

Great Britain willow tit survey 2019-2021: A Welsh perspective

Report No: 636

Simon Wotton (RSPB Centre for Conservation Science)

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Contents

Crynodeb Gweithredol	1
Executive summary	2
Introduction	3
Method.....	5
Results.....	1
Discussion	6
Acknowledgements.....	7
References	8
Appendix 1: National willow tit survey methods	9
Appendix 2: National willow tit survey form.....	13

Crynodeb Gweithredol

Cynhaliwyd arolwg cyntaf Cymru o Ditw'r Helyg rhwng 2019 a 2021, fel rhan o arolwg ehangach ar gyfer Prydain gyfan. Er i gyfyngiadau Covid-19 effeithio'n fawr ar yr arolwg yn 2020 a 2021, bu'n bosib cynhyrchu amcangyfrifon ar gyfer y wlad, ar lefel sirol, ac ar gyfer ardaloedd Datganiadau Ardal CNC.

Amcangyfrifir mai poblogaeth Titw'r Helyg yng Nghymru yw 1,178 o barau bridio (876-1,375, gyda therfynau hyder o 95%). Mae hyn yn cynrychioli 21.2% o'r boblogaeth a amcangyfrifir ar gyfer Prydain (sef 5,550; 4,847-6,265). Roedd y mwyafrif i'w canfod yng Nghanolbarth Cymru a De-Orllewin Cymru (ardaloedd Datganiadau Ardal) – lle ceir 47.4% a 43.2% o boblogaeth fridio Cymru a 10.1% a 9.2% o boblogaeth Prydain yn ôl eu trefn. O ran siroedd, Sir Gaerfyrddin a Cheredigion oedd â'r gyfran uchaf o boblogaeth Cymru, sef 31.1% a 25.3% yn y drefn honno.

Executive summary

The first Wales willow tit *Poecile montanus* survey, as part of the wider survey of Great Britain (GB), was undertaken between 2019 and 2021. Although badly affected by Covid-19 restrictions in 2020 and 2021, it has been possible to produce estimates at the country, vice county and NRW Area Statement levels for Wales.

The willow tit population in Wales is estimated at 1,178 (95% confidence limits, 876-1,375) breeding pairs and represents 21.2% of the estimated GB population (5,550, 4,847-6,265). The majority of willow tits were in the mid-Wales and South-West Wales NRW Area Statement areas, representing 47.4% and 43.2% of the Welsh breeding population and 10.1% and 9.2% of the GB population respectively. The vice-counties of Carmarthenshire and Ceredigion held the highest proportion of the Welsh population, at 31.1% and 25.3% respectively.

Introduction

Willow tits *Poecile montanus* are highly sedentary, remaining in an area close to their breeding territory throughout the year. The *kleinschmidti* race of willow tit is endemic to the British Isles. Willow tits occupy a variety of woodland and scrubby habitat, preferring young, damp woodland with an abundance of standing decaying timber (Lewis *et al.*, 2009). The willow tit is the fastest declining resident bird species in the UK, and the second-fastest declining species overall, after turtle dove (*Streptopelia turtur*). The population has declined by 86% between 1995 and 2020 (Harris *et al.*, 2022). Willow tit is Red-listed on both the UK (Stanbury *et al.*, 2021) and Wales (Johnstone and Bladwell, 2016) Birds of Conservation Concern and is also listed under section 7 of the Environment (Wales) Act 2016 as a species of principal biodiversity importance in Wales. As a result of the significance of decline, willow tit has been the subject of targeted research in recent years in order to determine the key drivers of decline and identify potential remedial conservation action.

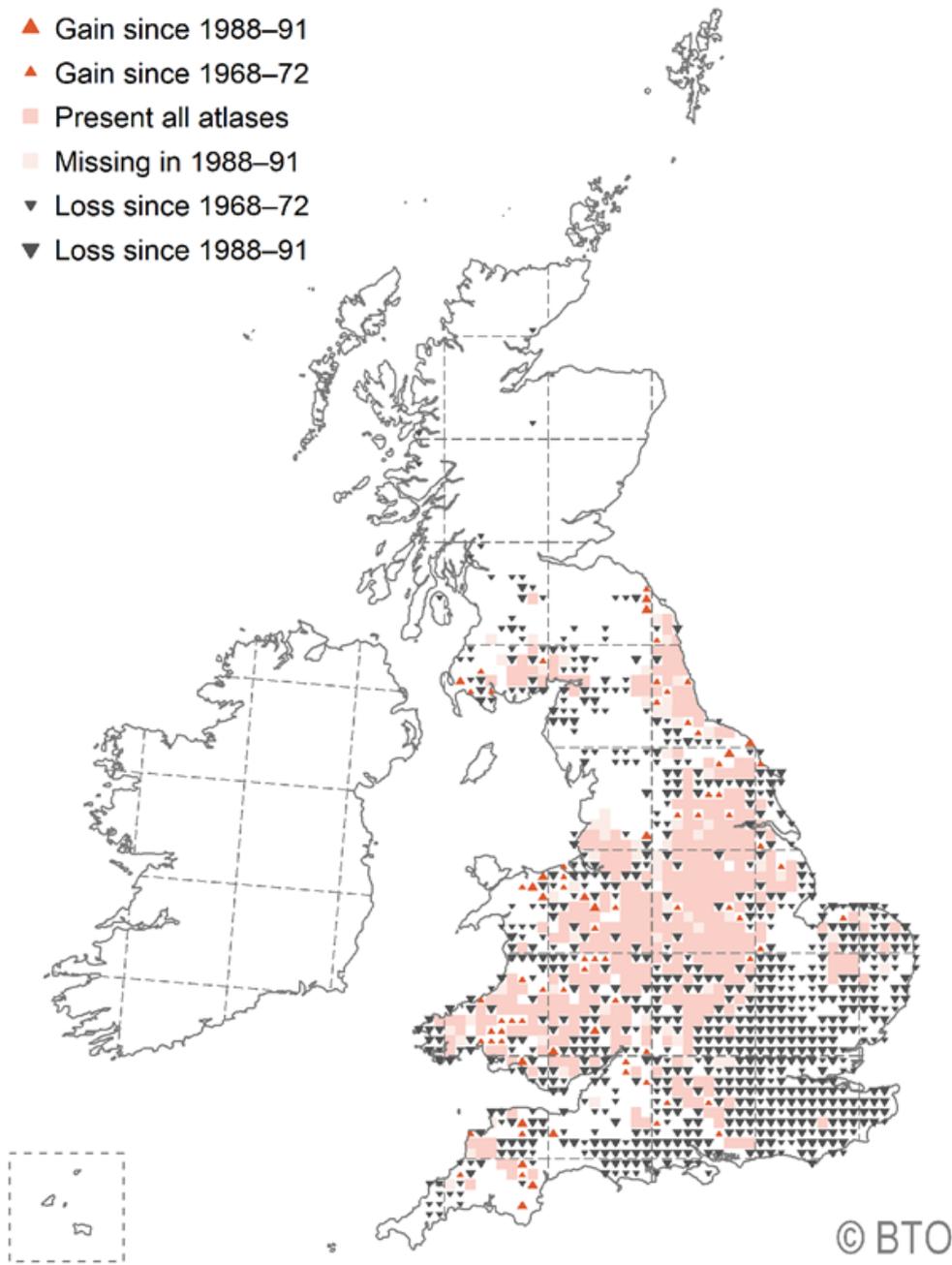
In recent years, willow tits have been lost from large areas of southern and eastern England and from parts of north and south Wales, as highlighted in the results of the 2008-11 Bird Atlas (Figure 1. Balmer *et al.*, 2013). Due to the declining numbers and range, monitoring is becoming increasingly difficult. While the BTO/JNCC/RSPB UK Breeding Bird Survey (BBS) is still able to produce UK population trends (86% decline, between 1995 and 2020 and 61% decline between 2019-2021), the sample size is now very low, with a minimum sample of 31 occupied BBS squares in 2021 (Harris *et al.*, 2022). Due to very few occupied BBS squares in Wales (4 in 2019 but 0 in 2021) an annual trend change for Wales is not possible.

