



Article (refereed) - postprint

Broughton, Richard K.; Alker, Peter J. 2017. **Separating British marsh tits *Poecile palustris* and willow tits *P. montana* using a new feature trialled in an online survey.**

© 2017 British Trust for Ornithology

This version available <http://nora.nerc.ac.uk/517411/>

NERC has developed NORA to enable users to access research outputs wholly or partially funded by NERC. Copyright and other rights for material on this site are retained by the rights owners. Users should read the terms and conditions of use of this material at <http://nora.nerc.ac.uk/policies.html#access>

This is an Accepted Manuscript of an article published by Taylor & Francis Group in *Ringing & Migration* on 20/06/2017, available online: <http://www.tandfonline.com/10.1080/03078698.2017.1324000>

Contact CEH NORA team at
noraceh@ceh.ac.uk

The NERC and CEH trademarks and logos ('the Trademarks') are registered trademarks of NERC in the UK and other countries, and may not be used without the prior written consent of the Trademark owner.

1 Separating British Marsh Tits *Poecile palustris* and Willow Tits *P. montana* using a new
2 feature trialled in an online survey

3

4 RICHARD K BROUGHTON ^{1*} and PETER J ALKER²

5

6 ¹Centre for Ecology & Hydrology, Benson Lane, Crowmarsh Gifford, Wallingford,
7 Oxfordshire OX10 8BB, UK ²63 Lodge Road, Orrell, Wigan, Greater Manchester WN5 7AT,
8 UK

9

10 * Correspondence author. Email: rbrou@ceh.ac.uk

11

12 Running head: Online survey of Marsh and Willow Tits

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29 ABSTRACT

30 Confident separation of Marsh Tits and Willow Tits remains a challenge in Britain due to the
31 similar appearance of the local races of both species. Several criteria are available to assist
32 the identification of birds in the hand, but none is completely diagnostic and most are invalid
33 for young juvenile birds. Due to the continued decline in abundance of both species,
34 however, it is becoming increasingly difficult to trial new identification criteria in the field, as
35 very few ringers are catching sufficient numbers of either species. This paper describes the
36 results of an online survey that was used to test a proposed new identification feature for
37 separating the two species, based on differences in the pattern of colour contrast on the
38 greater covert feathers. The online survey was effective in recruiting a sufficient sample of
39 ringers of varying experience, who were asked to identify images of Marsh Tits or Willow Tits
40 based only on features of the greater coverts that were demonstrated using training images.
41 On average, each ringer correctly identified 82% of the 18 images, and each image was
42 correctly identified by an average 84% of the 140 ringers. The pattern of the greater coverts
43 is therefore recommended as an additional, complementary criterion for separating Marsh
44 Tits from Willow Tits. Online surveys are also recommended as an efficient platform for the
45 dissemination and trialling of identification features among the ringing community.

46

47 Keywords: internet, ringing, taxonomy

48

49

50

51

52

53

54

55

56

57 INTRODUCTION

58 In Britain the local races of the Marsh Tit *Poecile palustris dresseri* and Willow Tit *P.*
59 *montana kleinschmidti* are widely considered to be one of the most challenging pairs of
60 resident birds to identify, causing difficulty for observers and ringers alike (Broughton 2009).

61 Various identification criteria for separating the two species in the hand have been proposed
62 and reconsidered for over a century (e.g. Rothschild 1907, Perrins 1964, Scott 1999,
63 Redfern & Clark 2001, Broughton 2009), and features continue to be tested (du Feu & Clark
64 2014, Broughton et al. 2016). One plumage feature that does not appear to have been
65 considered previously is the colour pattern of the greater coverts. It was noted during
66 fieldwork that the greater coverts of Willow Tits appear to be more patterned than those of
67 Marsh Tits (pers. obs.), with a dark centre to the feather contrasting with a paler margin and
68 tip. On Marsh Tits, however, the greater covert feathers generally appeared to be more
69 uniform and with less obvious contrast.

70 The greater coverts are a feather tract that is routinely inspected by ringers that target
71 passerines, primarily for determining the age of individuals in many species (Svensson
72 1992). As such, ringers are generally used to evaluating and distinguishing subtle
73 differences in feather shape or colour, and so the feature was considered to have potential
74 as a new identification tool for Marsh and Willow Tits.

