Merlin



Figure 1: Merlin chick in Perthshire in 2018 (Photo: Chris Baker, Tayside & Fife RSG).

Merlin is monitored widely across Scotland by SRMS data contributors.

Merlin has also been subject to periodic national surveys via The Statutory Conservation Agency/RSPB Annual Breeding Bird Scheme (SCARABBS) programme. Scottish breeding population estimates are available from three national surveys: a partial survey in 1983/84(Bibby & Nattrass 1986); 1993/94 (Rebecca & Bainbridge 1998) 785 (95% confidence limits 602–994) breeding pairs; and 2008 (Ewing et al. 2011) 733 (512-979) breeding pairs. There was an estimated -7% (non-significant) change in breeding population size between 1993/94 and 2008.

Our latest analysis of SRMS Merlin data for the period 2009-2018 produced no national trends in

breeding number or productivity. Trends were produced for five of the 12 SRMS regions (Table 1) and for six of the 20 NHZ regions (Table 2) for which the SRMS holds Merlin records.

Users of the published trends users should be aware that no records contributing towards trends in breeding numbers are available from northern Scotland, Lewis or Uist (Figure 11). Productivity records are drawn from across the Merlin's Scottish range, but come predominantly from eastern areas with low monitoring coverage in Highland and in Lewis. Some Merlin records from Shetland that have only recently been made available to SRMS are not included in the current analysis.

National trends

No trends in breeding numbers or breeding productivity are available for Merlin at a national level.

SRMS regional trends

Breeding numbers of Merlin did not change significantly in Highland, Lothian & Borders, North East Scotland, Orkney and Tayside & Fife (Table 1, Figure 2).

Breeding success showed non-linear variation in North East Scotland and no significant change in Tayside & Fife (Table 1, Figure 3).

Clutch size, brood size and number of fledglings did not change significantly in North East Scotland (Table 1, Figures 4-6).

Trends for this species are not yet available for Argyll, Central, Dumfries & Galloway, Lewis & Harris, Shetland, South Strathclyde or Uist.

NHZ regional trends

Breeding numbers of Merlin decreased in NHZ 11 but did not change significantly in NHZs 02, 05, 10, 12 and 20 (Table 2, Figure 7).

Breeding success decreased in NHZs 11-12 and 20 (Table 2, Figure 8).

Clutch size and number of fledglings did not change significantly in NHZ 11 (Table 58, Figure 9). No trends in brood size are available (Table 2).

Trends for this species are not yet available for NHZs 01, 03-04, 06-09, 13-17, 19 and 21.

Details of contributing records

4,138 (292 to 514 per year, mean: 414 records) from 2009-2018 contributed to this trends analysis (Table 5).

References

Bibby, C.J. & Nattrass, M. (1986) Breeding status of the Merlin in Britain. Br. Birds, 79, 170-185.

Steven R. Ewing, Graham W. Rebecca, Alan Heavisides, Ian R. Court, Patrick Lindley, Marc Ruddock, Simon Cohen & Mark A. Eaton (2011) Breeding status of Merlins *Falco columbarius* in the UK in 2008, Bird Study, 58:4, 379-389, DOI: 10.1080/00063657.2011.606497

G.W. Rebecca & I.P. Bainbridge (1998) The breeding status of the Merlin *Falco columbarius* in Britain in 1993–94, Bird Study, 45:2, 172-187, DOI: 10.1080/00063659809461089 **Table 1:** Summary of SRMS regional trends for Merlin during 2009-2018. Non-significant changes are highlighted in grey. 'Non-linear' indicates non-linear trends. '—' indicates where the species occurs but no trend is available. 'No SRMS data' indicates where the SRMS does not hold any records for the region of interest. 'Absent' indicates where the species is not known to breed.

SRMS Region	Pairs	Success	Clutch size	Brood size	Number of fledglings
Argyll					
Central			<u> </u>		_
Dumfries & Galloway			<u> </u>		_
Highland	Not significant	—	_		—
Lewis & Harris	_	—	<u> </u>		—
Lothian & Borders	Not significant		_	_	_
North East Scotland	Not significant	Non-linear	Not significant	Not significant	Not significant
Orkney	Not significant		—	—	_
Shetland	—	—	_	_	—
South Strathclyde	_	—	<u> </u>		—
Tayside & Fife	Not significant ^{sv}	Not significant ^{rs}	—	_	
Uist			_	_	

^r No home range random effect, ^s Sample sizes small, ^v Variable effort.

Table 2: Summary of NHZ regional trends for Merlin during 2009-2018. Figures in parentheses indicate the annual change, with decreases highlighted in blue and non-significant changes highlighted in grey. '—' indicates where the species occurs but no trend is available. 'No SRMS data' indicates where the SRMS does not hold any records for the region of interest. 'Absent' indicates where the species is not known to breed.

