Changes in the conservation status of breeding birds in Catalonia (NE Iberian Peninsula) in the period 2002–2012

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The first assessment of the conservation status of breeding birds in Catalonia was conducted in 2002 on the basis of (a) population sizes and distributions and (b) the changes in these two parameters that occurred in the period from the 1980s to the beginning of the 2000s. A second more recent assessment was made that took into account population sizes and distributions in 2012 and the changes occurring in the period 2002–2012. Both assessments were made using the criteria established by the International Union for Conservation of Nature (IUCN) and it was thus possible to study the change in conservation status by applying the Red List Index, the indicator recommended by this body for this purpose. A key point in this methodology is how to determine genuine changes in status and differentiate them from changes associated with variations in the level of knowledge or with modifications in evaluation criteria. Once these factors had been taken into account, we applied the Red List Index (RLI) algorithm using 155 species (67% of bird species breeding in Catalonia) for both 2002 and 2012. The index showed an improvement of the threat status of 4% during this 10-year period. Then, we re-evaluated the 2002 status using more up-to-date criteria and knowledge and applied the same algorithm to calculate the index again (re-RLI) for 232 species (all breeding species). The re-RLI index improved by 5% during this ten-year period. The results suggest a general improvement in the overall conservation status of breeding birds in Catalonia over the last 10 years.

Key words: Red List Index, threat status change, regional IUCN categories, breeding birds, Catalonia.

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The governments of 190 countries agreed a decade ago to promote measures to reduce the rate of biodiversity loss (Secretariat of the Convention on Biological Diversity 2003). This led to considerable interest in the development of indices that could measure this loss and assess change over time (Pereira & Cooper 2006). Thus, the International Union for Conservation of Nature (IUCN) and its partner organizations developed the Red List Index (Butchart *et al.* 2004).

The Red List Index (RLI) represents a measure of temporal changes in the risk of extinction in species (Butchart *et al.* 2004, 2005, 2007). The phenomenon of extinction is a key aspect in the context of biodiversity loss and has a clear relevance to ecological processes and ecosystem functioning (Butchart *et al.* 2006). In addition, extinction is an easy-to-understand concept that is well understood by the general public, and is important in decision making (Bubb *et al.* 2009). The RLI answers the key question: how is the risk of extinction changing? Thus, it is an index of the proportion of species expected to maintain their existence in the future without any additional conservation actions – in which the future in most cases is taken to be a period of 10–50 years (Butchart *et al.* 2007, Bubb *et al.* 2009). This index is based on the changes in categories of the IUCN Red List and can be calculated for any representative set of species that have been assessed at least twice with a sufficient time lapse in between (Butchart *et al.* 2004, 2005, 2007).

The IUCN Red List was first produced in 1963 and facilitated the development of scientific standards for evaluating the degree of threat of any species at global scale (IUCN 2001, 2012a). In 1996 the crucial decision was taken to provide guidelines that would allow these criteria to be applied at regional scale (e.g. continents, countries or provinces) (Gärdenfors *et al.* 2001, IUCN 2012b). Using these regional criteria, a first assessment of the threat categories of breeding birds in Catalonia (NE Iberian Peninsula) was published in the *Catalan Breeding Bird Atlas 1999–2002* (Estrada *et al.* 2004). Recently, these threat categories have been updated on the basis of data generated by a number of monitoring projects that provide information on changes in breeding bird populations in Catalonia in 2002–2012 (Anton *et al.* 2013). The aim of this study is to use these two IUCN Red List assessments (2002 and 2012) and the methodology developed by Butchart *et al.* (2007) for the generation of RLI to determine changes in conservation status of Catalan breeding birds.