75 Individual interpretations of pattern and colour tone are subjective, however, and it can be
76 difficult to communicate the perceived differences to others. Due to the poor conservation
77 status of Marsh and Willow Tits in Britain, with both undergoing substantial and accelerating
78 declines in range and numbers since the 1960s (Robinson et al. 2015), there are further
79 difficulties in finding an adequate number of ringers that are catching sufficient birds of either
80 species on which to trial any proposed identification feature.

81 In light of these challenges, this paper describes the use of online tools to recruit a sufficient
82 sample of ringers take part in a web-based trial of the identification criterion based on the
83 greater coverts. In addition to testing the value of the greater covert pattern in separating
84 Marsh and Willow Tits, an associated aim was to assess the use of the online media to

85 engage with a broad sample of ringers and adequately communicate subtle differences in
86 plumage features. The results were used as a case study in the use of online surveys as a
87 training tool for ringers, which, if successful, would have a much wider application among the
88 specialist ringing community.

89

90 METHODS

91 During long-term research at Monks Wood, Cambridgeshire (52° 24'N 0° 14'W), Marsh Tits
92 of known age were routinely captured (by RKB) throughout the year and digital photographs
93 of the greater coverts were taken using a 12.1 megapixel compact digital camera (*Canon*
94 *Powershot SX40 HS*). Willow Tits were captured (by PJA) throughout the year in north-west
95 England, at various sites around Greater Manchester and adjoining areas of Lancashire and
96 Merseyside within 9 km of Wigan (53° 32'N 2° 37'W). As with Marsh Tits, digital photographs
97 were taken of the greater coverts, using a 10 megapixel compact digital camera (*Olympus*
98 *XZ-1*).

99 For the identification trial a total of ten Marsh Tit images were selected (five adults, five
100 juveniles) and eight Willow Tits (three adults, five juveniles). The juvenile birds were less
101 than a year old and had retained up to five unmoulted greater coverts, having undergone
102 some or all of the post-juvenile moult in their first summer.

103 The Marsh Tit images were almost all taken under a heavy tree canopy, compared to the
104 open skies for the Willow Tits, giving a discernible greenish cast to many of the Marsh Tit
105 photos that may have given cues to their identity. Consequently, the colour cast of the
106 affected Marsh Tit images was adjusted in *Corel Paint Shop Pro Photo X2* graphics software
107 to eliminate this effect by-eye.

108 The survey was compiled using templates available from Bristol Online Surveys
109 (www.onlinesurveys.ac.uk), an online service that was used to build and host the survey.

110 The structure was intended to be self-explanatory and very easy to navigate, consisting of
111 an introductory page that asked initial multiple-choice questions on the level of ringing permit
112 (A: the highest level in the British and Irish scheme, C: intermediate, T: trainee) and the

113 number of Marsh and Willow Tits ringed in the previous three years: never, rarely (five or
114 fewer), occasionally (six to ten), or regularly (11 or more).

115 The second page described the aims of the survey and introduced the concept of the greater
116 covert feature being tested. This 'training page' featured two images of each species (one
117 adult, one juvenile) showing the greater coverts on the open wing in the hand. A description
118 was given alongside the images of the salient points to look for in identification, with a brief
119 summary at the end. The images and text delivered on this page are shown in Fig. 1.

120 After reading the training page, respondents were then invited to click a button and progress
121 to the next page to begin the survey. This section consisted of 18 individual pages, each
122 featuring one of the selected images of the greater coverts of a Marsh or Willow Tit, and a
123 multiple choice question asking 'Which species?'. Possible answers available to the
124 respondent were 'Marsh Tit' or 'Willow Tit', one of which must be selected (clicked) before
125 progressing to the next image on the following page. Images could only be viewed one at a
126 time, as this would generally be how users would experience birds in the field. The final page
127 announced the end of the survey and thanked respondents for taking part.

128 The survey was launched on February 15th 2016 and publicised via a message posted to the
129 *BTO Ringers' Forum* Yahoo Group (<https://groups.yahoo.com/neo/groups/btoringers/info>).
130 Password access was installed as a safeguard against malicious or spurious responses from
131 non-target users, with the password being included in the launch message on the forum.
132 Respondents were asked to complete the survey once, and only fully completed surveys
133 were recorded. Results of the survey were downloaded from the hosting site via a private
134 login.

