




# Peer Community In Ecology

## Searching for conservation opportunities at the margins

**Ana S. L. Rodrigues**  based on peer reviews by **Elena D Concepción** and **Scott Wilson**

Mallet Pierre, Béchet Arnaud, Sirami Clélia, Mesléard François, Blanchon Thomas, Calatayud François, Dagonet Thomas, Gaget Elie, Leray Carole, Galewski Thomas (2023) Field margins as substitute habitat for the conservation of birds in agricultural wetlands. bioRxiv, ver. 3, peer-reviewed and recommended by Peer Community in Ecology.

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In a progressively human-dominated planet (Venter et al., 2016), the fate of many species will depend on the extent to which they can persist in anthropogenic landscapes. In Western Europe, where only small areas of primary habitat remain (e.g. Sabatini et al., 2018), semi-natural areas are crucial habitats to many native species, yet they are threatened by the expansion of human activities, including agricultural expansion and intensification (Rigal et al., 2023).

A new study by Mallet and colleagues (Mallet et al., 2023) investigates the extent to which bird species in the Camargue region are able to use the margins of agricultural fields as substitutes for their preferred semi-natural habitats. Located in the delta of the Rhône River in Southern France, the Camargue is internationally recognized for its biodiversity value, classified as a Biosphere Reserve by UNESCO and as a Wetland of International Importance under the Ramsar Convention (IUCN & UN-WCMC, 2023). Mallet and colleagues tested three specific hypotheses: that grass strips (grassy field boundaries, including grassy tracks or dirt roads used for moving agricultural machinery) can function as substitute habitats for grassland species; that reed strips along drainage ditches (common in the rice paddy landscapes of the Camargue) can function as substitute habitats to wetland species; and that hedgerows can function as substitute habitats to species that favour woodland edges. They did so by measuring how the local abundances of 14 bird species (nine typical of forest edges, 3 of grasslands, and two of reedbeds) respond to increasing coverage of either the three types of field margins or of the three types of semi-natural habitat.

This is an elegant study design, yet – as is often the case with real field data – results are not as simple as expected. Indeed, for most species (11 out of 14) local abundances did not increase significantly with the area

of their supposed primary habitat, undermining the assumption that they are strongly associated with (or dependent on) those habitats. Among the three species that did respond positively to the area of their primary habitat, one (a forest edge species) responded positively but not significantly to the area of field margins (hedgerows), providing weak evidence to the habitat compensation hypothesis. For the other two (grassland and a wetland species), abundance responded even more strongly to the area of field margins (grass and reed strips, respectively) than to the primary habitat, suggesting that the field margins are not so much a substitute but valuable habitats in their own right.

It would have been good conservation news if field margins were found to be suitable habitat substitutes to semi-natural habitats, or at least reasonable approximations, to most species. Given that these margins have functional roles in agricultural landscapes (marking boundaries, access areas, water drainage), they could constitute good win-win solutions for reconciling biodiversity conservation with agricultural production. Alas, the results are more complicated than that, with wide variation in species responses that could not have been predicted from presumed habitat affinities. These results illustrate the challenges of conservation practice in complex landscapes formed by mosaics of variable land use types. With species not necessarily falling neatly into habitat guilds, it becomes even more challenging to plan strategically how to manage landscapes to optimize their conservation. The results presented here suggest that species' abundances may be responding to landscape variables not taken into account in the analyses, such as connectivity between habitat patches, or maybe positive and negative edge effects between land use types. That such uncertainties remain even in a well-studied region as the Camargue, and for such a well-studied taxon such as birds, only demonstrates the continued importance of rigorous field studies testing explicit hypotheses such as this one by Mallet and colleagues.