Material and methods

Bird data

The IUCN Red List categorisation of breeding bird species in Catalonia was assessed using information generated by several data sources ranging from large-scale standardised surveys to casual observations. The main data sources – in order of the amount and quality of the data they provide – were:

1) The *Catalan Breeding Bird Atlas* (Estrada *et al.* 2004), which was the basis for the distribution of many species in both assessments.
2) The *Catalan Winter Bird Atlas* (Herrando *et al.* 2011), an up-to-date source of information for distributions and population numbers in resident species (only used in the 2012 assessment).
3) The Catalan Bird Common Survey (ICO 2013). This was particularly significant for the population trends of 117 species in the period 2002–2012 (only used in the 2012 assessment).
4) Waterbird censuses carried out in Catalan natural parks, above all in the Ebro Delta (unpublished data).
5) Specific censuses of threatened species such as certain raptors carried out by the Catalan Government (unpublished data).
6) Scientific publications on the status in Catalonia of certain groups of species (Baucells *et al.* 2010) or of particular species (e.g., Montalvo & Figuerola 2006; Aymerich *et al.* 2012).
7) Systematic or non-systematic observations by ornithologists, often taken from the online platform www.ornitho.cat or birding yearbooks (e.g. Anton 2009).

Assessment of conservation status

Two assessments of conservation status were made in Catalonia following the categories and criteria set by the IUCN (IUCN 2001, 2012a) and the guidelines for its use at the regional scale (Gärdenfors *et al.* 2001, IUCN 2012b). The first evaluation, published in Estrada *et al.* (2004), was carried out for the c. 20-year period elapsed between the two breeding bird atlases, that is, from the early 1980s (fieldwork 1975–1983 but above all at the end of the period) to the early 2000s (fieldwork 1999–2002). The second evaluation was carried out more recently for the period 2002–2012 (Anton *et al.* 2013). The categories of threat used in both evaluations were taken from the IUCN regional guidelines: Not Evaluated (NE), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Regional Extinct (RE) and Data Deficient (DD). The category Not Applicable (NA), which was introduced in the most recent guideline document (IUCN 2012a), was only used in the second assessment. A total of 237 species were evaluated and categorised in one of these Red List categories for at least one of the two assessments; 232 species were considered as regularly breeding native species in at least one of the two study periods (Appendix).

IUCN categories and their contribution to the RLI

IUCN categories have to be transformed into numerical values to allow the information for the extinction risk to be summarized using a mathematical algorithm such as the RLI. We adopted the equal-steps approach proposed by Butchart *et al.* (2005): Least Concern (LC) = 0;

Near Threatened (NT) = 1; Vulnerable (VU) = 2; Endangered (EN) = 3; Critically Endangered (CR) = 4; and Extinct (EX) = 5. These categories allow the change in species status between two consecutive assessments to be weighted. In this approach, each step from Least Concern towards Extinct represents, at least, the worsening by one measure of the extinction risk of the species in question. This approach is simple and the trends in the resulting index are driven by a relatively large number of species, and generate a robust and representative index. This is because the number of species in each category (and the number of species moving in and out of each category) is disproportionately greater in the lower threat categories (Butchart *et al.* 2005), and because a species moving from Least Concern to Near Threatened contributes just as much to the changing score as a Critically Endangered species that is reclassified as Extinct.

Calculation of the RLI

The RLI was calculated using the following formula (Butchart *et al.* 2007):

$$RLI_t = 1 - \frac{\Sigma_s W_{c(t,s)}}{W_{EX} \cdot N}$$

where $W_{c(t,\,s)}$ is the numerical value or weight of the category *c* of species *s* at time *t*, W_{EX} is the numerical value or weight given to the category for extinct species, and *N* is the number of evaluated species. This produces an index that varies from 0 to 1, in which a score of 1 means that all species are categorized of Least Concern (LC), while a score of 0 represents the state in which all species are extinct.

Adaptation of RLI at regional level

The IUCN considers that the RLI can be applied at smaller scales than that of the whole world (Bubb *et al.* 2009). A good example of this downscaling procedure is provided by a study of the breeding birds of British Columbia, Canada (Quayle *et al.* 2007). In the present study, we made a minor adaptation to the RLI given the small geographic extent of our study area (32,000 km^2). Our variation on the protocols developed by Butchart *et al.* (2004, 2005, 2007) at global scale consisted of the incorporation of positive values for natural colonization processes, i.e. the establishment of new native breeding species at regional level. This process of regional colonization was considered as the opposite to regional extinction.