Although collation of records by the Rare Breeding Birds Panel (RBBP) is useful for the design of future surveys and Woodward *et al.* (2020) produced a GB estimate of 2,750 territories they are both currently insufficient to enable robust population estimates, measures of change or maps of current distribution to be produced. A national survey was therefore needed if ongoing conservation work is going to be properly underpinned by robust evidence.

This report describes the results in Wales of the first GB survey, between 2019 and 2021, conducted under the Statutory Conservation Agencies & RSPB Annual Breeding Bird Scheme (SCARABBS) programme. The survey was organised by RSPB, with support from the Rare Breeding Birds Panel (RBBP), Natural England (NE), Natural Resources Wales (NRW) and the Welsh Ornithological Society (WOS).

Breeding Distribution Changes all atlases

- ▲ Gain since 1988–91
- ▲ Gain since 1968–72
- Present all atlases
- Missing in 1988–91
- ▼ Loss since 1968–72
- ▼ Loss since 1988–91



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Figure 1. Change in the distribution of willow tits between the first Atlas (1968-72) and the third Atlas (2008-11) (Balmer *et al.*, 2013).

Method

Survey design and coverage

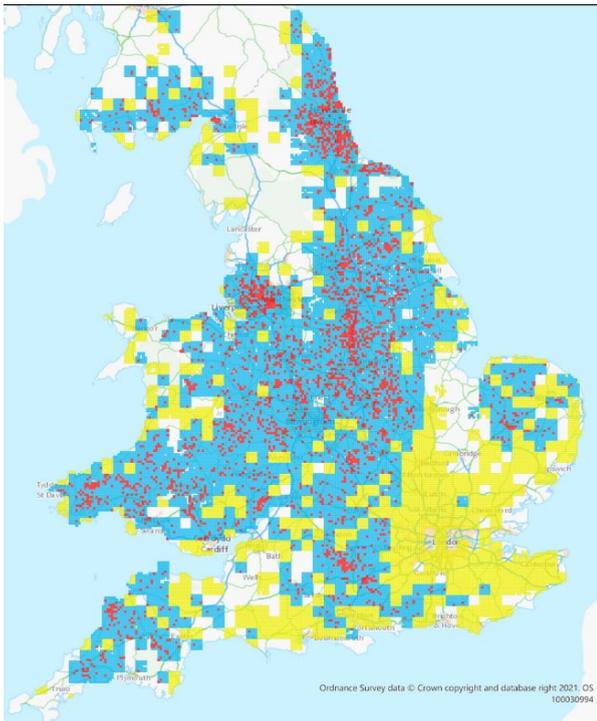
The aim was to conduct county level surveys across the known GB range by willow tit study groups, county bird clubs, other conservation organisations and volunteers and RSPB staff, between 2019 and 2020. Given the effects of the Covid-19 pandemic, the survey period was extended to 2021, although this proved unsuccessful as much of the range remained under restricted access due to lockdown measures during the 2021 survey period.

GB survey coverage was at the tetrad (2x2 km square) level and included non-random coverage of self-selected squares in core areas, mostly around existing monitoring/intervention efforts. In Wales, this included coverage of the RSPB reserve - Lake Vyrnwy. In counties with few recent records, the aim was to cover known and recently occupied sites. Across the bulk of the range, a stratified random design was used:

- 1) Higher intensity sampling of occupied tetrads, from the 2008-11 Atlas and contemporary occupied tetrads (**stratum 1**). In stratum 1, 215 tetrads were selected (see Table 1).
- 2) Medium intensity sampling of remaining tetrads in occupied 10km squares, from the 2008-11 Atlas and later (**stratum 2**). In stratum 2, 324 tetrads were selected (see Table 1).
- 3) Lower intensity sampling through the rest of the 'historical' range, based on the 1988-91 Atlas 10km square distribution (**stratum 3**). In stratum 3, 61 tetrads were selected (see Table 1).