### **References:**

- IUCN, & UN-WCMC (2023). Protected Planet. Protected Planet.  
<https://www.protectedplanet.net/en>
- Mallet, P., Béchet, A., Sirami, C., Mesléard, F., Blanchon, T., Calatayud, F., Dagonet, T., Gaget, E., Leray, C., & Galewski, T. (2023). Field margins as substitute habitat for the conservation of birds in agricultural wetlands. *bioRxiv*, 2022.05.05.490780, ver. 3 peer-reviewed and recommended by Peer Community in Ecology. <https://doi.org/10.1101/2022.05.05.490780>
- Rigal, S., Dakos, V., Alonso, H., Auniņš, A., Benkő, Z., Brotons, L., Chodkiewicz, T., Chylarecki, P., de Carli, E., del Moral, J. C. et al. (2023). Farmland practices are driving bird population decline across Europe. *Proceedings of the National Academy of Sciences*, 120, e2216573120.  
<https://doi.org/10.1073/pnas.2216573120>
- Sabatini, F. M., Burrascano, S., Keeton, W. S., Levers, C., Lindner, M., Pötzschner, F., Verkerk, P. J., Bauhus, J., Buchwald, E., Chaskovsky, O., Debaive, N. et al. (2018). Where are Europe's last primary forests? *Diversity and Distributions*, 24, 1426–1439. <https://doi.org/10.1111/ddi.12778>
- Venter, O., Sanderson, E. W., Magrath, A., Allan, J. R., Beher, J., Jones, K. R., Possingham, H. P., Laurance, W. F., Wood, P., Fekete, B. M., Levy, M. A., & Watson, J. E. M. (2016). Sixteen years of change in the global terrestrial human footprint and implications for biodiversity conservation. *Nature Communications*, 7, 12558. <https://doi.org/10.1038/ncomms12558>

## **Reviews**

### **Evaluation round #2**

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Version of the preprint: 2

## Authors' reply, 14 June 2023

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Decision by [Ana S. L. Rodrigues](#) , posted 18 April 2023, validated 18 April 2023

### Manuscript has improved substantially but still warrants minor reviews

Many thanks to the authors for their thoughtful replies to my comments and those of the reviewers. I am perfectly satisfied with the new analyses, and in particular I find the results much clearer and easier to interpret. The two reviewers also agree that the manuscript has substantially improved and only one of them (Scott Wilson) has still some minor remarks that I recommend the authors take into consideration.

From my side, I also have a few remarks that can be addressed through a minor revision.

The main one is that I think there is a margin for improvement in the discussion. As context to my comments: the study design is one where for three bird guilds (9 forest edge species; 3 grassland species; 2 reedbed species), the authors investigate how the abundance of species is affected by the area of a type of semi-natural habitat considered to be their primary habitat (respectively: woodlands; grasslands; wetlands) and by the area of a type of field margin that may correspond to a substitute habitat (respectively: hedgerows; grass strips; reed strips) as a way of testing whether field margins can act as suitable substitute habitats. The expectation was thus that the results should confirm the value of the semi-natural areas as primary habitat for each of the species; and then the relative value of the respective type of field margin in relation to the semi-natural areas would let us know if it is or not an adequate substitute habitat, thus allowing for a test of the habitat compensation hypothesis.

The results are (inevitably) not as simple. Regarding the forest edge species, only 1/9 responds positively to woodland area (great tit), and only 1/9 (greenfinch) responds positively to the area of hedgerows. Regarding grassland species, only 1/3 (corn bunting) responds positively to grassland area, and it responds even more strongly to grass strips. Regarding wetland species, only 1/2 (reed warbler) responds positively to wetland area, and it responds even more strongly to reedbed strips. What these results are telling me is that this turned out not to be such a good model system for testing the habitat compensation hypothesis after all, because for most of the species analyzed (11/14) there is no evidence that the areas of semi-natural habitat studied correspond indeed to areas of "primary habitat". For the 3/14 species for which there is such evidence: for one (the great tit) there is positive but weak evidence that field margins are a substitute habitat (positive but no significant effect; for two of them, the substitute habitat turns out to be even better than the primary, so arguably it is not so much a "substitute" but a preferred habitat in its own right.

This is the beauty of studies based on real data, and the fact the results did not go always in the expected direction does not detract from the quality of the study. Nonetheless, the discussion needs to acknowledge it more explicitly. Currently the discussion focuses strongly on the specifics of the three individual species for which the result shows that they prefer field margins, and on the adverse effects of some types of field margins to some of the species. This is all very interesting, but what is missing at the beginning of the discussion is a broad level analysis of what the results tell us (or cannot tell us) specifically regarding the habitat compensation hypothesis, which was the main question of the study (as reflected in the title), including perhaps a discussion of how the hypothesis could be better tested (with a different study design?)