In order to introduce numerically this process of colonisation into the RLI algorithm, native (non-introduced) species classified as new colonisers in the first assessment (i.e. categorised as NE) that have established themselves (i.e. evaluated as CR, EN, VU, NT, LC or DD in the second assessment) were given a score of 5 for the first assessment. It is worth highlighting that in this particular case NE is numerically equivalent to RE (5). In a hypothetical case in which a Critically Endangered species first becomes regionally extinct and then re-colonises the study area and returns to its original Critically Endangered status, the numerical process assessed in four consecutive evaluations would be thus: CR(4)→RE(5)→NE(5)→CR(4). The first pair reflects the process of extinction and the second pair the re-colonisation. We believe that this process of colonisation should be reported not only for species known to be regionally extinct in former Red List assessments, but also for any native species spontaneously establishing itself in the study region. However, special caution has to be taken when assigning numerical values and introducing NE species into the RLI calculations. This procedure does not imply that all species considered as NE in a given assessment should automatically be given a score of 5 and incorporated in the RLI; rather, only those that finally settle and breed regularly in the studied area should be considered. In our study, this is the case of species such as the Great Egret *Egretta alba*, which went from NE in 2002 to EN in 2012, thus from a score of 5 to 3 in the numerical categories. In our opinion, this procedure for considering not only disappearances but also additions to regional breeding avifauna provides a more accurate picture of the dynamics of colonisations and extinctions in populations at regional level.

Genuine changes in status

Species may change their Red List categories between assessments due to factors other than genuine changes in their populations and these cases should not be used in any robust comparison of conservation status between study

periods. Butchart *et al.* (2004) enumerated three factors that may induce a false change in the conservation status of a species:

1) *Knowledge*, applied to species classified using fresh information (which may have existed before the second assessment but was only available after it).
2) *Criteria revision*, applied to species that change their category due to a revision of the definitions of the IUCN Red List (IUCN 2001).
3) *Taxonomy*, applied to species change category due to the 'lumping' or 'splitting' of a species, or a description of new species.

In our study, 77 species were considered to have undergone non-genuine changes in their category between assessments. There was an improvement in the knowledge of 23 bird species in the past decade, especially in the case of common birds (see Appendix), due to the launch in 2002 of the Catalan Common Bird Survey (SOCC; ICO 2013). Improvements in the knowledge of population trends for common species affected 20 species. Today these species are considered to be declining but they were considered as more or less stable in the 2002 evaluation due to the poorer basis of the coarse-scaled distribution changes (Estrada *et al.* 2004). As well, there were a further three uncommon species whose situation according to recent studies would seem to differ from that considered in 2002. For example, Hernández-Matías *et al.* (2013) provided robust evidence that the viability of the Catalan population of Bonelli's Eagle *Aquila fasciata* depends on the arrival of individuals from other populations and so the assessment of the rescue effect criteria (IUCN 2012b) is now based on new demographic data suggesting that the Catalan population of the species is actually (and possibly was already in the 2002 assessment) a sink population.

The IUCN criteria were applied differently to 54 species in 2013 in comparison to 2002. This was especially noticeable in the regional corrections, possibly the most freely interpretable issue of the Red List guidelines for regional assessments (Gärdenfors *et al.* 2001, IUCN 2012a). This was also very relevant to the decision to when calculate (in 2002) or not (in 2012) Red List categories for species that are occasional breeders in Catalonia or whose breeding had not been confirmed in the last 30 years. There were also a few species that were evaluated differently in the two editions due to changes in criteria that include the reduction in the threat status of large raptors supposed to be close to their carrying capacity based on population size (only applied in 2002) or the assigning of the threat category reported at a large geographical scale (e.g. Spain) when this was higher than that calculated for Catalonia (only applied in 2002). Finally, in a few cases the population data available in 2002 were wrongly interpreted.

No species were affected by taxonomic changes during this period.

RLI vs re-RLI

In order to make a reliable comparison between the conservation status of breeding birds in Catalonia in 2002 and 2012 (see Appendix), we used only 155 species with genuine changes in the two status assessments to calculate the RLI. However, this is a subset (67%) of all breeding species and consequently this index may be biased because a significant number of species are not taken into account. For this reason, we calculated an alternative index (re-RLI) using exactly the same algorithm and procedures as for the RLI but containing all native breeding bird species that were considered to breed regularly in either of the two assessments. In order to do this, we made a re-evaluation of the 2002 threat status on the basis of current knowledge and criteria for the species for which status change was considered to be non-genuine (see Appendix).