135

136 **Statistical analyses**

137 The survey results data contained an anonymous identifier for each respondent and answers
138 to each question regarding experience and image identification. Responses were grouped
139 by permit level and reported experience of each species and identification questions were
140 analysed as the proportion that were correctly identified by each respondent, and also the

141 proportion for each image (bird) that were identified correctly by all respondents. These
142 proportions of correct identifications were compared between groups of differing experience,
143 and also summarised for all ringers to give an overall indication of the success of the greater
144 covert feature in distinguishing between Marsh and Willow Tits.

145 Angular transformation was applied to proportional data before comparisons were made
146 between groups using Kruskal Wallis H tests. Non-parametric tests were used due to non-
147 normality of data, which was assessed using Anderson-Darling tests. All statistics were
148 performed in *Minitab 16*.

149

150 RESULTS

151 A total of 140 ringers took part in the survey, most (66%) during the first full day after launch
152 and 86% within three days. No further responses were being added by the tenth day, when
153 the survey was closed. Most respondents (64%) held the highest level of permit (A), with
154 27% holding an intermediate C permit, and 9% were trainees (T permit).

155 Three-quarters (76%) of all ringers had handled either Marsh or Willow Tits in the previous
156 three years, but only 15% regularly handled either species (Fig. 2) and no ringers regularly
157 handled both. Trainees were the least likely to have handled either species, with 50% having
158 no experience of Marsh Tits in the last three years and 67% not ringing any Willow Tits.
159 Amongst C-permit holders, the vast majority had rarely or never ringed a Marsh Tit (84%) or
160 Willow Tit (97%) and none had handled more than ten of the latter over the last three years.
161 Even among the most experienced ringers (A permit), only a third had handled more than
162 five Marsh Tits in that time period, and just 9% had handled more than five Willow Tits.

163 Despite these variations in experience, each ringer answering the survey had correctly
164 identified 82% (1.7 s.e.) of birds on average, based only on the images of the greater
165 coverts, with little variation between holders of different permits (Fig. 3a). Twelve ringers
166 (9%) identified all birds correctly, with a third (34%) making only one mistake or none, and
167 only eight (6%) misidentifying more than half of the images. There was a slight tendency for
168 ringers with greater experience of either species to correctly identify more birds than those

169 with less experience (Fig. 3b), but differences were not statistically significant (Kruskall
170 Wallis test: $H = 4.92$, $df = 3$, $P = 0.178$). Taken together, these results indicated that ringing
171 experience was not very important in discerning the identification feature being tested, and
172 all ringers could perform similarly well with the basic instruction provided (see Fig. 1).

173 Each image/bird featured in the survey was correctly identified by an average 84% of
174 respondents. The proportion of success varied between 60-94%, meaning that all birds were
175 identified correctly on a collective basis, but some were more difficult than others. The
176 accuracy of identifying both species was similar, with an average 85% (76-94%) of ringers
177 correctly identifying the ten Marsh Tits and 83% (60-92%) the eight Willow Tits, suggesting
178 that neither species was more difficult than the other. Juvenile Marsh Tits appeared the most
179 difficult species/age group to identify (Fig. 4), with an average of 81% (76-89%) of ringers
180 being correct compared to an average 84-88% (60-94%) for other groups, but differences
181 were not statistically significant ($H = 3.06$, $df = 3$, $P = 0.382$). The images for each species
182 that received the highest, lowest, and closest to average proportions of correct identifications
183 are shown in Fig. 5 to illustrate the variety of difficulty experienced by respondents to the
184 survey.

185 Feedback from respondents, received via private email or through the Yahoo Group forum
186 used to advertise the survey, was generally positive about the concept of trialling
187 identification features in this way, and also contained constructive comments on
188 improvements. These comments centred on the survey not providing immediate feedback at
189 the end of the 'quiz' to indicate how many images the respondent had identified correctly,
190 which was not considered during survey design.

