

## Muscicapidae: split *Erithacus rubecula* (European Robin) into three species

Markus Lagerqvist

### Background

This is an adjusted version of a pre-proposal submitted to the Palearctic RAG, 2025-12-28 recommending a split of *Erithacus rubecula* (European Robin) into three species based on an integrative approach combining mtDNA, songs and calls, morphology and bio geographics. The proposal is based mainly on the results by Sangster et al. (2022), but also Bergmann & Schottler (2001) and Stock & Bergmann (1988).

Sangster et al.: <https://doi.org/10.15111/zsc.12561>

Stock & Bergmann: [01-DutchBirding-Bergmann&Schottler.pdf](#)

Currently in AviList, the European Robin is divided into nine subspecies with the following ranges:

- *Erithacus rubecula melophilus* - breeds British Isles; partially migratory, some wintering to southwestern Europe
- *Erithacus rubecula rubecula* - breeds continental Europe eastward to the Ural Mountains, southward to northern Morocco and western Türkiye; northern and northeastern populations migratory, wintering in western and southern Europe and northern Africa; also (resident) on the Azores, Madeira, and western Canary Islands (La Palma, La Gomera, and El Hierro)
- *Erithacus rubecula superbis* - central Canary Islands (Teneriffe)
- *Erithacus rubecula marionae* - central Canary Islands (Gran Canaria)
- *Erithacus rubecula witherbyi* - northern Algeria and northwestern Tunisia
- *Erithacus rubecula valens* - Crimean Peninsula
- *Erithacus rubecula caucasicus* - eastern Türkiye eastward to the Caucasus region
- *Erithacus rubecula hyrcanus* - southeastern Azerbaijan and northern Iran
- *Erithacus rubecula tataricus* - breeds western Siberia (Ural Mountains to Semipalatinsk); winters to Iran

### Genetics

The genetic analyses in Sangster included Cytochrome b (cyt b) sequences (1125bp) of 92 individuals belonging to the subspecies *rubecula* from continental Europe, the Azores, Madeira, and the Canary Islands (excluding Tenerife and Gran Canaria), *superbus* from Tenerife, *marionae* from Gran Canaria, and *caucasicus* from eastern Turkey and the Caucasus.

The analysis shows that *rubecula*, *superbus*, and *marionae* are well separated from each other, with differences in mtDNA of 4.2–4.8 percent, and that *marionae* is a sister taxon to *rubecula* + *superbus*. *Caucasicus* also appears to be genetically distinct, but only one individual of this subspecies was included in the analysis. The *marionae*-clade differed from the *rubecula*-clade by 4.2%, from the *superbus*-clade by 4.8% and from the single sample of *E. r. caucasicus* by 4.5%.

