patches.

SRMS region	Number of registered patches
Central Scotland	9
Lothian & Borders	4
Highland	4
Tayside	3
Argyll	2
Dumfries & Galloway	2
South Strathclyde	1
Grand Total	**25**

The registered patches were a range of shapes, some (five patches) regular shapes based on the OS grid system but the greater proportion (20 patches) irregular shapes with the boundary delineated by physical features in the landscape. The patch sizes ranged from 1.1 km^2 to 7.8 km^2 in size with the average patch size being 3.8 km^2 ('tetrad sized'). The patches registered to date are encompassing a broad range of habitats, from open countryside through to suburban and urban habitats.

From data returned to the SRMS to date, Buzzard appears to be the species receiving the most registrations, but this is perhaps not surprising given that of all the *Raptor Patch* species this is the most easily visible one that most people are comfortable identifying. Overall the numbers of registrations within each patch are small, but we might expect numbers of the more difficult species (Kestrel and Sparrowhawk in particular) found to increase a little as volunteers gain experience at locating them.

Where next for Raptor Patch?

The *Raptor Patch* pilot has demonstrated that there appears to be an appetite to get involved in *Raptor Patch* from an audience (largely) not currently involved in monitoring raptors in Scotland. According to Amy Challis, the SRMC, "While not everyone that comes along to a training day chooses to get involved in *Raptor Patch*, we are giving lots of people the opportunity to try raptor monitoring for the first time to decide if it is an activity that they wish to pursue. As a result, we have got some really promising volunteers involved in monitoring raptors".

The SRMG will be looking at how we can develop *Raptor Patch* in the future. This will include considering the design, how we promote the survey in the future, how we roll Raptor Patch training events out to other locations across Scotland and most importantly how we ensure that we can support and maintain the motivation of volunteers that we have already got so that they continue monitoring raptors into the future.

Please visit:
http://raptormonitoring.org/getting-involved/raptor-patch
if you might be interested in getting involved in *Raptor Patch*.

3 How have SRMS data been used over the last year?

The Scottish Raptor Monitoring Scheme aims to help get the raptor data that we hold to those conservation bodies that can best use it to benefit raptor conservation, whether they are a statutory agency or non-governmental organisation. In 2017, with SRMS data contributors' permission, SRMS data were supplied to SRMS partners and other organisations for a number of purposes. Below Ian Johnstone describes an ongoing project for which SRMS data have been provided to RSPB to investigate potential causes of Merlin declines across the UK.

RSPB analysis of Merlin monitoring data in partnership with raptor study groups across the UK

by Dr Ian Johnstone (RSPB)

Potential drivers of change

The Merlin has returned to the UK red list because of faltering population recovery. The reasons for this are unclear, but could include:

1) *Change in management intensity*. Frequent heather burning removes mature heather nest sites (as reported for northern England and southern Scotland) and can reduce Meadow Pipit prey. Conversely, in Wales a concern is grazing reductions as part of Natura 2000 management and agri-environment schemes, resulting in tall dense moorland vegetation.

2) *Change in land cover*. Whilst gross modification of historic upland land uses has slowed, the area of improved grassland and forest cover increased rapidly in the past across the UK, and this might currently influence the distribution and abundance of Merlin via, for example, conifer maturation altering early season woodland prey abundance and/or accessibility (Merlin diet is well studied).

3) *Reduced avian prey abundance at critical times*. Some sites report Merlins arriving on territory but not progressing to nesting, consistent with changes in early season prey abundance and/or timing of availability.

4) *Predation* of nests (e.g. by foxes or Buzzards) or adults (e.g. by Goshawks, which have increased in range).

5) *Climate change*. The southern edge of the Merlin's climate envelope is predicted to contract northwards to the Scottish Highlands by the end of this century, suggesting scope for climate impacts throughout much of its UK range.

Figure 8. Merlin chick, Orkney. (Photo: Jim Williams, Orkney RSG).

Investigating the extent to which potential drivers can describe regional changes in Merlin populations

A potentially powerful way to understand the role each of these might have in driving abundance change is to compare patterns in the breeding abundance and success of regional populations between which environmental conditions vary. This approach should provide evidence to 'short-list' these candidate drivers of abundance. Our objectives are: 1) to describe

temporal and regional variation in Merlin site occupancy and success across UK regional populations and 2) to test predictions arising from the candidate drivers of abundance using a suite of available environmental and bird datasets.

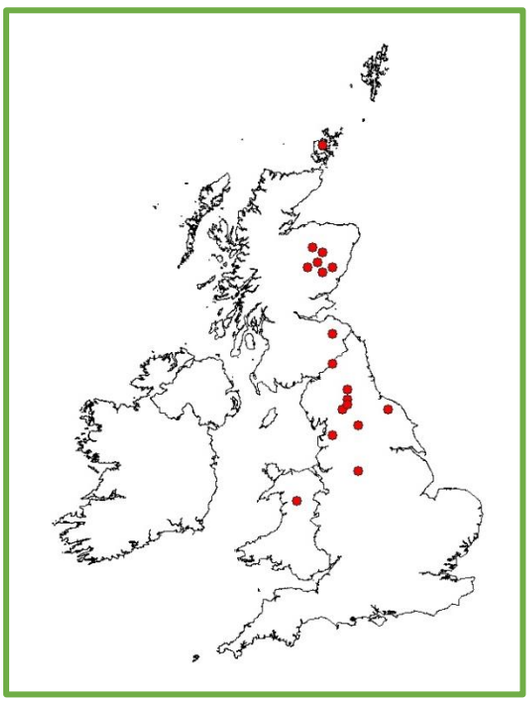

Figure 9. Location of the 18 regional long-term studies contributing data to the RSPB Merlin analysis.

Datasets have been shared for this project by 18 regional long-term studies (eight from Scotland, nine from northern England, one from Wales) spanning the period 1993-2017, which covers two UK national censuses (1993/94 and 2008).

Except for 2001 when activity was limited by the foot and mouth disease outbreak, an average of 459 sites (range 351-549) was checked annually for occupation by breeding pairs and breeding outcome using the widespread SRMS approach of multiple visits. Furthermore, the number of unique sites checked annually increased by 17% between 1993 and 2017, reflecting the high and consistent level of effort put into monitoring this species.

With the preparation of data on Merlin and explanatory variables largely complete, we will soon be developing analyses to describe trends in abundance and breeding success, and the extent to which each candidate cause of change has in explaining the observed variation within and across regions, both individually and in combination.

Despite SRMS data being made available for this project, the run of data held by the SRMS (2003 onwards) was not considered long enough to fully explore the 25 year period over which regional Merlin declines have been reported. Having explored the dataset provided by the SRMS to identify potential studies for further exploration, data from eight long-term Scottish studies were acquired by RSPB direct from Scottish Raptor Study Group for this project. The varying format of these datasets along with those provided by raptor workers elsewhere in the UK meant it took considerably longer than expected for RSPB to check and prepare these data for analysis.

The SRMS aspires to hold more historic data (from breeding raptors monitored prior to the SRMS's establishment in 2003) so that they can be made available for projects such as the one described above. The benefits to conservation professionals is that such data can have been through the SRMS's quality assurance checks to ensure that it is in the best shape possible to be used efficiently to support raptor conservation.

If you have a long-term study (started before 2003) for raptors please consider contacting the SRMC about sharing your data with the SRMS.

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