NHZ Region	Pairs	Success	Clutch size	Brood size	Number of fledglings
01. Shetland	—	—	—	—	—
02. North Caithness and Orkney	Not significant	_		_	
03. Coll, Tiree and the Western Isles	_	_	—	—	_
04. North West Seaboard	—	_	—	—	_
05. The Peatlands of Caithness and Sutherland	Not significant ^s	—	—	_	_
06. Western Seaboard	<u> </u>	<u> </u>	_	<u> </u>	_
07. Northern Highlands	—	—	—	—	_
08. Western Highlands	—	—	—	—	_
09. North East Coastal Plain	—	—	—	—	_
10. Central Highlands	Not significant ^s	—	—	—	_
11. Cairngorm Massif	Decrease (-6.7%)	Decrease (-1.3%)	Not significant ^r	_	Not significant ^r
12. North East Glens	Not significant	Decrease ^s (-1.4%)	_	—	_
13. East Lochaber	—	—	—	—	_
14. Argyll West and Islands	—	—	—	—	_
15. Loch Lomond, The Trossachs and Breadalbane	—	_	—	—	_
16. Eastern Lowlands	_	_	_	—	_
17. West Central Belt	—	—	—	—	_
18. Wigtown Machairs and Outer Solway Coast	Absent	Absent	Absent	Absent	Absent
19. Western Southern Uplands and Inner Solway	_	_	_	—	_
20. Border Hills	Not significant	Decrease ^s (-1.3%)	—	_	
21. Moray Firth			_	<u> </u>	

^r No home range random effect, ^s Sample sizes small.

Trend in Pairs of Merlin in Highland using SRMS data



20 n = 27 n = 27 n = 25 26 n = 26 30 u U II L 15 Pairs 10-5. 0. Year 2009 2010 2012 2014 2015 2016 2018 2017 2011

Trend in Pairs of Merlin in Lothian & Borders using SRMS

data

Highland trend: Not significant

Trend in Pairs of Merlin in Orkney using SRMS data



Trend in Pairs of Merlin in Tayside & Fife using SRMS data

Lothian & Borders trend: Not significant



Trend in Pairs of Merlin in North East Scotland using SRMS



North East Scotland trend: Not significant

Figure 2: Trends in numbers of breeding pairs of Merlin by SRMS region during 2009-2018.



Figure 3: Trends in breeding success of Merlin by SRMS region during 2009-2018.



Figure 4: Trends in clutch size of Merlin by SRMS region during 2009-2018.



Figure 5: Trends in brood size of Merlin by SRMS region during 2009-2018.



Figure 6: Trends in number of fledglings of Merlin by SRMS region during 2009-2018.

Trend in Pairs of Merlin in 02. North Caithness and Orkney using SRMS data



02. North Caithness and Orkney trend: Not significant



and Sutherland using SRMS data 9 ~ ø ø \sim ÌI. ji, l L È – ÷ 10-Pairs ٠ 5-0-Year 2018 2009 2010 2011 2012 2014 2015 2016 2017

Trend in Pairs of Merlin in 05. The Peatlands of Caithness

05. The Peatlands of Caithness and Sutherland trend: Not significant (caveats: Sample sizes small)



Trend in Pairs of Merlin in 10. Central Highlands using SRMS data



10. Central Highlands trend: Not significant (caveats: Sample sizes small)







Trend in Pairs of Merlin in 12. North East Glens using SRMS



Figure 8: Trends in breeding success of Merlin by NHZ region during 2009-2018.



Figure 9: Trends in clutch size of Merlin by NHZ region during 2009-2018.



Figure 10: Trends in number of fledglings of Merlin by NHZ region during 2009-2018.

Parameter	Region	First year of trend	Last year of trend	Number of years	Mean number of home ranges across years	Mean parameter value (and 95% confidence limits)	Trend during the period	Caveats	Estimated % annual change (and 95% confidence limits)		
Pairs	Highland	2009	2018	10	15.5	5.7 (3.9 to 7.5)	Not significant		-5.9 (-14.1 to 3.1)		
	Lothian & Borders	2009	2014	6	26.8	8.0 (5.0 to 11.0)	Not significant		11.4 (-5.8 to 31.7)		
	North East Scotland	2011	2018	8	60.4	22.9 (19.0 to 26.7)	Not significant		-4.5 (-10.4 to 1.7)		
	Orkney	2009	2018	10	25.3	3.8 (3.1 to 4.5)	Not significant		-2.5 (-12.8 to 8.9)		
	Tayside & Fife	2009	2018	10	18.4	9.1 (7.2 to 11.0)	Not significant	Sample sizes small, Variable effort	-5.8 (-12.3 to 1.3)		
Success	North East Scotland	2009	2018	9	35.7	0.7 (0.7 to 0.8)	Non-linear		Non-linear		
	Tayside & Fife	2009	2018	10	20.1	0.7 (0.7 to 0.8)	Not significant	Sample sizes small, No home range random effect	-1.2 (-2.7 to 0.2)		
Clutch size	North East Scotland	2011	2018	8	25.6	4.0 (3.9 to 4.1)	Not significant		0.7 (-2.4 to 3.9)		
Brood size	North East Scotland	2011	2018	8	21.6	3.6 (3.5 to 3.8)	Not significant		-1.1 (-4.7 to 2.7)		
Number of fledglings	North East Scotland	2011	2018	8	27.3	3.1 (2.9 to 3.2)	Not significant		-1.9 (-5.2 to 1.6)		

Table 3: Details of SRMS Regional trends for Merlin.