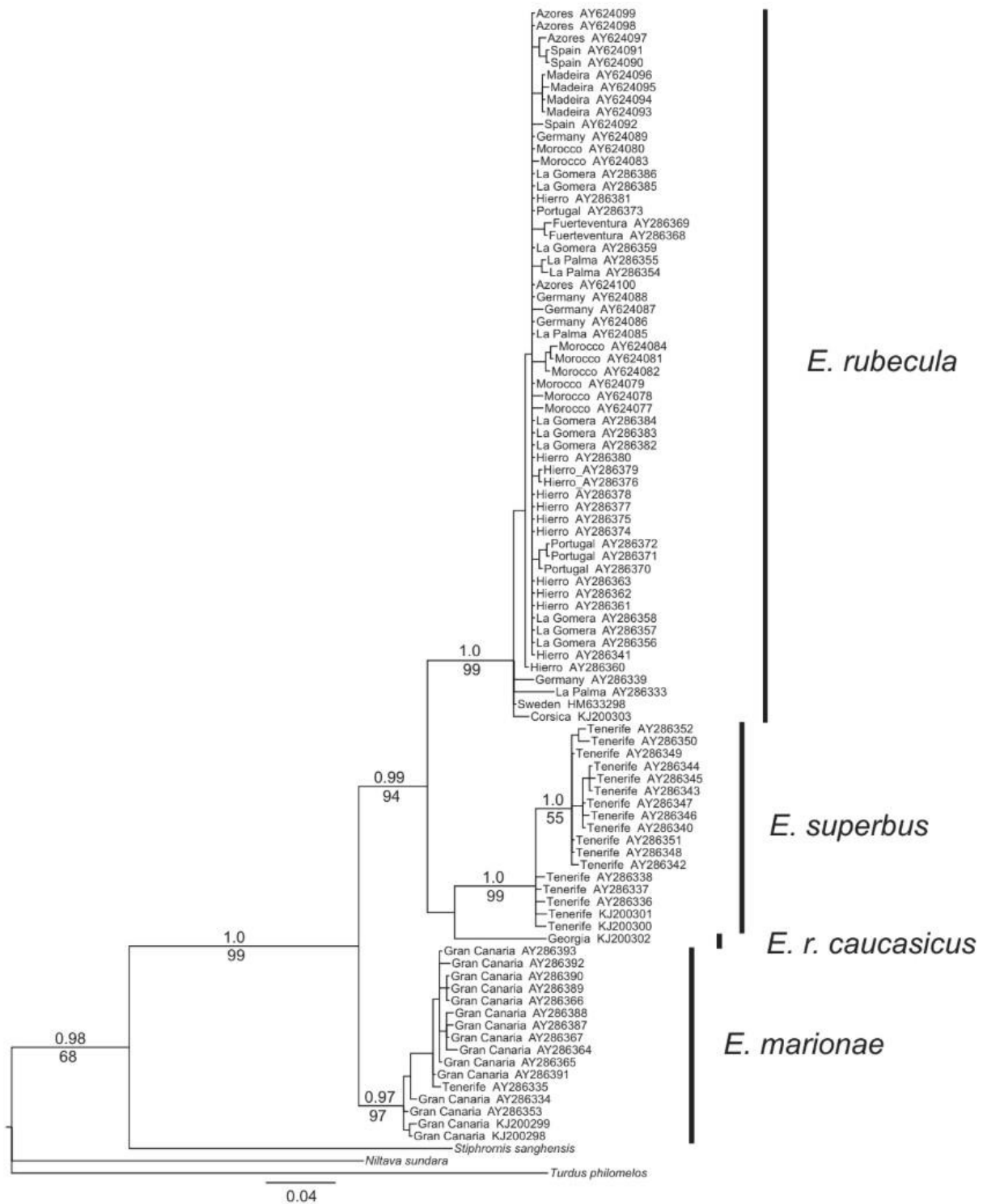


Figure: Majority-rule consensus tree obtained from Bayesian analysis of 1125bp of cytochrome *b* sequences of 92 *Erithacus robins* and three outgroups.

### Yardstick comparison

As a yardstick, the sequence divergence in the *Erithacus* taxa mentioned above are greater than those of other accepted endemics in the Canary Islands compared to their closest mainland relatives such as *Columba bolli* vs. *C. trocaz* (2.5%), *Saxicola dacotiae* vs. *S. rubicola* (2.7%), *Phylloscopus canariensis* vs. *P. collybita* (3.5%), *Fringilla teydea* vs. *F. polatzeki* (2.0%) and *Fringilla canariensis* vs. *F. maderensis* (1.6%).

### **Comment from Stervander on the genetic analysis:**

The mitochondrial divergence is relatively deep. I was a little surprised that neither of the studies had tried to estimate the divergence time, so I set out to do that, gathering sequence material, evaluating appropriate substitution models, and running analyses in Beast2 applying a strict clock following the 2.1%/MY cytB clock. This results in splits at between 4.5 and 5 MYA.

If it really is correct that *superbus* is sister to the nominate group, with *marionae* as sister to those, that would indeed (most reasonably) reflect multiple colonisations of the Canary Islands, on up to three independent occasions. This might seem unlikely to some but has been shown in other systems like the Canary blue tits (see e.g. 2015 Mol Ecol: <https://doi.org/10.1111/mec.13145>). But, importantly, the analyses I ran do not recover *superbus* as sister to the nominate group with strong support. Instead, the divergence between those two clades as well as *marionae* and *hyrcanus*\* should probably best be considered a polytomy.

Now, there are a couple of complicating factors and uncertainties. One is the lack of any larger-scale nuclear data. The other is the poor sampling from parts of the distribution, and the position emerging for that one *caucasicus/hyrcanus* sample. It is reported as a *hyrcanus* from the Swedish Museum of Natural History collections, but its collection site instead agrees with the distribution of *caucasicus*, as noted by Sangster et al. On the other hand, the two neighbouring subspecies seem reasonably similar and, without any quantitative analyses of song (not my area), they also seem to have similar song.

Should the position of Caucasian robins indeed be confirmed as sister to *superbus*, that would call for rather surprising biogeographic interpretations. However, the node support is not strong and again I would argue it should be considered part of a basal polytomy.

As an aside, there is a single sample that splits out as sister to all other birds in the nominate clade. It is from a paper on bluethroats, which includes a few sampling sites, one of which is east of the Ural Mths. I suspect that this robin sample may have been collected there, which would be within the range of *E. r. tataricus*, and I am waiting for confirmation/clarification from the authors.

### **Bioacoustics**

Analyses of vocalizations were made on song (29 *marionae*, 17 *superbus*, and 14 *rubecula*), as well as alarm calls and the begging calls of females. Previous studies with playback experiments have shown that *superbus* responds less to *rubecula* song than to *superbus* song (Stock & Bergmann, 1988). The results indicate clear differences between the three subspecies regarding both song, alarm calls, and begging calls (see table 2). The authors did not have access to sufficient data to conduct corresponding analyses of *caucasicus*.

The song of *E. r. marionae* differs from European *E. rubecula* in:

1. shorter song duration;
2. fewer phrases per song;
3. higher proportion of songs with a high frequency introductory note;
4. shorter phrase duration;
5. shorter absolute phrase duration;
6. shorter duration of first phrase;
7. fewer notes in song;
8. lower proportion of unique notes in song;

9. fewer unique notes in song;
10. fewer notes in first phrase;
11. higher proportion of frequency shifts;
12. fewer frequency shifts;
13. more repetition of notes in last phrase;
14. higher minimum frequency;
15. smaller frequency range;
16. fewer low-, mid- and high-frequency notes;
17. lower proportion of LF notes;
18. higher proportion of HF notes, and;
19. fewer unique songs (i.e. more repetitions of entire songs within a song sequence).