I also find that currently the conclusions and the abstract are not well supported by the results (abstract lines 41-48: "Our study confirms that bird guilds are favored by the area of their primary habitat but are also influenced by the area of field margins. Reedbed birds are favored by the area of wetlands and reed strips and are negatively impacted by grassland cover. Grassland birds are favored by grassland and wetland areas and negatively impacted by woodland and hedgerow areas. Finally, forest edge birds are favored by hedgerows and

negatively impacted by reed strips. These results suggest that field margins may represent substitute habitats for some bird species and highlight their importance for biodiversity conservation in wetland agricultural landscapes"; discussion lines 375-376: "In conclusion, our results highlight that field margins are valuable landscape components to improve biodiversity conservation while keeping a sufficient area dedicated to food production in rice paddy landscapes"). Indeed, in my interpretation the study does not add strong evidence to the importance of field margins as either a substitute habitat (the main question of the study; only weakly supported for 1/14 species tested – great tit) or as a habitat (valuable landscapes) in its own right (only for 2/14 species tested – corn bunting and reed bunting).

Other minor points:

- Line 64: I recommend to add "focus on maintaining and increasing the capacity"
- Lines 80-81: recommend being more precise as "the habitat compensation hypothesis has been investigated in the context of farmland abandonment and in dry agricultural areas"
- Lines 106-108: this sentence is ambiguous; clarify what the "the greatest rate of decline" means (in relation to what?)
- Line 128: A reference from 1994 is not sufficient to support the statement that "the area... is now stable"
- Line 135: "fields" rather than "field"
- Lines 154-155: when you say that the area of each type of field margin and semi-natural habitat was measured "within a 500 meter buffer around the centroid of each crop field", it would be useful to clarify that the fields are much smaller than this (so that the field margins, where the bird counts were made are well within this buffer). You currently provide the size of the fields in the results (line 237), but it may make more sense to give earlier (in line 135, or in the legend of Figure 1). Also, in the abstract (line 37), saying "a 500 m buffer around each sampled crop" gives the impression it is a 500 m buffer around the boundaries of each field; please clarify it is around the centroid of the field.
- Line 190: recommend "birds that use urban areas" rather than "birds using" (the latter is a bit ambiguous in that it could suggest you assessed if birds were using urban areas as part of your study; the former makes it clearer that it is an information obtained from other sources)

### **Reviewed by Elena D Concepción, 15 March 2023**

Thank you very much for the revised version of the article. I consider that the authors have responded adequately to the comments and suggestions I made on the initial version. I also consider that they have responded adequately to those of the other reviewers. In fact, I believe that the results of the new analysis are clearer than the previous ones and allow to draw more direct conclusions and implications for the management of the study area. I have no additional points to this new version of the article.

### **Reviewed by Scott Wilson, 16 March 2023**

I thought the authors did a nice job of addressing the reviewer comments. I enjoyed reading the revision and have only a few relatively minor suggestions for the text. Again, this is a nice contribution.

Line 60: Suggest "European terrestrial area"

Line 135: Should be "crop fields" and then "variation" on line 136

Line 209-210: This sentence is repeated here and lines 206-207, otherwise a good description of this issue.

Results: I like the addition of the species-level effects, these help us understand within guild variation in responses and that's important for management. However, I think the new Results text could be streamlined to improve readability. As an example, in 3.3, I would combine 274-275 and 279-280 to a single line "There were no significant effects of woodland area, hedgerow area, crop diversity or crop mean field size on the abundance of the reedbed bird guild". I would also reduce text in the other sections, for example 271-273

could be “The abundance of Eurasian reed warbler was positively related to both wetland area ( $\beta = 0.04 \pm 0.01$ ) and the area of reed margins ( $\beta = 0.26 \pm 0.09$ , Table 2, Fig. 2).” Readers can see Figure 2 for further comparisons of the magnitude of the effects. A similar integration of the text could be done for this guild on lines 276-278 and for the other two guilds in 3.2 and 3.1.

Lines 295-298: Based on the new results, one of the main highlights for me is that different types of field margins can provide substitute habitat but the responses vary even within guilds that we consider to have similar habitat requirements. I’d suggest an opening sentence presenting this idea and then that could be followed by the current line 295-298 on the cases where field margins were substitute habitats. The next two paragraphs then do a good job of developing this idea further. The point on lines 299-302 is very interesting and perhaps unexpected (at least to me) and is a second main highlight from this work.

Line 348: Should be “sample size”

Line 362: Suggest “within a single landscape”

Line 363-364: Suggest “...type of field margins that most favour species in need of conservation attention”.

## Evaluation round #1

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Version of the preprint: 1

### Authors’ reply, 28 February 2023

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### Decision by Ana S. L. Rodrigues , posted 30 June 2022

#### **A very interesting study, that can still be improved**

This manuscript has been revised by two reviewers, both of which consider this work interesting and a valuable and topical contribution to the literature, and I fully agree with them. There is however in my view a margin for improvement in terms of clarity of presentation of the context of the study, and also in the statistical analyses. I add below some comments and recommendations, which are complementary to those by the two reviewers.