Results

Of the 155 bird species with genuine changes in conservation status between the assessments carried out in 2002 and 2012, only Dupont's Lark *Chersophilus duponti* became extinct (RE). As well, the number of critically endangered (CR) species halved, three species were added to the Endangered (EN) category, and the number of vulnerable (VU) species was reduced by one (Figure 1; see Appendix). Therefore, there was a slight decline in the number of species within threat categories during the period 2002–2012. The RLI for 2002 was 0.80 but was 0.83 for 2012. Therefore, the RLI increased 4% during the period 2002–2012.

Taking into account all species (232), the number of Critically Endangered species (CR)

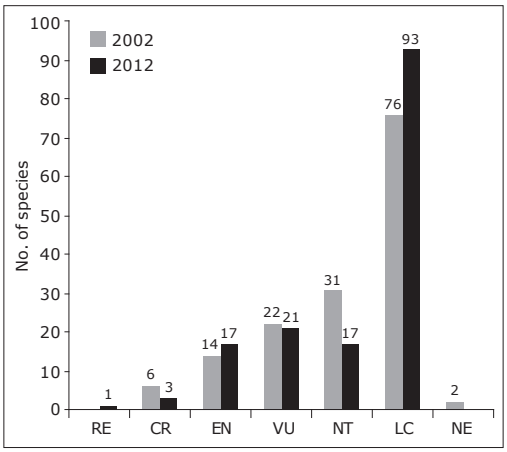

Figure 1. IUCN Red List categories for the 155 breeding bird species in Catalonia with genuine changes in status occurring between the assessments carried out in 2002 and 2012. This was the set of species included in RLI. Threat categories: RE = Regional Extinct; CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; NE = Not Evaluated (only the species classified as NE in 2002 that eventually established themselves and were considered as regular breeders by the 2012 assessment were included in RLI; see Material and methods). *Categories de la Llista Vermella de la UICN per a les 155 espècies d'ocells nidificants a Catalunya que mostren canvis genuïns d'estatus a partir de les avaluacions realitzades l'any 2002 i 2012. Aquest conjunt d'espècies va ser inclòs en el RLI. Categories d'amenaça: RE = Extint a nivell regional; CR= En perill crític; EN= En perill; VU= Vulnerable; NT= Proper a l'amenaça; LC= Preocupació menor; NE = No avaluada (només les espècies classificades com NE al 2002 que finalment es van establir i es van considerar nidificants regulars en l'avaluació de 2012 estan incloses al RLI; vegeu Material i mètodes).*

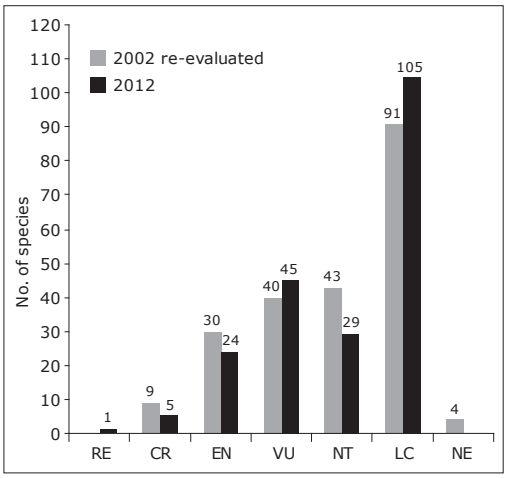

Figure 2. IUCN Red List categories for the 232 breeding bird species in Catalonia with changes in status between the assessment carried out in 2012 and the re-evaluation of the 2002 status for those species in which changes in criteria and knowledge did not permit direct comparison (see Material and methods and Appendix for details). This was the set of species included in re-RLI. Threat categories: RE = Regional Extinct; CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; NE = Not Evaluated (only the species classified as NE in 2002 that eventually established themselves and were considered as regular breeders by the 2012 assessment were included in RLI; see Material and methods).
Categories de la Llista Vermella de la UICN per a les 232 espècies d'ocells nidificants a Catalunya que mostren canvis d'estatus a partir de l'avaluació realitzada l'any 2012 i de la reavaluació dels estatus 2002 en aquelles espècies on hi havia canvis de criteri o de coneixement que no permetien una comparació directa (Vegeu Material i mètodes i Apèndix per a detalls). Aquest conjunt d'espècies va ser inclòs en el re-RLI. Categories d'amenaça: RE = Extint a nivell regional; CR= En perill crític; EN= En perill; VU= Vulnerable; NT= Proper a l'amenaça; LC= Preocupació menor; NE = No avaluada (només les espècies classificades com NE al 2002 que finalment es van establir i es van considerar nidificants regulars en l'avaluació de 2012 estan incloses al RLI; vegeu Material i mètodes).