The combined effect of these differences was easily heard in the field.

Songs of *E. r. marionae* appear similar on sonograms to those of *E. r. superbus* but differed significantly in having:

1. fewer low-frequency notes (<4 kHz) and more mid-frequency notes (4–7 kHz);
2. higher minimum frequency;
3. more (and higher proportion of) unique notes per song;
4. less note repetition in the last phrase, and;
5. higher proportion of unique songs (i.e. fewer repetitions of entire songs within a song sequence).

Even though the songs of Gran Canaria Robins are superficially similar to those of *E. superbus*, they could be correctly classified in 100% of the cases using multivariate analysis.

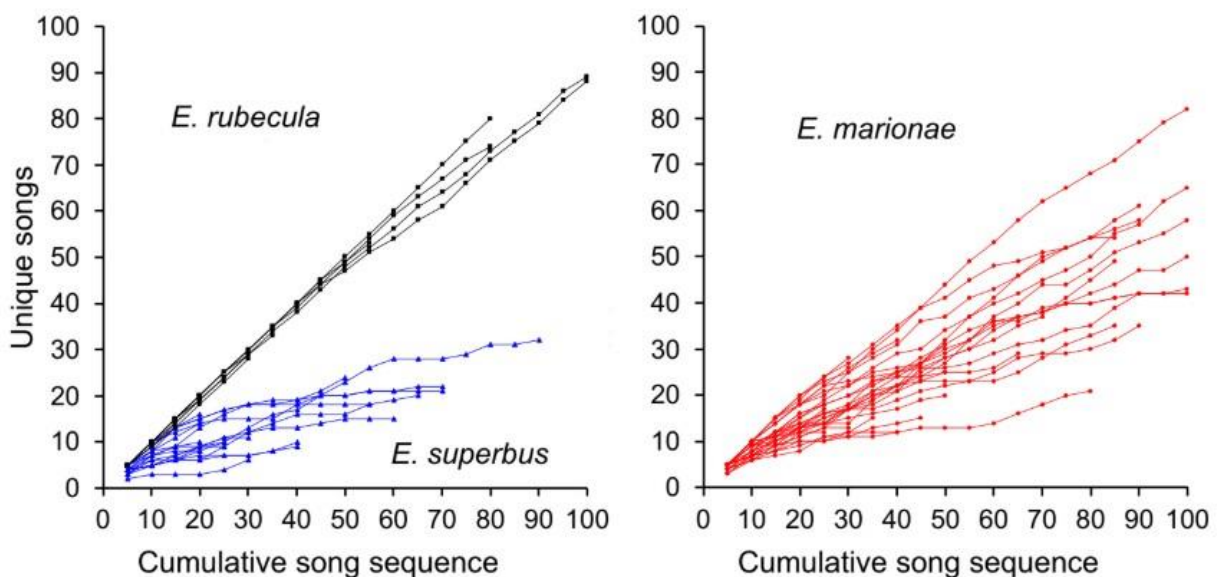


FIGURE 3 Number of unique song types in song sequences of three species of *Erithacus* robins

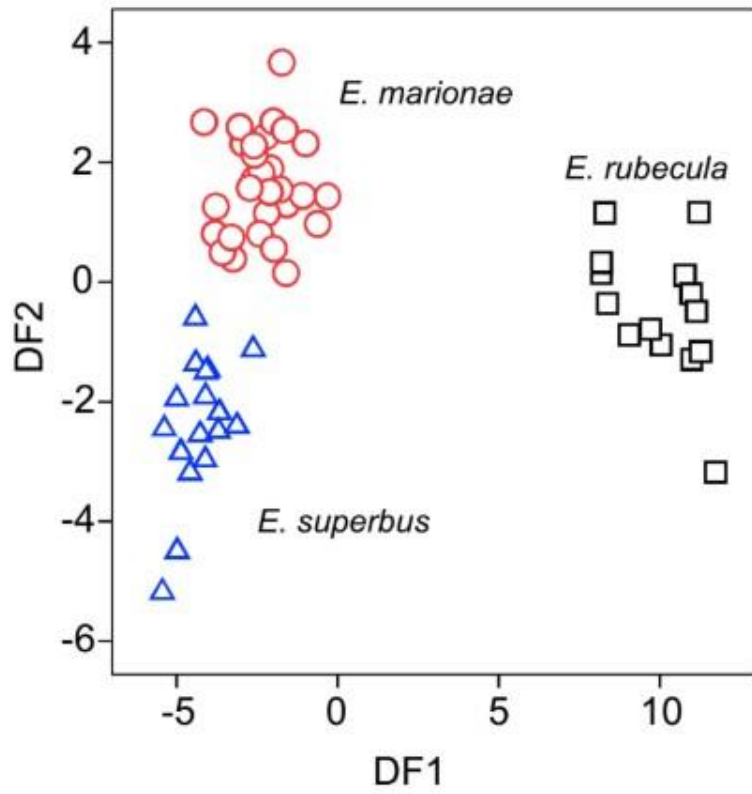
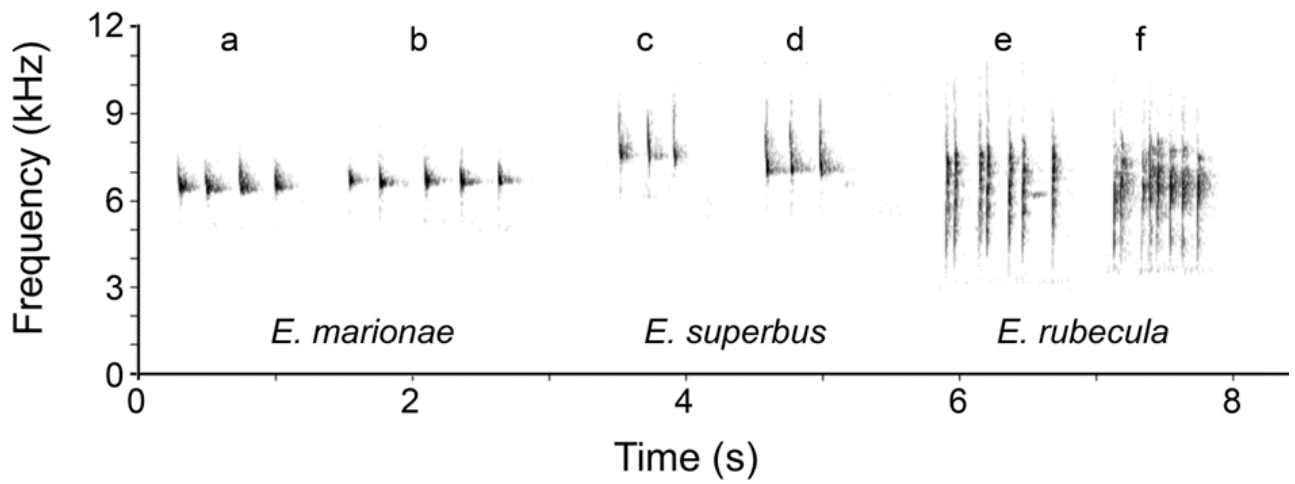