191

192 DISCUSSION

193 The survey was successful in attracting a significant sample of ringers with a broad range of
194 experience, and most with some previous knowledge of Marsh Tits and/or Willow Tits.
195 Nevertheless, the total of 140 respondents represented only 5% of the ringers registered in
196 the British and Irish scheme in 2014 (Walker et al. 2015). The survey was only operational

197 for ten days, however, and advertised on only one online platform (which had 995 registered
198 users but probably a much smaller number of active users). As such, and considering the
199 relatively low numbers of full-grown Marsh Tits (981) and Willow Tits (286) ringed in Britain
200 during 2015 (Robinson et al. 2016), the survey is likely to have reached many of the primary
201 target audience, i.e. those ringers likely to be catching either of these species.

202 On average, more than eight out of ten respondents (84%) correctly identified each image of
203 a Marsh or Willow Tit from only the greater covert pattern. On average each individual ringer
204 correctly identified 82% of the images, and experience of either species, or ringing in
205 general, made little difference. This suggests that simple guidance and illustration of the
206 distinction between the greater coverts of each species, as given in the introductory pages of
207 the survey, was adequate for ringers of all ability to apply the method with similar success.

208 Using the greater covert pattern, the level of correct identification of Marsh Tits (averaging
209 85%) and Willow Tits (83%) was relatively high, rivalling other identification features such as
210 cheek pattern (87-94% accuracy, Broughton 2009), tail feather measurements (89%,
211 Broughton et al. 2016) or presence/absence of pale marks on the bill (96-99%, Broughton et
212 al. 2008). Unlike cheek pattern, however, which is only valid for birds after their post-juvenile
213 moult, and also the bill and tail features that are invalid for young juveniles in the first few
214 weeks after fledging, the greater covert pattern appears a valid feature for identifying birds of
215 any age. Using combinations of these features, it should be possible to identify with
216 confidence essentially all Marsh or Willow Tits.

217 If the sample captured by the survey was representative of ringing activity throughout Britain,
218 then the low proportion of ringers that regularly catch Marsh or Willow Tits is serious cause
219 for concern. For Willow Tits in particular, the great majority of intermediate (C permit) and
220 trainee (T) ringers did not ring any birds at all during the previous three years. This
221 underlines the genuine scarcity of this rapidly vanishing species, whose abundance in Britain
222 declined by 90% from 1988-2013 (Robinson et al. 2015). For Marsh Tits too, whose
223 abundance fell by 40% between 1988-2013 (Robinson et al. 2015), only one in five ringers
224 responding to the survey had handled more than five birds in the last three years.

225 From these figures it can be assumed that only a small minority of current and future ringers
226 in Britain will have much experience of identifying these species in the hand. As such,
227 additional training methods of the type being trialled in this study could help fill the gap of
228 direct field experience and help to ensure that those birds which are caught will not be
229 misidentified. Correct identification of these species will be essential for accurate monitoring
230 of the remaining populations.

231 The results and feedback from respondents to the survey suggest that online methods can
232 be a highly successful platform for trialling identification criteria among the ringing
233 community. Improvements to future surveys of this kind could include the standardisation of
234 images by using the same equipment and conditions, perhaps with the aid of a lightbox or
235 lamp to reduce the variation in colour cast experienced with Marsh and Willow Tit images
236 due to differing conditions.

237 Some of the feedback suggested other improvements for user satisfaction in future surveys,
238 such as immediate reporting of the user's performance in any trials. This could be
239 accommodated, although care would be needed not to bias testing of other users that may
240 be present at the same time, or tempt users to retake the test and revisit the more
241 challenging questions. Our survey could not exclude users from taking the test more than
242 once, although they were explicitly requested not to do so. Individual passwords could
243 enable such restrictions to be placed on users, but this would increase the complexity of
244 accessing the survey and may deter some people.

245 In summary, the online survey was successful in trialling a new identification feature for
246 separating Marsh and Willow Tits, i.e. the pattern of the greater coverts. With only four
247 images and brief comments as tuition, a pooled sample of ringers was able to identify all
248 birds with a moderately high degree of success. This identification method is recommended
249 to ringers as a new tool to be used alongside other established criteria, such as tail
250 measurement, bill and plumage features, when handling British Marsh Tits or Willow Tits.
251 The feature may also be valid for birds from other populations, such as the similar

252 subspecies in adjacent Continental Europe (e.g. France, Netherlands, Belgium, Germany),
253 and testing would be useful.