Parameter	Region	First year of trend	Last year of trend	Number of years	Mean number of home ranges across years	Mean parameter value (and 95% confidence limits)	Trend during the period	Caveats	Estimated % annual change (and 95% confidence limits)
Pairs	02. North Caithness and Orkney	2009	2018	10	25.3	3.8 (3.1 to 4.5)	Not significant		-2.5 (-12.8 to 8.9)
	05. The Peatlands of Caithness and Sutherland	2009	2017	8	7.25	5.1 (4.0 to 6.3)	Not significant	Sample sizes small	-6.7 (-16.6 to 4.5)
	10. Central Highlands	2009	2016	6	8.5	1.0 (-0.3 to 2.3)	Not significant	Sample sizes small	-5.0 (-30.9 to 30.5)
	11. Cairngorm Massif	2011	2018	8	47.125	19.2 (15.3 to 23.2)	Decrease		-6.7 (-13.0 to 0.0)
	12. North East Glens	2009	2018	10	33	13.3 (11.0 to 15.6)	Not significant		1.3 (-4.5 to 7.5)
	20. Border Hills	2009	2018	10	22.4	6.2 (4.2 to 8.2)	Not significant		-7.2 (-15.0 to 1.3)
Success	11. Cairngorm Massif	2009	2018	10	31.1	0.8 (0.7 to 0.8)	Decrease		-1.3 (-2.7 to -0.1)
	12. North East Glens	2009	2018	10	15.7	0.8 (0.7 to 0.8)	Decrease	Sample sizes small	-1.4 (-3.0 to 0.0)
	20. Border Hills	2009	2018	10	17.6	0.8 (0.7 to 0.9)	Decrease	Sample sizes small	-1.3 (-2.2 to -0.6)
Clutch size	11. Cairngorm Massif	2010	2018	9	20.333	4.0 (3.9 to 4.1)	Not significant	No home range random effect	0.1 (-3.0 to 3.2)
Number of fledglings	11. Cairngorm Massif	2010	2018	9	24.889	3.0 (2.8 to 3.1)	Not significant	No home range random effect	-0.5 (-3.6 to 2.8)

Table 4: Details of NHZ Regional trends for Merlin.

Table 5: Number of Merlin home range checks for occupancy reported to the SRMS during 2009-2018, in each of the 12 SRMS Regions, with approximate proportion of estimated population monitored. At the bottom of the table, row A is the mean number of home range checks over the most recent five years. Row B gives the estimated proportion of the national population in each region, based on Bird Atlas Timed Tetrad Visit (TTV) data. The depth of red shading indicates the relative importance of each region for this species. If survey effort was spread evenly across the whole population, the ratio of A:B would not vary much between regions.

Year	ARGYLL	CENTRAL SCOTLAND	DUMFRIES & GALLOWAY	HIGHLAND	LEWIS & HARRIS	LOTHIAN & BORDERS	NORTH EAST SCOTLAND	ORKNEY	SHETLAND	SOUTH STRATHCLYDE	TAYSIDE & FIFE	UIST	Total
2009	3	3	9	62	9	49	40	73	2	13	62	0	325
2010	5	5	11	62	11	48	0	75	0	19	56	0	292
2011	5	13	12	59	3	50	102	69	0	11	63	4	391
2012	2	8	7	38	3	52	110	46	0	13	75	7	361
2013	6	7	10	64	3	51	99	52	0	18	65	7	382
2014	3	7	12	46	1	55	101	64	47	12	60	15	423
2015	3	3	10	66	4	40	112	71	76	18	60	7	470
2016	10	0	15	92	2	30	110	67	74	17	63	9	489
2017	2	3	9	107	6	41	100	80	78	14	65	9	514
2018	1	8	11	97	2	37	105	75	89	5	53	8	491
A: Mean home range checks	3.8	4.2	11.4	81.6	3.0	40.6	105.6	71.4	72.8	13.2	60.2	9.6	477.4
B: Proportion of estimated Scottish population	6.3	2.5	2.8	34.8	3	4.8	11.1	2.8	8.3	1.5	10.9	11.1	100



Figure 11: Areas corresponding to the clusters of home ranges from which sufficient data were reported to attempt to derive population trends for Merlin between 2009 and 2018 (a) together with maps showing variation in the number of Merlin records reported to SRMS during 2009-2013 (b) and 2014-2018 (c), in the context of the known Merlin breeding distribution taken from the 2007-2011 Bird Atlas. SRMS data are depicted as grey squares with darker shading indicating more records while Bird Atlas data are depicted as red dots with the size of dot positively related to probability of breeding.