FIGURE 4 Discriminant function scatterplot of song variables. Depicted are the two roots of 24 song variables measured for *Erithacus marionae*, *E. superbus* and *E. rubecula* ( $N = 60$ )



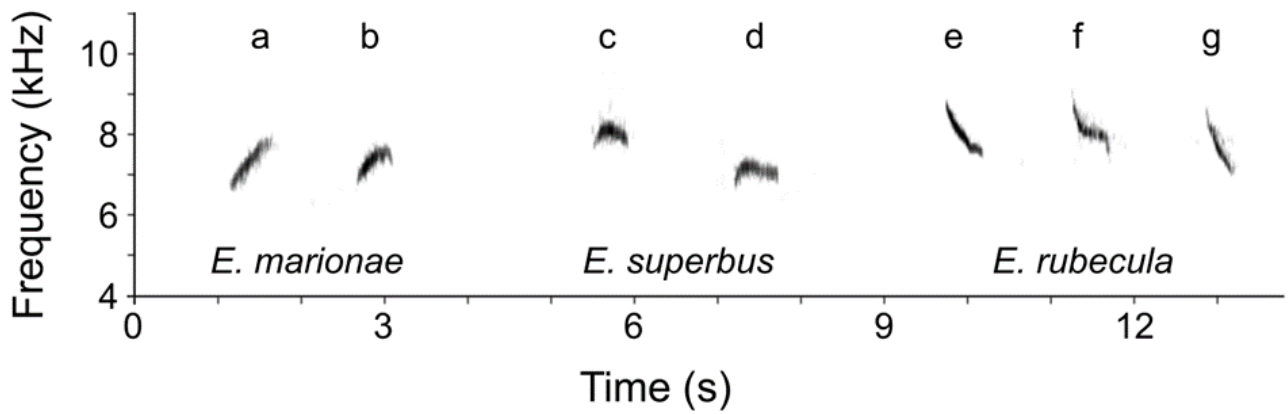


Figure: Tic calls and seep calls from Sangster et al (2022)

Below sonograms from the analysis in Stock & Bergmann showing differences in song, song imitations, alarm calls between *rubecula*, *superbus* and *marionae*.