Data from the 1988-91 and 2008-11 Bird Atlases, recent county atlases, county recorders, the RBBP and from other sources were used to identify the relevant strata (Figure 2).

a)



b)

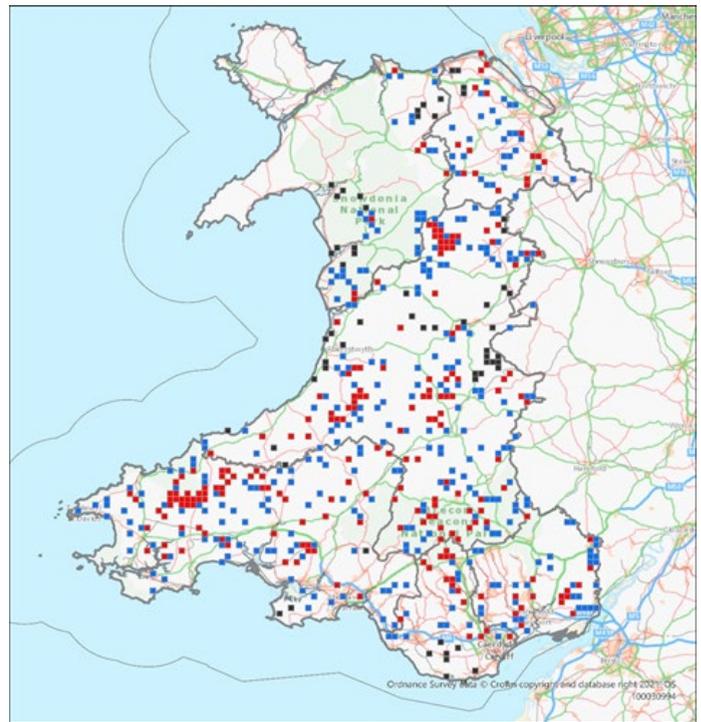


Figure 2. a) The defined area for the willow tit survey stratified random sampling approach across Great Britain, highlighting the high (red), medium (blue) and low (yellow) intensity sampling strata, and b) the original tetrad sample selection in Wales, by strata (red=stratum 1; blue=stratum 2; black=stratum 3).

Field methods

Based on pilot work to determine willow tit responsiveness to playback and detectability, a playback method was used during the pre-breeding season (mid-February to mid-April) when the birds are territorial. The recording used for the survey was a combination of willow tit alarm call and song. The survey covered all potential suitable habitat in each survey tetrad with surveying from half-an-hour after dawn until midday (Appendix 1). Surveys were conducted on all suitable habitat within 1-km squares, using a standardised playback method (transects at 200m intervals, stops every 200m, playback for two minutes then a two-minute wait). A summary of suitable willow tit breeding habitat was provided using the survey instructions (Appendix 1) and survey form (Appendix 2).

A separate tetrad map with accompanying form was provided for each visit. The survey form (Appendix 2) was used to record visit information, details of any willow tits encountered, and an overall survey summary.

Before surveying, it was recommended to all surveyors to:

- Identify areas of potential habitat using Google earth and OS maps and mark these up on survey sheets.

- Create a survey route and mark the map with survey points, approximately 200m apart so all areas of potentially suitable habitat are visited and no suitable habitat is more than 100m from a survey point.

One or more visits were carried out in each survey tetrad between mid-February and mid-April. If no willow tits were found after two visits despite there being (potentially) suitable breeding habitat in the tetrads, surveyors were asked to consider undertaking a third visit. Willow tits become very quiet from mid-April, a time when birds are excavating a nest cavity and breeding. Ideally, surveys were undertaken on 'fine' days, as willow tits are much more likely to be detected on relatively warm days with no wind and rain. In addition, willow tits are more likely to respond to calls during the morning, and when not heavily overcast.

A pre-determined transect was walked covering potentially suitable habitat in the survey tetrad and a playback stop was made every 200 metres. Playback points were distributed so no suitable habitat was more than 100m from a point, and the location of each point was marked on the tetrad map (as P1, P2, P3, etc). If it was not possible to gain access to all areas of suitable habitat in the tetrad, the playback point was from the nearest public access.

At each playback stop the standard recording of willow tit call and song was played for the full length of the recording (two minutes). A further two minutes was then spent looking and listening for a willow tit response. A response was recorded if any willow tit vocalisations were heard or birds were seen at the survey point. If a response was determined during playback the recording was stopped, with details recorded before moving on to the next playback point.

Although the playback recording used during the survey contains willow tit calls and song, a wide range of other species can sometimes respond, for example marsh tits *Parus palustris* and other tit species. Surveyors were asked to record any marsh tits, this is particularly useful given the potential identification difficulties between the two species.

For each willow tit record, surveyors were asked to assess the habitat structure (and height) of the woody habitat and add one (or more) habitat category codes using the habitat categories and codes below.

1	Habitat structure
A	Low scrub, shrubs and managed hedgerows (1.5m to 3m)
B	Tall hedges, bushes, scrub and young trees (3m to 6m)
C	Trees and woodland edge (>6m)

2	Habitat category
A	Linear features (e.g. hedges, tree lines, thin strips of woodland, railway embankments)
B	Semi-natural scrub
C	Young plantation (<5m high)
D	Plantation woodland (>5 m high);
E	Semi natural woodland (>5m high).

The full survey methods and recording form are provided as appendices to this report (Appendix 1 and 2).

Analysis

All willow tits recorded during the survey were georeferenced from the survey maps using ArcGIS Pro 2.8.1. Registrations were analysed to produce a maximum and minimum number of territories within each tetrad, based on the interpretation of breeding activity described in Gibbons *et al.* (1993). Using the breeding evidence codes, the estimated minimum number of territories comprised the probable and confirmed territories in the tetrad, and possible breeding birds that were recorded in suitable breeding habitat in the tetrad but showed no signs of territorial behaviour. The maximum estimate included potentially additional territories that could not be confirmed as different or where the territory was probably in an adjacent tetrad. Adjacent willow tits were classed as different when individual records were more than 500 m apart.

Territories overlapping tetrads were analysed using the following rules. Territories which overlapped two survey tetrads were allocated to the tetrad containing the centroid of all the registrations. If the territory overlapped both a survey and non-survey tetrad, and the centroid fell outside the survey tetrad, it was only included in the maximum count; however, if that centroid fell inside the survey tetrad, it was included in both the minimum and maximum counts.

For Wales, population estimates were calculated individually for each vice-county and NRW Area Statement areas (Figure 3 and see [Natural Resources Wales / Area Statements](#)). In each case estimates were calculated for the three strata separately then combined, to allow for the different sampling intensity within each stratum. Confidence limits (CLs) on the population estimates were obtained by using a bootstrapping procedure (Efron and Tibshirani, 1986). In order to generate population estimates the numbers within each stratum were calculated separately and then combined with 999 replicates, with the 2.5th and 97.5th percentiles from these replicates taken as the 95% confidence limits. Any additional core tetrads were added to the final vice-county totals. The confidence limits for the Wales estimate were calculated by summing the unsorted bootstrapped estimates for each vice-county.

b)



a)



Figure 3. Geographical coverage of (a) Welsh vice counties and (b) Natural Resources Wales' Area Statements.