I encourage the authors to consider these in a revised version of the manuscript.

#### 1) Hypothesis tested

The study starts by discussing declines in farmland birds, then clarifying that “Patches of semi-natural habitats, such as woodlands, grasslands and wetlands, remaining within agricultural landscapes may provide permanent habitat for wildlife and host a large part of farmland biodiversity”. So here these semi-natural habitat patches are seen as part of the farmland landscape, contributing to farmland biodiversity.

Then the study is framed in the context of the habitat compensation hypothesis (lines 72-73) which “states that species may compensate for the loss of their primary habitat by using agricultural habitats as a substitute”. In this context, the analysis and discussion treat semi-natural habitat patches (wetlands, woodlands and grasslands) as “primary habitat” and the field margins as “agricultural habitats”.

But it could be argued that the field margins are not “agricultural habitats” but simply particular types of patches of “semi-natural habitat” within an agricultural landscape – and indeed in line 71 they are presented as such.

All this to say that I am not sure that the study is actually testing the habitat compensation hypothesis (effect to the substitution of primary habitat by agricultural habitat). It seems to me that it is instead testing if

field margins (particular types of semi-natural habitat) add valuable semi-natural habitat area to agricultural landscapes.

To me this seems like a very pertinent question, given that field margins fulfil functions in agricultural systems (e.g. draining ditches, hedgerows as separation between properties, grass strips as access areas) and so are much more likely to be retained in agricultural landscapes than other types of semi-natural habitat patches that could be converted to arable land. If they are valuable semi-natural habitats, they can be a win-win between agriculture and conservation.

In this light, to me one of the key conclusions of the study would be that field margins do have a habitat value for some of the species, but (for the same area) they are not as valuable as the habitat patches. For example, the effect of reed strips on reedbed birds is 0.58, compared to 0.79 for wetlands.

## 2) Landscape context of the study

Currently the Introduction and the Study Area section give the impression the paper is all about rice fields, with the field margins being those wide bands (>3m, to be waterproof) separating rice paddies.

It is then a surprise when we find out in lines 144-145 that the study covers different types of crops. The reader will then have made a mental image of the field margins that does not quite match the reality of the field.

I recommend that the introduction clarifies that different types of crops are cultivated in the Camargue, and also that the methods section presents a more precise definition of "field margin". (Are they the darker lines in the map in Appendix A?)

## 3) Species' guilds

I am not sure of the advantage of classifying a priori species into guilds, rather than letting the results speak for themselves. For example, the results for the common nightingale indicate that it has a quite different response to other species classified as a forest edge species (Fig 4).

Furthermore, like reviewer 2 I am confused as how to interpret the results in Figures 2-4: I cannot tell if a negative contribution to a positive effect means that there was a negative effect (the species' abundance declines when the area of a given landscape type increases), or just a slightly less positive effect (the abundance increases less than for other species in the guild).

For these reasons, I would recommend that rather than classifying the species into guilds a priori, the authors include all the species in the same model (with species as random effects), and then present results on the effects of each of the landscape variables on each of the species (as in Table 2, but with one species per column). The interesting analysis then being to compare for each species the effect of type of habitat vs the effects of field margin type. For example, for species for which wetland area has a positive effect: how does the effect of the area reed strips compare (also positive? similar in magnitude?); and how does the effect of hedgerow area compare (negative? similar in magnitude?).

I predict that this would give clearer results as to the species for which field margins (and which types of field margin) can work as valuable habitat than the current discussion based on guilds. For example, I suspect that the current counter-intuitive result that forest edge birds do not respond to woodland area may be an artifact of having quite different types of species within the forest edge guild (including nightingales). Instead, I would recommend defining forest edge species a posteriori, as those for which woodland area has a significant positive effect.

## 4) Interaction between habitat patches and field margins

The analysis treats each landscape variable as independent, but it is plausible that the value of field margins depends on the presence of habitat patches. For example, reed strips may be more valuable if close to wetlands. This could perhaps be tested in the model using interaction terms between each type of field margin and the corresponding habitat patch (reed strips – wetlands; hedgerows – woodland areas; grass strips – grassland

areas).

This is also related to the point rightfully presented in the discussion (lines 331-333) that field margins may be unsuitable breeding habitats even if species use them (and could even be ecological traps). Worth discussing there that field margins could also be useful adjacent habitats (e.g. used for feeding but not for nesting) in which case they add value to existing patches of semi-natural habitat even if they cannot replace them.