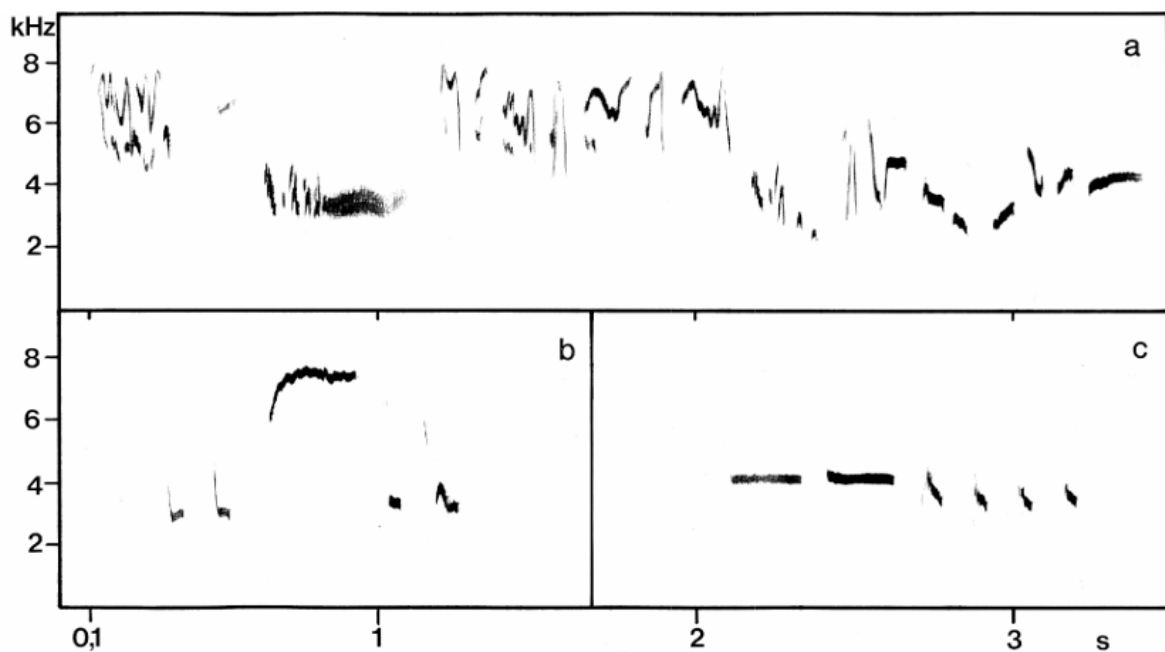


FIGURE 1 Sonograms of songs of European Robin / Roodborst *Erithacus rubecula* and Tenerife Robins / Teneriferoodborst *E. superbis* (Hans-Heiner Bergmann). a, European Robin, Volkesfelden, Dillkreis, Hessen, Germany, 18 April 1976. b-c, Tenerife Robin, Monte del Agua, Teno mountains, Tenerife, Canary Islands, 20 February 1987. Songs of *superbus* are significantly shorter

FIGURE 2 Sonograms of song imitations by Tenerife Robin / Teneriferoodborst *Erithacus superbus* (Hans-Heiner Bergmann, except 2d). a, possible song imitation of Atlantic Canary *Serinus canaria*, Genoves, Tenerife, Canary Islands, 16 February 1987. b, model for a: typical song phrases of Atlantic Canary / Kanarie, Vilaflor, Tenerife, Canary Islands, 10 April 1972. c, song strophe imitating song of Northern Chiffchaff *Phylloscopus collybita* of subspecies *P c collybita*, Monte del Agua, Teno mountains, Tenerife, Canary Islands, 20 February 1987. d, possible model for c: song of Northern Chiffchaff / Tjiftjaf, Weil, Baden-Württemberg, Germany, date unknown (E Arendt). Three dots indicate that songs are shortened in sonagram

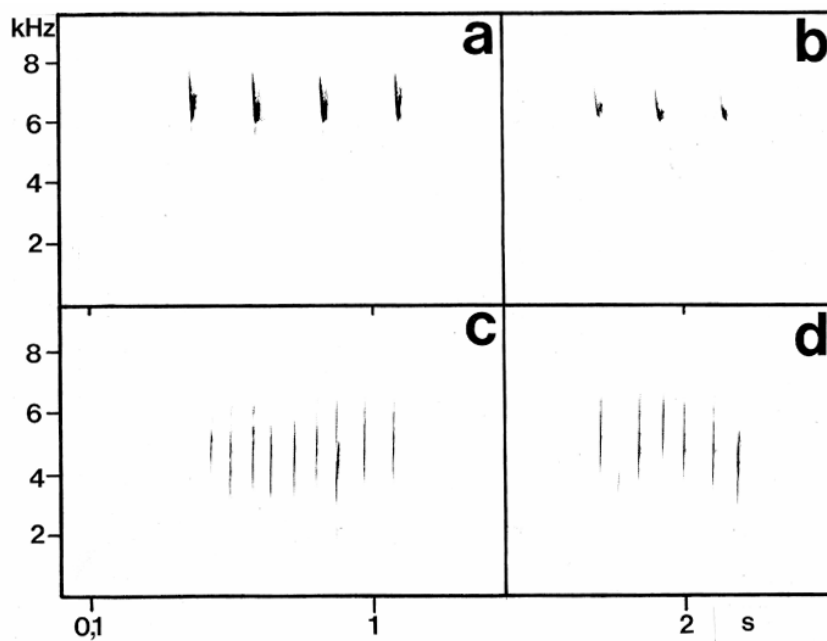
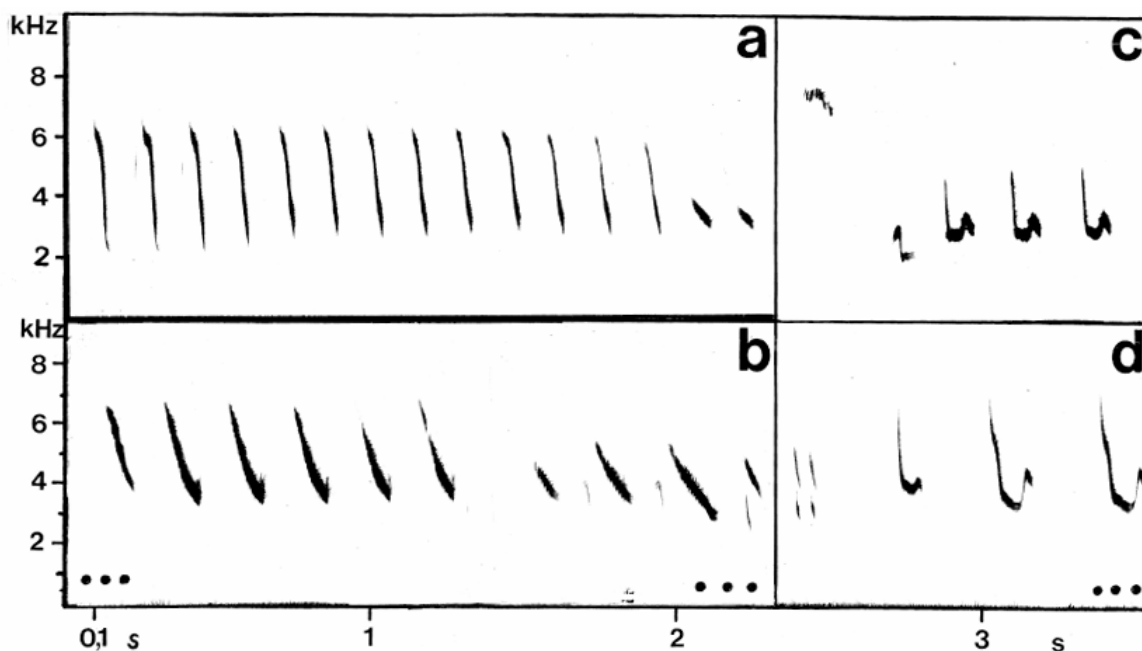