254 The general use of online surveys is recommended for trialling new identification features
255 among the ringing community, and could also be used for assessing features for ageing and
256 sexing of birds. With a testable idea, high quality images, suitable guidance and a user-
257 friendly online platform and interface, a large amount of trial data can be collected from a
258 broad sample of users in a very short period. The results can provide solid evidence of the
259 validity (or otherwise) of identification criteria, and also the ability of the target audience to
260 apply them. The reporting of any results is essential, however, to promote engagement and
261 the uptake of successful methods.

262

263 ACKNOWLEDGEMENTS

264 Great thanks are extended to all respondents to the online survey. Marsh Tit work in
265 Cambridgeshire was funded by the Natural Environment Research Council.

266

267 REFERENCES

268 **Broughton, R.K.** (2009) Separation of Willow Tit and Marsh Tit in Britain: a review. *British*
269 *Birds* **102**, 604-616.

270

271 **Broughton, R.K., Hinsley, S.A. & Bellamy, P.E.** (2008) Separation of Marsh Tit *Poecile*
272 *palustris* from Willow Tit *Poecile montana* using a bill criterion. *Ringling & Migration* **24**, 101-
273 103.

274

275 **Broughton, R.K., Alker, P.J., Bellamy, P.E., Britton, S., Dadam, D., Day, J.C., Miles, M.**
276 **& Hinsley, S.A.** (2016) Comparative biometrics of British Marsh Tits *Poecile palustris* and
277 Willow Tits *P. montana*. *Ringling & Migration* **31**, 30-40.

278 **du Feu, C. & Clark, J.** (2014) More on separating Marsh and Willow Tits. *Ringling News* **13**
279 **(3)**, 3.

280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306

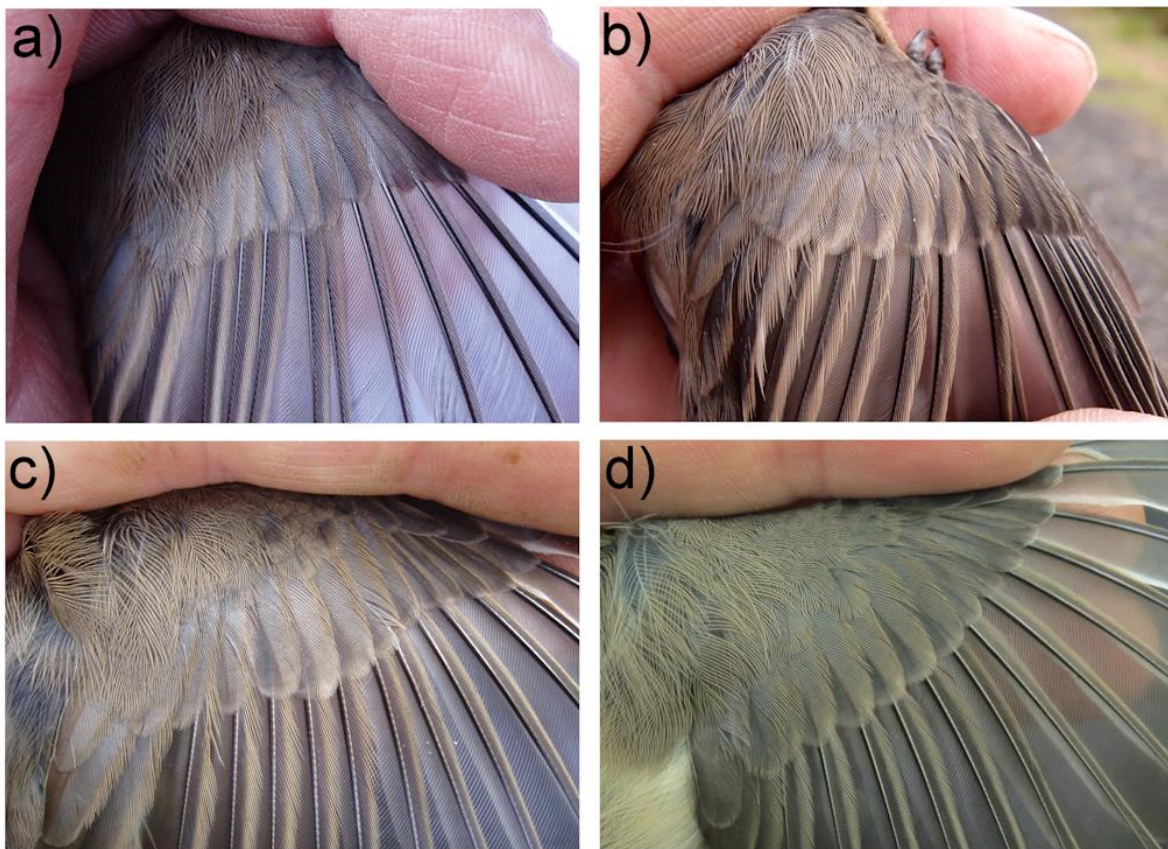
Robinson, R.A., Marchant, J.H., Leech, D.I., Massimino, D., Sullivan, M.J.P., Eglinton, S.M., Barimore, C., Dadam, D., Downie, I.S., Hammond, M.J., Harris, S.J., Noble, D.G., Walker, R.H. & Baillie, S.R. (2015) BirdTrends 2015: trends in numbers, breeding success and survival for UK breeding birds. Research Report 678. BTO, Thetford. <http://www.bto.org/birdtrends>