Results

Survey coverage

Overall, 436 tetrads were surveyed in Wales, from the defined range of 4,027 tetrads, across the three strata. Coverage in Wales, by stratum, as well as a comparison with coverage across the GB range, is shown in Table 1. Tetrads were surveyed in the following vice-counties: Breconshire, Carmarthenshire, Ceredigion, Denbighshire and Flintshire, East and West Glamorgan, Gwent, Meirionnydd, Montgomeryshire, Pembrokeshire and Radnorshire (Table 2a) and the six terrestrial NRW Area Statements areas (Table 2b).

Table 1. Tetrad coverage in Wales and a comparison with coverage across the British Isles.

	Stratum 1			Stratum 2			Stratum 3		
	Sample	Surveyed*	% covered	Sample	Surveyed*	% covered	Sample	Surveyed*	% covered
Wales	393	139	35.4	2,738	238	8.7	896	59	6.6
GB	2,683	823	30.7	12,835	1,181	9.2	2,745	213	7.8

*including non-random coverage, as described in the methods.

Table 2. Tetrad coverage in Wales, by (a) vice-county, and (b), NRW Area Statement.

(a) Vice-county

	Stratum 1		Stratum 2		Stratum 3	
	Sample	Surveyed*	Sample	Surveyed*	Sample	Surveyed*
Breconshire	63	17	336	25	15	0
Carmarthenshire	92	12	470	26	25	1
Ceredigion	35	16	268	35	103	8
Denbigh & Flintshire	39	10	388	33	58	3
Glamorgan	38	11	274	12	114	10
Gwent	15	10	161	22	149	1
Meirionnydd	5	2	107	28	132	14
Montgomeryshire	25	21	210	34	192	12
Pembrokeshire	54	32	297	7	67	7
Radnorshire	27	8	227	16	34	3

*including non-random coverage, as described in the methods.

(b) NRW Area-Statement

	Stratum 1		Stratum 2		Stratum 3	
	Sample	Surveyed*	Sample	Surveyed*	Sample	Surveyed*
Mid Wales	150	63	1052	110	352	24
North East Wales	29	6	306	24	45	2
North West Wales	12	4	171	36	144	14
South East Wales	19	12	193	24	172	1
South Wales Central	27	10	149	3	71	6
South West Wales	156	44	867	41	113	12

*including non-random coverage, as described in the methods.

Population estimates in Wales

Willow tits were recorded in 137 tetrads (Figure 4) out of the 436 tetrads surveyed with a minimum of 261 and maximum of 273 pairs found. The population estimates presented are based on the minimum number of pairs recorded, to avoid the potential for double-counting pairs as a result of the novel playback method.

The willow tit population in Wales was estimated at 1,178 pairs (95% confidence limits, 876-1,375) and represents 21.2% of the estimated GB population (Table 3). In stratum 1, there were an estimated 400 pairs (319-480). In stratum 2, there were an estimated 773 pairs (568-1,040). In stratum 3, no willow tits were found in selected sample tetrads but five pairs were found through additional coverage.

The population estimates by vice-county are shown in Table 4. The highest estimates were in Carmarthenshire, Ceredigion, Breconshire and Montgomeryshire. The core of the population in Wales appears to range from NE Pembrokeshire up through much of mid Wales. More work is needed to identify and understand the population hotspots, but it is apparent that there are hotspots in and around some nature reserves, including Cors Caron NNR in Ceredigion and Lake Vyrnwy RSPB reserve in Montgomeryshire.

The NRW Area Statement population estimates are shown in Table 5. The key Area Statements are Mid Wales (holding 47.4% of the Welsh population) and South West Wales (holding 43.2% of the Welsh population).

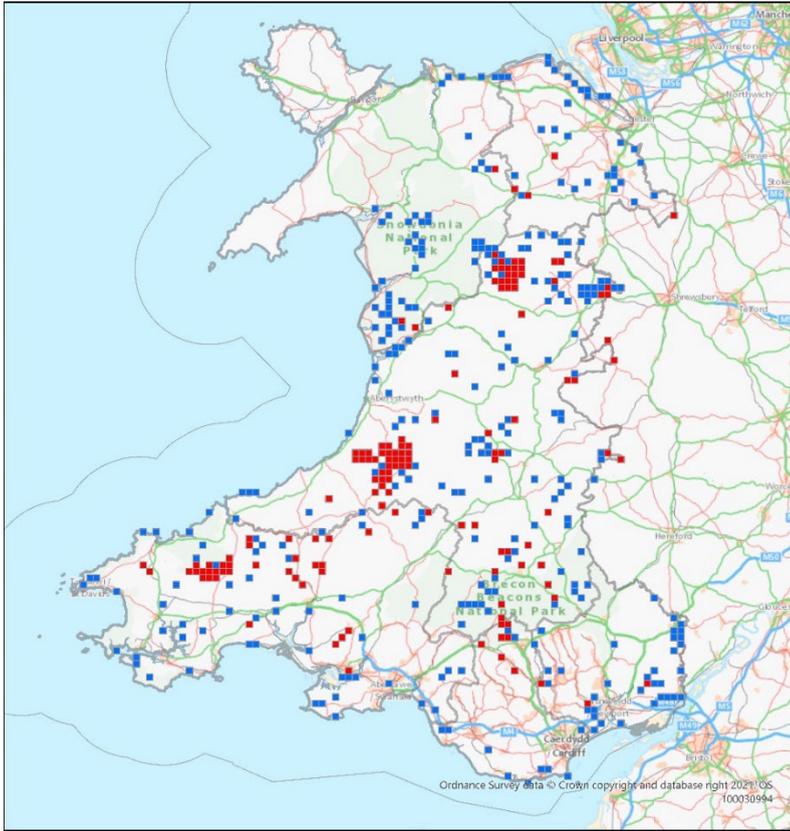


Figure 4. Tetrad coverage across Wales. Red tetrads were occupied by willow tits, blue tetrads were unoccupied.

Table 3. The estimated population of willow tits in Wales, 2019-21, and by stratum. The overall British total is shown as a comparison. The 95% confidence limits are shown in parentheses.

	Wales	GB
Stratum 1	400 (319-480)	2,341 (2,072-2,625)
Stratum 2	773 (568-1,040)	3,184 (2,615-3,951)
Stratum 3	5	25 (12-44)
Population estimate	1,178 (876-1,375)	5,550 (4,847-6,265)

Table 4. Estimated number of willow tit pairs by vice-county. The figures in parentheses are 95% Confidence Limits.