FIGURE 3 Sonograms of alarm calls of Tenerife Robin / Teneriferoodborst *Erithacus superbus* and European Robin / Roodborst *E rubecula* (Hans-Heiner Bergmann). a-b, Tenerife Robin, Monte del Agua, Teno mountains, Tenerife, Canary Islands, 20 February 1987. c-d, European Robin, Marburg, Hessen, Germany, 16 July 1978

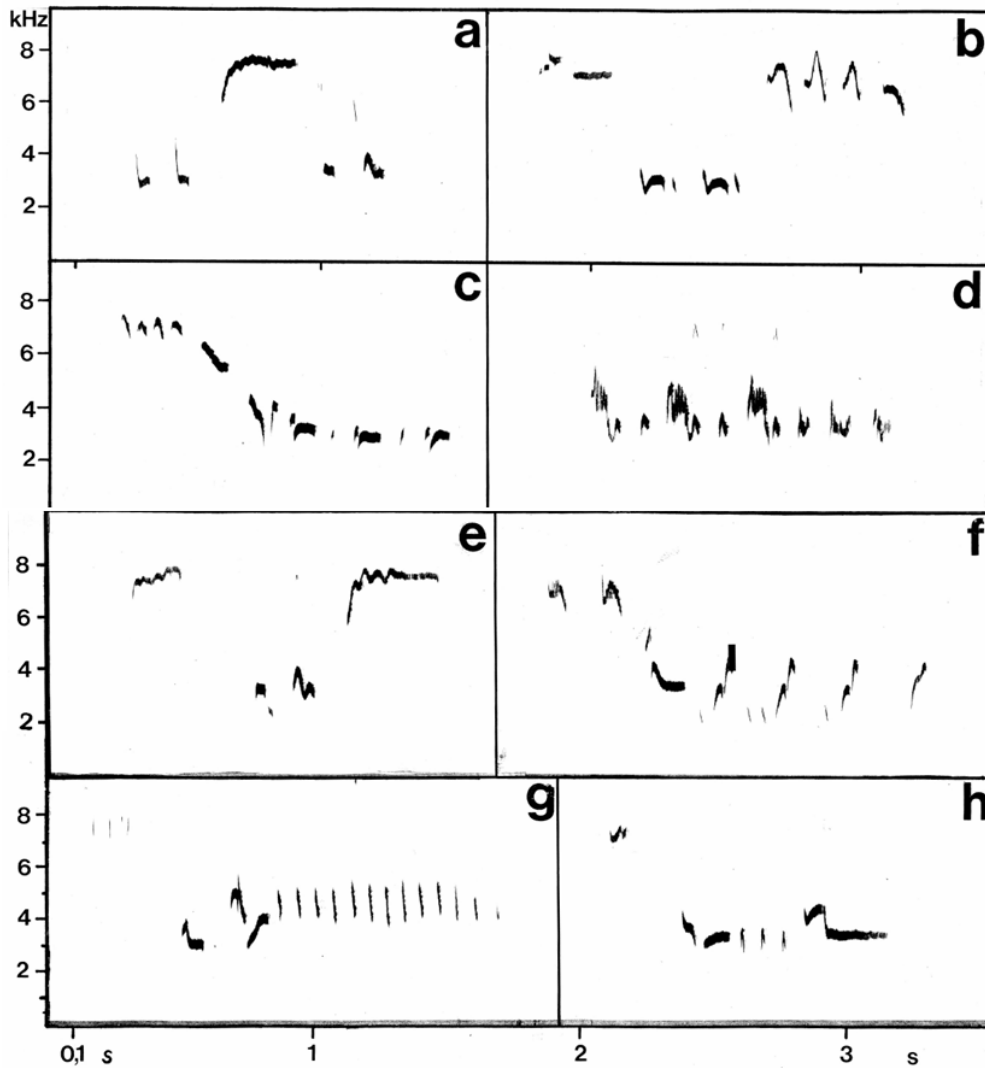


FIGURE 4 Sonograms of songs of Tenerife Robin / Teneriferoodborst *Erithacus superbus*, Monte del Agua, Teno mountains, Tenerife, Canary Islands, 20 February 1987 (Hans-Heiner Bergmann). Note rich structure