Robinson, R.A., Leech, D.I. & Clark, J.A. (2016) The Online Demography Report: Bird ringing and nest recording in Britain & Ireland in 2015. BTO, Thetford (<http://www.bto.org/ringing-report>)

Svensson, L. (1992). *Identification Guide to European Passerines* (4th Edition). L. Svensson, Stockholm.

Walker, R.H., Robinson, R.A., Leech, D.I., Moss, D., Kew, A.J., Barber, L.J., Barimore, C.J., Blackburn, J.R., Clewley, G.D., de Palacio, D.X., Grantham, M.J., Griffin, B.M., Schäfer, S. & Clark, J.A. (2015) Bird ringing and nest recording in Britain and Ireland in 2014. *Ringing & Migration* **30**, 84-147.

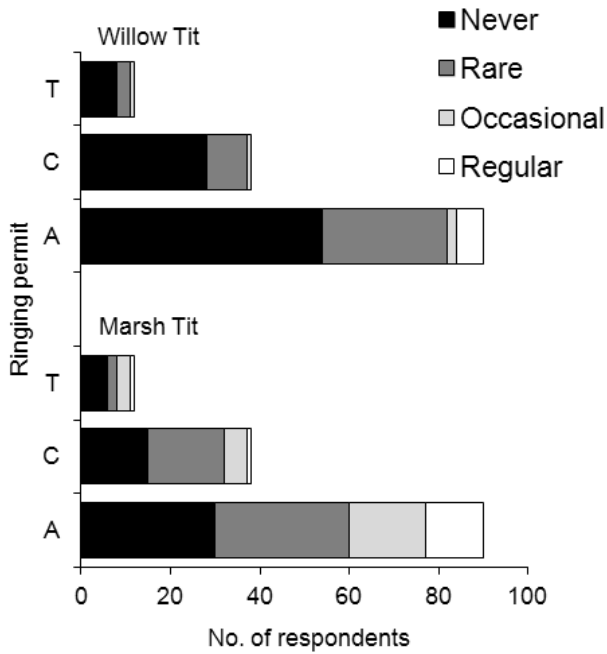
307 Figure 1. Four images used to 'train' users of an online survey to trial the identification of
308 proposed differences in the greater covert pattern of a) first-year and b) adult Willow Tits
309 compared to c) first-year and d) adult Marsh Tits. Information given in the survey advised
310 users to note on Willow Tits the very dark central shaft and greyish centre of the greater
311 covert feathers that contrasts with a brownish fringe. Pale tips may be present on the outer
312 web only, as in the Willow Tit in b). On Marsh Tits the central shaft is a less obvious
313 brownish colour, rather than the blackish on Willow Tits, and the outer webs of the greater
314 covert feathers are a more uniform brown with a slightly olive fringe. Marsh Tits greater
315 coverts were suggested to often have a slightly paler tip running across the inner and outer
316 webs in adults, as in d), or a strongly pale tip on the outer web of unmoulted greater coverts
317 in first-years, as in c).