	Stratum 1		Stratum 2		Stratum 3		Population estimates
	% covered	WT records	% covered	WT records	% covered	WT records	
Breconshire	27.0	17	7.4	5	0	Na	125 (56-204)
Carmarthenshire	13.0	11	5.5	16	4.0	0	367 (206-520)
Ceredigion	45.7	32	13.1	42	7.8	0	298 (178-427)
Denbigh & Flintshire	25.6	1	8.5	2	5.2	1	32 (4-89)
Glamorgan	28.9	9	4.4	2	8.8	0	30 (15-45)
Gwent	66.7	2	13.7	0	0.7	0	3 (2-8)
Meirionnydd	40.0	2	26.2	5	10.6	0	19 (7-39)
Montgomeryshire	84.0	29	16.2	18	6.3	4	115 (68-168)
Pembrokeshire	59.3	54	2.4	0	10.4	0	91 (54-135)
Radnorshire	29.6	5	7.0	4	8.8	0	98 (20-192)

Table 5. Estimated number of willow tit pairs by NRW Area Statement. The figures in parentheses are 95% Confidence Limits.

	Stratum 1		Stratum 2		Stratum 3		Population estimates
	% covered	WT records	% covered	WT records	% covered	WT records	
Mid Wales	42.3%	79	10.5%	70	6.8%	4	559 (390-754)
North East Wales	20.7%	2	7.8%	2	4.4%	1	74 (5-229)
North West Wales	33.3%	0	21.1%	4	9.7%	0	12 (4-29)
South East Wales	63.2%	3	12.4%	0	0.6%	0	4 (3-9)
South Wales Central	42.3%	9	2.0%	2	8.5%	0	22 (12-30)
South West Wales	28.2%	69	4.7%	16	10.6%	0	509 (297-761)

Habitat associations

Broad information is presented on the habitat structure and associations around the willow tit records although it was not the aim of this survey to establish habitat and vegetation associations, particularly given the playback methods used for the survey.

The habitat structure around the willow tit survey registrations in Wales and for GB are shown in Figures 5a-b. The predominant habitat structure recorded in Wales was tall hedges, bushes, scrub and young trees between 3m and 6m in height. The habitat category/type for Wales and GB show similar willow tit selectivity (Figures 6a-b).

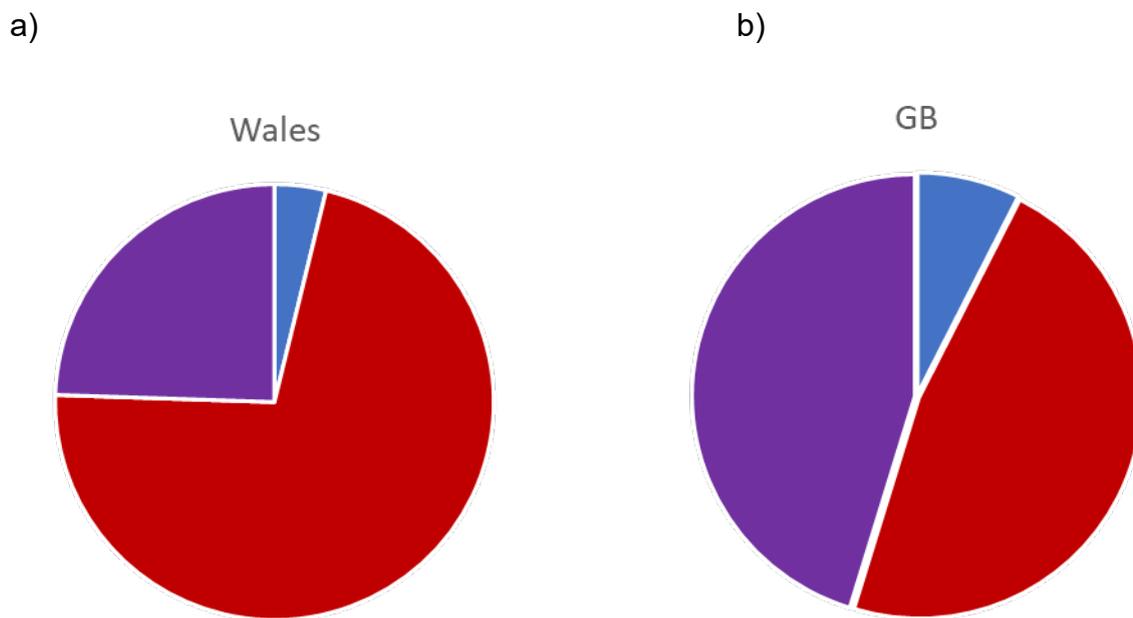


Figure 5. The habitat structure around Willow Tit records, in (a) Wales and (b) Great Britain as a comparison. Key: Tall hedges, bushes, scrub and young trees (3m to 6m) = red; Trees and woodland edge (>6m) = purple; Low scrub, shrubs & managed hedgerows (1.5-3m) = blue.

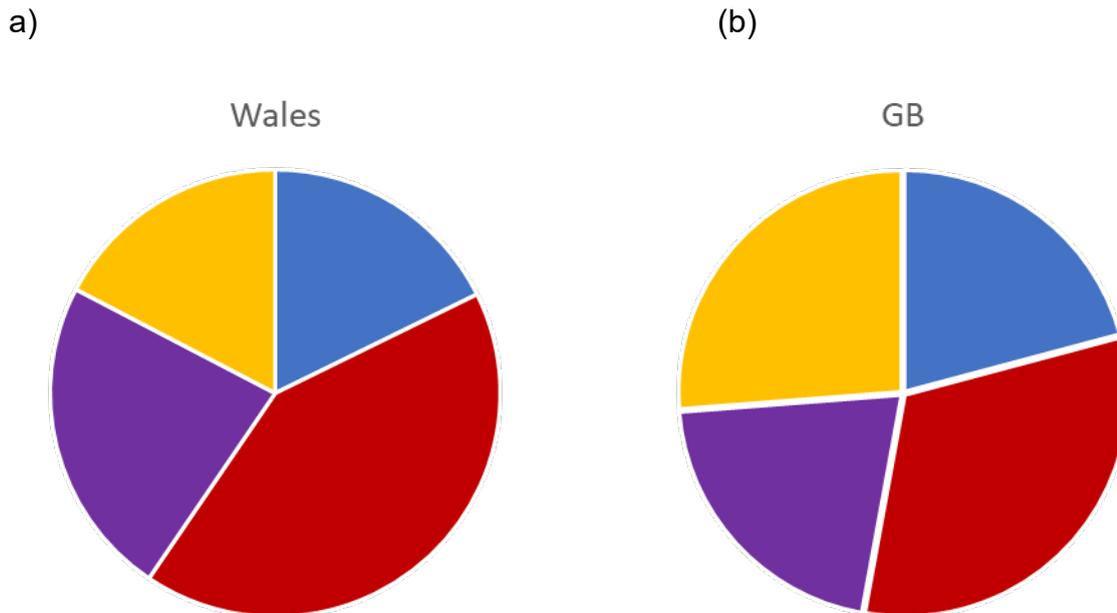


Figure 6. The habitat category/type around willow tit records in (a) Wales and (b) Great Britain as a comparison. Key: linear features (e.g. hedgerows) = blue; scrub = red; category plantation forest = yellow; semi-natural woodland = purple.