Some examples of songs and calls from Xeno-canto:

Song of *superbus*:

<https://xeno-canto.org/1059770>

<https://xeno-canto.org/1045471>

<https://xeno-canto.org/964665>

Call of *superbus*:

<https://xeno-canto.org/632433>

<https://xeno-canto.org/354861>

Song of *marionae*:

<https://xeno-canto.org/768331>

<https://xeno-canto.org/398575>

<https://xeno-canto.org/358720>

Song of *nominate*:

<https://xeno-canto.org/215109>

<https://xeno-canto.org/80330>

Call of *nominata*:

<https://xeno-canto.org/1050324>

<https://xeno-canto.org/1049894>

Song of *caucasicus*:

<https://xeno-canto.org/946409>

<https://xeno-canto.org/482690>

Alarm call, call of *caucasicus*:

<https://xeno-canto.org/937703>

<https://xeno-canto.org/937643>

## Morphology

As for plumage characteristics, *marionae* and *superbus* differ from *rubecula* in having

- a light, pale eye ring;
- a darker and grayer ash-gray forehead and breast sides;
- a distinctive darker, deeper rust colour on the face and breast;
- a darker olive-grey back, and;
- a whiter belly and undertail.

*Marionae* and *superbus* have very similar plumage and are even synonymised in Shirihai & Svensson (published before Sangster). In both males and females, wing and bill length differed significantly among the three groups. Male and female *E. r. marionae* had shorter wings than both *E. r. superbus* and European robins of the corresponding sex.

Similarly, male and female *E. r. superbus* robins had shorter wings than *E. rubecula* from Europe and North Africa. Bill length of male *E. r. marionae* did not differ from that of *E. r. superbus* robins but was significantly greater than that of *E. rubecula* from Europe and North Africa. Both male and female robins from *E. r. superbus* had longer bills than *E. rubecula* from Europe and North Africa of the corresponding sex.



*Erithacus rubecula rubecula*. © rubacolor



*Erithacus rubecula superbus*. © Alessia Guggisberg



*Erithacus rubecula superbus*. © Juan Emilio



*Erithacus rubecula superbus*. © Magdalena Nogaj



*Erithacus rubecula marionae*. © Juan Emilio Checa



Skins from the MNCC in Edinburgh, to the left a *superbus* from Tenerife and to the right three nominate ssp. for comparison.

## Biogeography

Sangster et al. addresses the criterion of reproductive isolation considering they have allopatric breeding ranges. They argue that three lines of evidence suggest that there are intrinsic barriers to interbreeding.

1. Tenerife (*E. r. superbus*) and the west Canarian Islands La Palma, El Hierro and La Gomera (*E. r. rubecula*) are geographically close, the shortest distance being a narrow <30 km stretch of water between La Gomera and Tenerife. On geographic grounds these populations may be expected to interbreed regularly. Yet no shared haplotypes were found, although this evaluation of gene flow is limited by the absence of nuclear markers and by the relatively low number of individuals sampled. In contrast, populations of *Phylloscopus canariensis*, *Anthus berthelotii*, *Serinus canaria* or the three *Sylvia* warblers breeding in the Canaries seem to interbreed regularly (Dietzen et al., 2006, 2008a; Illera et al., 2007, 2020).
2. *E. rubecula* from Europe and North Africa and *E. r. superbus* show differences in plumage and song characters. Such differences are commonly observed among closely related but reproductively isolated species in chats and flycatchers, including *Saxicola*, *Luscinia*, *Tarsiger*, *Phoenicurus* and *Ficedula* (e.g. Cramp, 1988; Martens & Eck, 1995; Urquhart & Bowley, 2002). Furthermore, differences in plumage and song characters are known to be involved in species recognition and reproductive isolation in *Ficedula* (Alatalo et al., 1994; Qvarnström et al., 2006).
3. A playback study has shown that *E. superbus* responds less often and less intensely to playback of songs of *E. rubecula* than to those of *E. superbus* (Stock & Bergmann, 1988), demonstrating that individuals of *E. superbus* are able to discriminate among songs of *E. rubecula* and *E. superbus*.

## Recommendation

Even though nuclear studies are lacking, large differences in mtDNA, distinct vocalizations (songs and calls), and clear differences in plumage and morphology are arguments for species status for *superbus* and *marionae*.

The differences between *superbus* and *marionae* are smaller, especially regarding plumage, so one could argue for a split of these two as subspecies. However, if *rubecula* and *superbus* are accepted as species, the sister-group relationship of the Gran Canaria population to *E. rubecula* + *E. superbus* indicates that the Gran Canaria population should also be treated as a species. They also differ in calls. The authors' recommendation to await further studies on *caucasicus* to determine its status seems wise.