318
319
320
321

322 Figure 2. Breakdown of 140 respondents to an online survey by ringing permit level (A:
323 greatest experience, C: intermediate, T: trainee) and number of Marsh Tits or Willow Tits
324 ringed over the previous three years (Never = none, Rare = 1-5, Occasional = 6-10, Regular
325 = 11+).

326



327

328

329

330

331

332

333

334

335

336

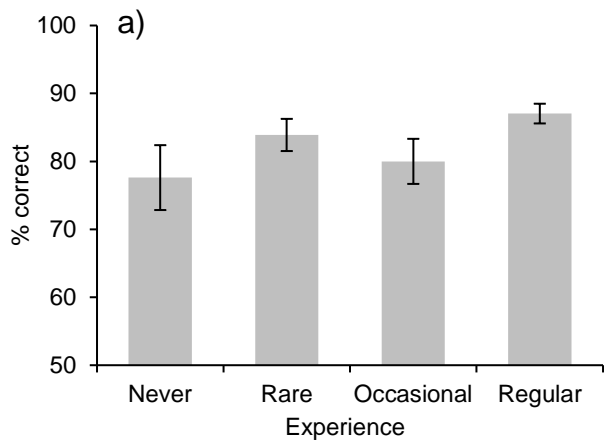
337

338

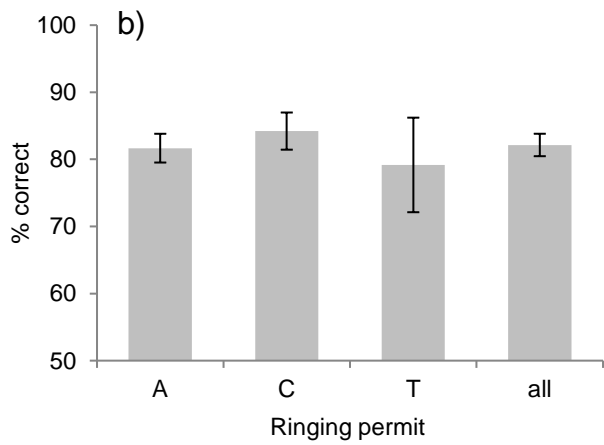
339

340 Figure 3. a) Mean (and s.e.) proportion of images of 10 Marsh Tits and 8 Willow Tits that
341 were correctly identified by each of 140 ringers. Identification was based solely on the
342 greater covert pattern; b) mean (and s.e.) proportion of ringers that correctly identified each
343 image, based solely on the pattern of the greater covert feathers.