Discussion

This is the first time that robust population estimates have been produced for willow tit, at the country and county levels. The country estimates are higher than anticipated, given the ongoing decline of the species, as reported through the annual BBS results (Harris *et al.*, 2022) and through the latest Bird Atlas (Balmer *et al.*, 2013). This is likely to be due to a combination of lower detectability during the Atlas fieldwork, particularly in tetrads with higher densities of willow tits, and the greater detectability of the bespoke playback method used for this survey. Also, the optimum survey period for willow tits is mid-February to mid-April, mainly outwith the standard breeding season survey period of April to June.

The survey results do reflect the ongoing range decline, perhaps more so in England than in Wales, but the core of the Welsh willow tit population is in mid-Wales with range contractions apparent in north and south Wales. The stratum 1 tetrads were recently occupied tetrads, over the past 10 years. Of the 139 stratum 1 tetrads covered during this survey, no willow tits were recorded in 46% of these tetrads. Also, willow tit has been an RBBP species since 2010. In Wales, 39 tetrads were surveyed where willow tit records had been submitted to the RBBP between 2010 and 2016; no willow tits were recorded in 13 (33%) of these tetrads.

The bulk of the Welsh population estimate was from stratum 2 tetrads, i.e. in tetrads with potentially suitable habitat from the occupied 10km-square Atlas range. This suggests that many willow tits in Wales are in areas where there are few bird watchers and little or no bird monitoring.

The survey results highlight the importance of the Welsh breeding population in a GB context and the importance of NRW Area Statements of Mid Wales and South West Wales in a Welsh context. Further analysis is needed on the level of site protection for willow tits in Wales. The survey has shown that core parts of the range in Wales overlap with some key nature reserves, e.g. Cors Caron, Ceredigion, and Lake Vyrnwy, Montgomeryshire.

The habitat type and structure associated with willow tits were not unexpected given the species ecology and design of the survey. Willow tits records in Wales were more associated with trees and woodland edge compared to those from the wider UK, with almost three quarters of Welsh records associated this habitat type (Figure 5). Similarly, Welsh willow tits were found slightly more often in scrub compared to the records from the wider UK (Figure 6). It is not clear whether these is an real difference or an artefact of the survey.

Our current understanding of the causes of willow tit population decline is poor. It is recommended that an integrated and comprehensive analysis of the combined Welsh and GB regional datasets may identify demographic drivers of change. The results from this survey can help target conservation action at local and regional levels. A key tool will be the newly published willow tit Conservation Handbook (Back From the Brink, 2021), for those who are looking to undertake practical habitat management for willow tit. Specifically, it provides advice on habitat management techniques and monitoring and surveying methods with supporting information on ecology and case study examples.

Acknowledgements

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Appendix 1: National willow tit survey methods



Willow Tit National Survey Methods 2021

Survey background

Our endemic race of Willow Tit is the second-fastest declining species in the UK, after Turtle Dove, and is Red-listed. This resident species, which is highly sedentary remaining in an area centred on the breeding territory throughout the year, has been lost from large areas of southern and eastern England in recent years. RSPB and others have conducted research into causes of decline and eliminated a number of potential causes which seem unlikely to be causing the large scale declines. One of the potential causes that need investigating further is whether deterioration in habitat quality is affecting this species. One of the main habitats that willow tits occupy in Britain is damp young woodland. This habitat is often short lived with sites frequently drying out and developing into mature woodland over 20-30 years. RSPB and other organisations, including Natural England, are currently trialling woodland management solutions for Willow Tit, and the species is part of the Back From the Brink HLF project (<https://naturebftb.co.uk/the-projects/willow-tit/>), involving detailed study of daily movements and habitat use as well as habitat management.

However, due to the declining numbers, monitoring the species is becoming increasingly difficult. Whilst the BTO/JNCC/RSPB UK Breeding Bird Survey is still able to produce an annual trend, the sample had fallen to just 28 squares by 2017. Although collation of records by the Rare Breeding Birds Panel is useful for the design of future surveys, it is currently insufficient to enable robust population estimates, measures of change or maps of current distribution to be produced: thus a national survey is needed if our conservation work is going to be properly underpinned by evidence.

Survey coverage

Across the range, survey tetrads (2x2km) have been selected for coverage, based on:

- 1) non-random, self-selected squares in core areas, mostly around existing monitoring/intervention efforts,
- 2) random sampling of occupied tetrads, from 2007-11 Atlas and later (high intensity),
- 3) random sampling of remaining tetrads in occupied 10km squares, from 2007-11 Atlas and later (medium intensity),
- 4) lower intensity sampling through the rest of the known range, from the 1988-91 Atlas,
- 5) in counties with few recent records, the aim is to cover known and recently occupied sites.

Data from the 1988-91 and 2007-11 bird atlases, recent county atlases and from the RBBP have been used to identify the tetrads to be included in the sample survey.

Field methods

A playback method will be used to survey Willow Tits during the pre-breeding season when the birds are territorial, covering all potentially suitable habitat in the survey tetrad. A summary of suitable Willow Tit breeding habitat is provided at the end of the survey instructions. The playback method, using a standard (2-minute) Willow Tit call and listening for a response, has been successfully developed by the RSPB Willow Tit research project. The recording used for the survey is a combination of willow tit alarm call and song. **The call volume should be checked before surveying: the call should be audible up to 100m away from playback.**

A separate tetrad map with accompanying form will be provided for each visit. The survey form should be used to record visit information, details of any Willow Tits encountered, and an overall survey summary.

Before surveying, it is best to:

- Identify areas of potential habitat using Google earth and OS maps and mark these up on survey sheets.
- Create a survey route and mark the map with survey points, approximately 200m apart so all areas of potentially suitable habitat are visited and no suitable habitat is more than 100m from a survey point.