**Reviewed by [Scott Wilson](#), 24 May 2022**

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**Reviewed by [Elena D Concepción](#), 13 June 2022**

The manuscript entitled “Field margins as substitute habitat for the conservation of birds in agricultural wetlands” is a highly interesting and timely piece of work that may considerably contribute to the design of more effective and targeted conservation measures for the rice paddy region of Camargue (France). This is particularly the case in the current context of reform of the EU Common Agricultural Policy (CAP). In addition, this manuscript aims at testing the “habitat compensation hypothesis” as a biodiversity conservation strategy in an ecosystem type, i.e., wetlands with agricultural use, that remains rather unexplored so far. The study is well focused, including a straightforward development of research objectives derived from the applicability of ecological theory to conservation management that results in specific hypotheses and expectations to test in the field. The study design and statistics are appropriate and robust. Overall, the methods’ section is exhaustive, clear and well explained, which guarantee the reproducibility and replicability of the study. Results are also explained in a straightforward way. And the discussion addresses the questions posed in the introduction without lucubration. I have only a few minor points that in my opinion deserve to be considered in the manuscript and that I detail as follows:

- Line 40: “crop diversity” it could be a good idea to mention the main crop types in the regions, as you did with the semi-natural habitats.
- Line 72: I would add some references about the “habitat compensation hypothesis” (e.g., Gascon et al. 1999, Brotons et al. 2003?)
- Line 86-90: I think this sentence is too long. I also wonder whether “whereas” is the most appropriate term. I would replace “whereas they have suffered [...]” with “despite having suffer [...]”.
- Lines 101-106: I do not get the rationale underlying the link among these three sentences. Please, clarify.
- Lines 107-114: This final paragraph perfectly synthesizes the aim, hypotheses and expectations of the study.
- Lines 142-145: “We selected [...] and marked gardening).” I would locate these two sentences at the beginning of the “Study design” section, just after the first sentence when you explain that you selected 86 organic crop fields. Then, I would go into details about how you chose these fields in order to represent the landscape gradient.
- Figure 1: Map scale?
- Lines 186-187: Exploring how generalist or urbanophilous species responded to habitat availability (or lack of...) would be very interesting. I can see this manuscript addresses another research question (i.e., the capacity of specific margins to substitute a specific habitat for a given bird guild), but I encourage the authors to explore (in another work) whether generalist species proliferate with increasing habitat homogenization and decreasing availability of natural and semi-natural habitats. Moreover, it would be interesting to know whether generalist species take more advantage than habitat-specialist species from some types of field margins prior to promote them as conservation measures for specific (i.e., of conservation concern) bird guilds that might result counterproductive if these margins benefit more generalist species than the target specialist ones.

In a very recent paper I co-authored (<https://www.sciencedirect.com/science/article/pii/S1470160X22005222>), we have evinced a generalized decline of specialist farmland birds and a progressive colonization of farmland habitats by non-farmland birds over the last decades in Spain. It is not my intention you to cite this work, just to point that the replacement of habitat specialists with generalist species is an issue that should be taken into consideration when exploring potential conservation measures to favor specialist species of conservation concern.

- Lines 201-204: Could you please specify how coverage was calculated? As the mean of averaged values for each surveyed taxon in each field?
- Line 223: Reading the R code I guess the zero-inflated parameter is associated to species identity. Is this right? I think it should be mentioned in the text.
- Lines 234-236: What does a negative estimate mean? that the species contribute less to the abundance increase but still increase its abundance? or that the species do not contribute at all and its abundance does not increase?
- Lines 340-348: The lack of effect could also be due to the narrow range of variation of this explanatory variable in your dataset, which was less than a half of the range of variation of grassland and wetland (median = 0.71 ha; 248 range: [0; 20.78]). Perhaps just there is not a wide enough gradient in woodland cover to have an effect on bird abundance.
- Lines 348-349: Any idea about the reason for this negative effect?
- Lines 375-377: I do not think that your results support that grass trips are a key lever to favor bird diversity. They did not have a positive effect on the abundance of any bird guild.
- Lines 377-380: It remains unclear whether you consider hedges as a valuable measure to apply in the study area despite their negative effects on grassland birds.
- Lines 380-381: Any reference about this?
- Lines 382-384: Do you refer to grassland birds? Mention them explicitly.

Yours sincerely,

Elena D. Concepción