Tenerife Robin for *E. superbus* and Gran Canaria Robin for *E. marionae* would be the obvious names if split. Both names are also already used for the subspecies, e.g. on iNaturalist.

## Voting and comments

The committee voted 6-1 for the proposal.

YES: Markus Lagerqvist (author), Erling Jirle (co-author), Gustav Asplund (co-author), Martin Stervander, Manuel Schweizer, Pierre Andre Crochet.

NO/PEND: Min Zhao

Below a few comments on from committee members

Comment from Zhao: I vote No/Pend on this case due to the very limited dataset (only Cytb) and the lack of reciprocal monophyly for the two focal groups (one Tenerife individual [AY286335] is nested within the Gran Canaria clade).

Additionally, the Georgia sample appears sister to the *superbus* clade, although without strong branch support (figure legend says: Support values are only presented for nodes supported by  $pp > .95$ ). Based on the presented results, if *marionae* and *superbus* are elevated, we should do the same for *caucasicus* for consistency. However, I do not think there is strong support for elevating *caucasicus* at this stage.

Overall, implementing a split now (whether two-way or three-way) risks necessitating further taxonomic revisions in the near future. It would be preferable to wait until more comprehensive data are available.

Comment from Schweizer: I would really love to see some proper nuclear data for the entire complex, to find out how much the mtDNA pattern is influenced by retention of ancestral polymorphisms and incomplete lineage sorting. Notwithstanding this, both *marionae* and *superbus* seem rather distinct when an integrative approach is applied, and if a majority of the RAG member voted for a split, I would support this.

Comment from Crochet: The analyses on calls are not ideal, as we are presented with sonograms of tic calls and seep calls from the three putative species and there are tests of statistically significant differences in several call parameters for both tic and seep calls but we are not shown the amount of variation and (lack of?) overlap in tic and seep calls; the text mentions diagnostic differences in tic and seep calls between all three "species" but no evidence is presented for this lack of overlap.

Having said that, I think the combination of differences in tic calls, seep calls, song and plumage between Europe and the Canaries are more in line with species-level divergence. What is especially relevant in this case is that not all islands in the Canaries are inhabited but these endemic taxa, since La Gomera, La Palma and El Hierro are inhabited by *rubecula*, as confirmed by both mtDNA and plumage. Interestingly, these three islands are further west (i.e. further away from the continent) than Tenerife and Gran Canaria.

Last, Fuerteventura have wintering *rubecula*. The emerging pattern is thus that Tenerife and Gran Canaria are inhabited by robin taxa that differ from *rubecula* in song, calls, plumage and are not connected by female gene flow, despite being "accessible" to *rubecula* as evidenced by the wintering of *rubecula* in Fuerteventura (at least) and the colonization of three islands further west by *rubecula*.

All in all, I think the evidence at hand is enough to justify formal recognition of the species-level divergence of the Canaries robin. If we wait for complete evidence (incl. genomic data) for every case we will move on too slowly.

Now, I still struggle to decide how to treat *marionae* vis a vis *superbus*. Plumage and song are very similar, the only "strong" differences are in calls (tic and seep both seem to differ diagnostically) and mtDNA (indicating near-complete isolation in female gene flow). I'm not too impressed by the "non-monophyly" of *superbus* + *marionae* as these relationships are inferred from short DNA fragments (1100bp of cytb) so we could perfectly have a monophyletic "Canarian Robin" in reality, yet it makes a 2-way split (Europe vs Canaries) difficult to justify.

All in all, I think I would favour a formal recognition of *Erithacus rubecula*, *E. superbus* and *E. marionae* as valid species after all, acknowledging that this is based on incomplete and partially contradictory evidence (cf the lack of mtDNA monophyly of the new *E. rubecula*) but prioritizing the

need to produce a taxonomy that reflects biodiversity with the evidence at hand rather than wait for perfect evidence (that might take years to come). The differences in calls reinforce the hypothesis that *marionae* and *superbus* are distinct lineages in spite of the somehow inconclusive mtDNA data.

I think I would finally favour YES here, somehow reluctantly but as the best of a bad choice. So I formally change my vote to YES.

I'm not too worried by the Caucasian robin at this stage, one mtDNA sequence with poorly supported position can be ignored for the time being.

## References

Bergmann, H.-H. and Schottler, B. H. 2001. Tenerife Robin – A species of its own? *Dutch Birding* 23:140–146.

Sangster, G., Luksenburg, J. A., Päckert, M., Roselaar, C. S., Irestedt, M. and Ericson, P. G. P. 2022. Integrative taxonomy documents two additional cryptic *Erithacus* species on the Canary Islands (Aves). *Zoologica Scripta* 51: 629–642. <https://doi.org/10.15111/zsc.12561>

Shirihai, H. and Svensson, S. 2018. *Handbook of Western Palearctic Birds. Volume 1: Larks to Warblers*. Bloomsbury, London, UK.

Stock, M. and Bergmann, H.-H. 1988. Der Gesang des Rotkehlchens (*Erithacus rubecula superbus*) von Teneriffa (Kanarische Inseln) – Struktur und Erkennen eines Inselndialektes. *Zoologische Jahrbücher. Abteilung für allgemeine Zoologie und Physiologie der Tiere*. 2:197–212.