One or more visits should be carried out in each survey tetrad between mid-February and mid-April - if you are only able to undertake one survey, we will be able to use the results. If no Willow Tits are found after two visits despite there being (potentially) suitable breeding habitat in the tetrads, please consider undertaking a third visit. Once the birds are serious about excavating and nesting, they become very quiet, from mid-April. Ideally, surveys should be undertaken on 'fine' days – if present, Willow Tits are much more likely to be detected on relatively warm days with no wind and rain. Willow Tits are more likely to respond to calls during the morning, and when not heavily overcast.

A pre-determined transect should be walked covering potentially suitable habitat in the survey tetrad and the route taken should be marked on the OS tetrad map on the accompanying survey form, if not marked beforehand. A stop should be made every 200 metres and noted on a recording form. Playback points should be distributed so no suitable habitat is more than 100m from a point, and the location of each point should be marked on the tetrad map (as P1, P2, P3, etc). **To gain access to all potentially suitable habitat in the tetrad, it may be necessary to gain access to private land. If you are unable to gain access to all areas of suitable habitat in the tetrad, the playback point should be from the nearest public access.**

At each stop the standard recording of Willow Tit call and song should be played for two minutes (this is the full length of the standard recording). A further two minutes should then be spent looking and listening for a Willow Tit response. A response is recorded if there are any Willow tit vocalisations heard or they are seen at the survey point. If a response is achieved during playback the recording is stopped and you should move on to the next playback point.

Although the recording used for the survey contains Willow Tit calls and song, a wide range of other species can sometimes respond; Marsh Tits and other tit species regularly respond to this recording.

Recording information

For each visit, record the date, visit number and start/finish times. Record the bird observations on the accompanying tetrad map for each visit. **ALL Willow Tit contacts (including any contacts between playback points) should be marked on the tetrad map by using standard BTO (CBC) symbols.** A list of the symbols is included later in these instructions. Where individual birds are known to have moved within a visit, join their sequential locations with a solid line. On the first visit mark the locations of the first territorial contact on the tetrad map as A1, the second as B1, etc; on the second visit map as A2, B2, etc.

Record ALL Willow Tit contacts on the **Survey form**, using the same territory codes as on the **tetrad map**. After each visit, on the **Survey form** please complete the 'summary of observations' for each territory, including the appropriate 'Territory Evidence' code (enter more than one, if necessary) and a summary of the activities under 'Other notes'. Also note the number of birds seen or heard. If possible, include details of where birds are seen

feeding. If no observations were recorded for a particular territory on a particular visit, please state this by entering 'nil' in the 'Territory Evidence' column.

Include whether the contact was located at a playback point and, if so, whether the bird was detected due to its response to playback (although this may not always be clear). Note if the response to playback was call, song or agitated behaviour, and note the time taken for the bird to react to the playback. Please also record the distance to the Willow Tit when first detected. The 'Territory Evidence' and 'Playback Response' codes are listed on page 2 of the Survey form.

Record the date of each visit under 'visit details' against the appropriate visit number, even if no Willow Tits were recorded.

Recording other bird species

It will also be useful to also record any Marsh Tit sightings, which also respond well to Willow Tit calls, on the Survey form. Record the same information as for Willow Tits, and please mark ALL Marsh Tit contacts on the tetrad map using standard BTO (CBC) symbols: on the first visit mark the locations of the first territorial contact on the tetrad map as MT_A1, the second as MT_B1, etc; on the second visit map as MT_A2, MT_B2, etc.

As Marsh and Willow Tits can be difficult to tell apart, it may be worth spending some time before your first visit to make a note of the key differences in calls and plumage. This BTO id video is a very useful resource:

<https://www.bto.org/develop-your-skills/bird-identification/videos/telling-apart-marsh-and-willow-tits>

Habitat recording

For each Willow Tit and Marsh Tit record, please assess the structure (and height) of the woody habitat and add A, B or C to column 1 of the Habitat Codes section, and add one (or more) category code to column 2. Further information can be given in the notes box if the habitat doesn't fit in to the given categories or you wish to provide more details.

Suitable Willow Tit habitat

Willow Tit habitats vary across the UK and Europe. In Northern Europe they favour conifer forests where they forage in winter during heavy snowfall, while during the breeding season they nest in areas with more birch trees on peaty soils. In the UK they are associated with a number of scrubby habitats, which may include overgrown hedges on river valleys and floodplains, young regrowth in conifer plantations, birch and willow scrub on former industrial sites, linear scrub along railway lines and canals, or scrubby areas on the edge of mature plantation or woodland. A key feature of these sites is the prevalence of pioneer tree and shrub species such as willow, birch, elder and hawthorn with few mature canopy trees. These sites are often but not exclusively on wetter areas.

Based on earlier research, the key properties of Willow Tit habitat are: Dominant tree/shrub species are Hawthorn, Elder, Alder, Birch and Willows, and undesirable tree species are Oak, Beech, Sycamore and mature Conifers where there is little or no shrub layer. Shrub cover at 2-4m above ground and canopy cover are roughly 50%. There are typically lots of standing small dead trees. Younger woods are preferred but only if they contain favoured tree species. Wetter soils are preferred, which retain moisture for longer during the breeding season i.e. poorly draining soils, or peat soils. Patches of suitable habitat can be as small as 1ha for breeding as they will use surrounding habitats and move between patches.

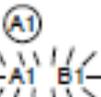
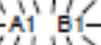
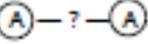
Willow Tits excavate holes in soft rotten stumps to nest in; they may excavate more than one hole before deciding where to nest. Nests are typically 1-2.5m above the ground in trunks of 10-20 cm in diameter. The most frequently used trees for nests are willow, birch and elder, although nests have been recorded in more than 20 other species.

Notes on disturbance and confidentiality

Breeding birds and their nest sites should not be disturbed, although it is very unlikely to find nesting Willow Tits during the survey period. It should be noted here that the RSPB and RBBP believe that playback does not cause undue disturbance and is essential for successful surveying of Willow Tits. It is not necessary to find a nest to confirm breeding. Data will be stored securely and only used for appropriate conservation purposes.

STANDARD BTO SYMBOLS FOR BIRD ACTIVITY

Rather than use the standard BTO code for Willow Tit (WT) when mapping the location of contacts, please use the terms A1, B1, etc., to denote records from the first visit and A2, B2, etc., from the second visit.