344



345



346

347

348

349

350

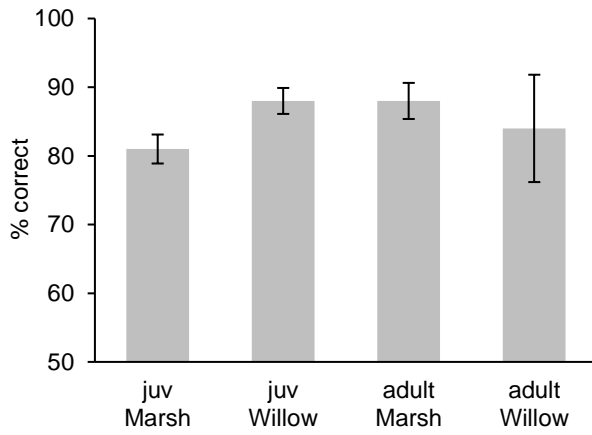
351

352

353

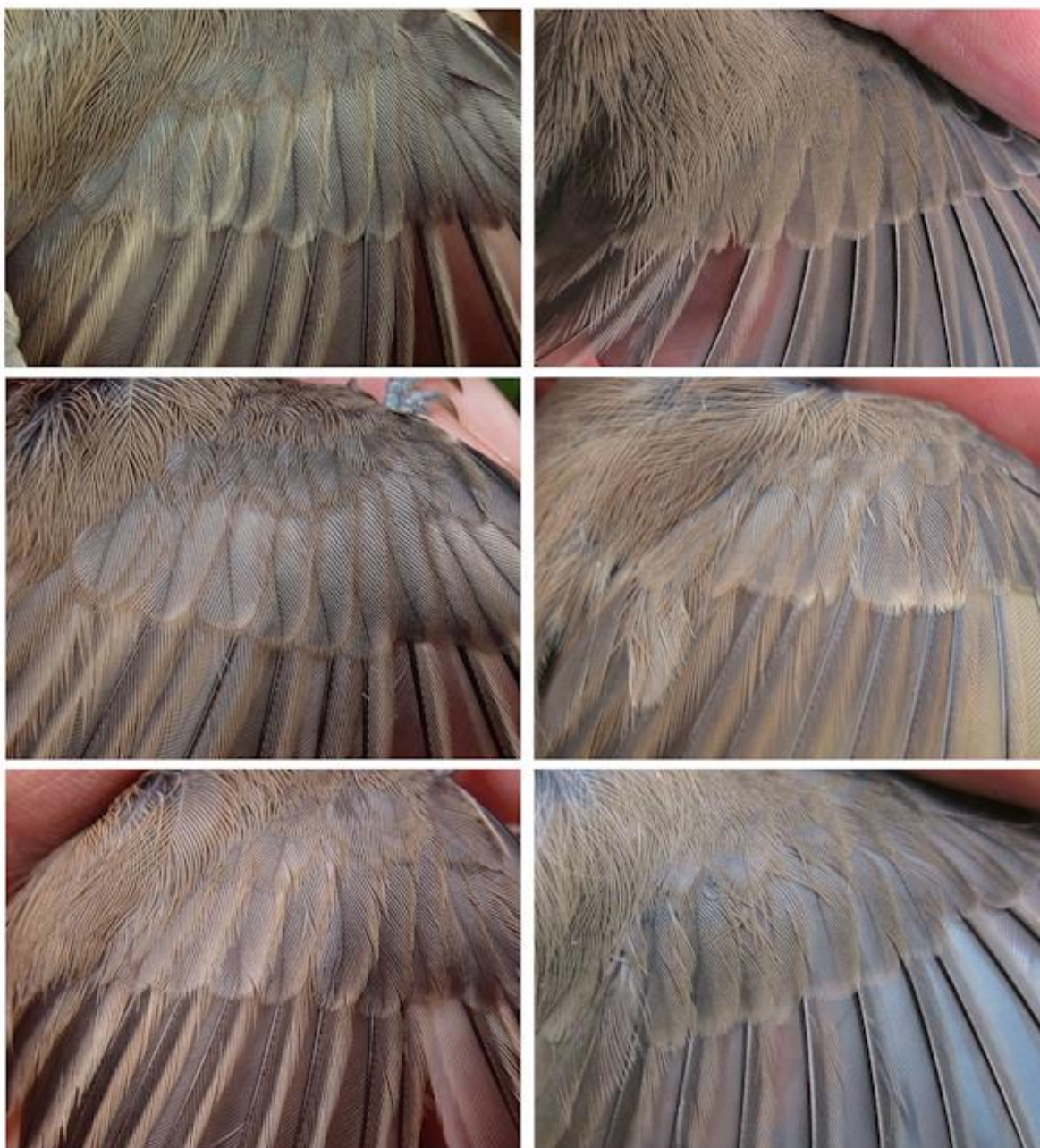
354

355 Figure 4. Mean (and s.e.) proportion of images of the greater coverts of 10 Marsh Tits (5
356 juvenile/first-year, 5 adult) and 8 Willow Tits (3 juvenile/first-year, 5 adult) that were correctly
357 identified by 140 ringers based on the greater covert pattern.



358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374

375 Figure 5. Images of the greater coverts of three British Willow Tits (left) and three British
376 Marsh Tits (right) used in the survey to trial the proposed differences in feather pattern.
377 These images received the highest proportion of correct identifications by survey
378 respondents (top), the proportion closest to the average (middle) or the lowest proportion of
379 correct answers (bottom), demonstrating the variation in perceived difficulty in judging the
380 greater covert pattern.



381

382