A1, 2A2	Willow Tit sight records with age, or number of birds if appropriate. A1♂ indicates one pair; 2A♂ means two pairs together.
A1	A calling Willow Tit.
<u>A1</u>	A Willow Tit repeatedly giving alarm calls or other vocalisations (not song) thought to have strong territorial significance.
	A singing Willow Tit.
	An aggressive encounter between Willow Tits.
+A1	An occupied nest of Willow Tits; do not mark unoccupied nests, which are of no territorial significance by themselves.
A1 mat	Willow Tit carrying nesting material.
A1 food	Willow Tit carrying food (during courtship display).
Willow Tit movements can be shown as follows:	
	A calling Willow Tit in flight (seen only in flight).
	A singing Willow Tit perched then flying away (not seen to land).
	A Willow Tit flying in and landing (first seen in flight).
The following conventions indicate when registrations relate to different birds, and when to the same bird:	
A1—A1	A Willow Tit moving between two perches. The solid line indicates it was definitely the same bird.
	Two Willow Tits in song at the same time, i.e. definitely different birds. The dotted line indicates a simultaneous registration and is of great value in separating territories.
	The solid line indicates that the registrations refer to the same bird.
	A question-marked solid line indicates that the registrations probably relate to the same bird.
A 	No line joining the registration indicates that the birds are probably different but depending on the pattern of other registrations they may be treated as if only one bird was involved.

Appendix 2: National willow tit survey form

	giving nature a home			NATIONAL WILLOW TIT SURVEY 2019-21		
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> 10 km square		<input type="text"/> Observer name			<input type="checkbox"/> Multiple cards	
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Tetrad		<input type="text"/> County				
<input type="text"/> Study Group or Willow Tit Project (if applicable)				<input type="text"/> Site name		

VISIT DETAILS							
Visit 1	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	WT territories on the 1st visit	<input type="text"/> min	<input type="text"/> max
Start time	:	End time	:	MT territories on the 1st visit	<input type="text"/> min	<input type="text"/> max	
Visit 2	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	WT territories on the 1st visit	<input type="text"/> min	<input type="text"/> max
Start time	:	End time	:	MT territories on the 1st visit	<input type="text"/> min	<input type="text"/> max	
Visit 3	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	WT territories on the 1st visit	<input type="text"/> min	<input type="text"/> max
Start time	:	End time	:	MT territories on the 1st visit	<input type="text"/> min	<input type="text"/> max	
TOTAL number of Willow Tit territories					<input type="text"/> min	<input type="text"/> max	
TOTAL number of Marsh Tit territories					<input type="text"/> min	<input type="text"/> max	

SUMMARY OF WILLOW TIT OBSERVATIONS										
WT territory	Ind (I), Pair (P), or count	Territory evidence codes	Found at playback point?	Playback point number	Located by playback?	reaction time (m:s)*	Playback response codes*	distance to WT (m)	Habitat codes	
									1	2
A (H)	visit 1		yes/no?		yes/no?	__ : __				
	visit 2		yes/no?		yes/no?	__ : __				
	visit 3		yes/no?		yes/no?	__ : __				
B (I)	visit 1		yes/no?		yes/no?	__ : __				
	visit 2		yes/no?		yes/no?	__ : __				
	visit 3		yes/no?		yes/no?	__ : __				
C (J)	visit 1		yes/no?		yes/no?	__ : __				
	visit 2		yes/no?		yes/no?	__ : __				
	visit 3		yes/no?		yes/no?	__ : __				
D (K)	visit 1		yes/no?		yes/no?	__ : __				
	visit 2		yes/no?		yes/no?	__ : __				
	visit 3		yes/no?		yes/no?	__ : __				
E (L)	visit 1		yes/no?		yes/no?	__ : __				
	visit 2		yes/no?		yes/no?	__ : __				
	visit 3		yes/no?		yes/no?	__ : __				
F (M)	visit 1		yes/no?		yes/no?	__ : __				
	visit 2		yes/no?		yes/no?	__ : __				
	visit 3		yes/no?		yes/no?	__ : __				
G (N)	visit 1		yes/no?		yes/no?	__ : __				
	visit 2		yes/no?		yes/no?	__ : __				
	visit 3		yes/no?		yes/no?	__ : __				

* Record only when located by playback

TERRITORY EVIDENCE CODES	
F	Flying over
H	Species observed in breeding season in suitable nesting habitat
S	Singing male present
P	Pair observed in suitable nesting habitat in breeding season
D	Courtship and Display (in or near potential breeding habitat)
A	Agitated behaviour or anxiety calls from adults
N	Visiting probable Nest site
B	Nest Building

PLAYBACK RESPONSE CODES	
S	Song
C	Calling
A	Agitated behaviour or anxiety calls
N	None

HABITAT CODES	
1 Habitat structure	2 Habitat category
A Low scrub, shrubs and managed hedgerows (1.5m to 3m)	A Linear features (e.g. hedges, tree lines, thin strips of woodland, railway embankments)
B Tall hedges, bushes, scrub and young trees (3m to 6m)	B Semi-natural scrub
C Trees and woodland edge (>6m)	C Young plantation (<5m high)
	D Plantation woodland (>5 m high);
	E Semi natural woodland (>5m high).

SUMMARY OF MARSH TIT OBSERVATIONS										
MT territory	Ind (I), Pair (P), or count	Territory evidence codes	Found at playback point?	Playback point number	Located by playback?	reaction time (m:s) [†]	Playback response codes [*]	distance to MT (m)	Habitat codes	
									1	2
A (F)	visit 1		yes/no?		yes/no?	:_				
	visit 2		yes/no?		yes/no?	:_				
	visit 3		yes/no?		yes/no?	:_				
B (G)	visit 1		yes/no?		yes/no?	:_				
	visit 2		yes/no?		yes/no?	:_				
	visit 3		yes/no?		yes/no?	:_				
C (H)	visit 1		yes/no?		yes/no?	:_				
	visit 2		yes/no?		yes/no?	:_				
	visit 3		yes/no?		yes/no?	:_				
D (I)	visit 1		yes/no?		yes/no?	:_				
	visit 2		yes/no?		yes/no?	:_				
	visit 3		yes/no?		yes/no?	:_				
E (J)	visit 1		yes/no?		yes/no?	:_				
	visit 2		yes/no?		yes/no?	:_				
	visit 3		yes/no?		yes/no?	:_				

OTHER NOTES

Please return the Tetrad maps and summary forms by 31 July 2020: either to your county/regional organiser or to Simon Wotton, Conservation Science, RSPB, The Lodge, Sandy, Bedfordshire, SG19 2DL.

National survey contact details:
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