was almost halved, the number of Endangered species (EN) was reduced by six and the number of Vulnerable species (VU) increased by five. Even including the 77 species whose status was re-evaluated in 2002, there was a decline in the number of threatened species in 2002–2012 (Figure 2, Appendix). The re-RLI increased by 5% from a value of 0.75 for 2002 to 0.79 for 2012.

Discussion

Evaluation of RLI in Catalonia and its trend

The assessment of the RLI of the breeding birds of Catalonia in 2012 gave a value of 0.84, which is low compared to the RLI value of 0.95 for Palearctic birds (Bubb *et al.* 2009). However, these values are not comparable because different mechanisms are governing extinctions at different scales. The number of bird species that can become extinct as breeders in Catalonia is high due to its small surface area and the faster extinction and colonization dynamics that occur at this regional scale. In addition, Catalonia possesses a great heterogeneity of environments, which favours populations with small, patchy isolated distributions. These kind of relict/

marginal populations often suffer from higher degrees of threat.

The RLIs obtained in this study were submitted to expert-based judgements that considered the potential implications of both the calculated extinction risks and the changes in these risks. Five possible categories were used for the evaluation of the RLI status in 2012, and four for changes occurring in 2002–2012 (see Table 1). The RLI value of 0.84 suggests an overall extinction risk in Catalonia in 2012 that can be classed as Regular. Fortunately, there was an increase of 4% in the RLI in 2002–2012 and therefore the change experienced over the last 10 years could be classified as Good according to the evaluation criteria proposed. Evaluation of the re-RLI in 2012 (0.79) and of its trend for the period 2002–2012 (5%) gives the same classifications as for the RLI.

Factors influencing the RLI assessment

One of the major factors affecting the assessment of change in conservation status is the comparability of the threat categories used in the different Red List classifications. Changes in criteria and changes in knowledge are the two main reasons why such comparisons can be inapplicable (Butchart *et al.* 2004). In our study, we excluded species from the RLI due to changes in criteria caused by one or more of the following factors:

1) Species' breeding status. Some species assessed in 2002 were not considered in 2012 because breeding has never been confirmed. Other species were moved to the new category Not Applicable (NA) because they are only casual breeders.
2) Magnitude of the rescue effect of the Catalan population by neighbouring populations. One or two reductions in the species category of threat at a regional level are possible according to IUCN (2012b). Depending on the ability of neighbouring populations to improve the situation of the Catalan population, one or two downgrades of the threat status were implemented in 2002. Given the lack of the necessary data for a robust evaluation of such a differential capacity, only one reduction was carried out in these cases in the 2012 assessment.
3) Population fluctuations were taken into account only for active breeding pairs in 2002 but for all mature individuals in 2012.
4) The carrying capacity of the environment in relation to the population of a species. This factor was used for large raptors in 2002 but not in 2012.

Overall, ornithological knowledge improved in Catalonia in the years between the two Red List assessments (2002–2012) and this has directly affected the assessment of the conservation status of some species. Most of the species that benefited were common birds that from 2002 onwards were detected by the annual monitoring program (SOCC). In the latest update for the period 2002–2012 (ICO 2013), the population trend was calculated for 130 species, 56% of the total number of breeding bird species in Catalonia (Estrada *et al.* 2004). These 130 species were not necessarily excluded from the RLI given that their status is not always affected by this additional source of information. For instance, the Chaffinch *Fringilla coelebs* is unequivocally classified as LC in both assessments. Only in 23 species was the status updated by the SOCC trends potentially different from the former status merely because of this newly available information. For example, the House Sparrow *Passer domesticus* underwent a population decrease of 15–22% in 2002–2012 and as a result was classified as NT in 2012.

Table 1. Evaluation of RLI (or re-RLI) values and trends for breeding birds in Catalonia in 2002–2012. *Avaluació dels valors de RLI (o re-RLI) obtinguts i la seva tendència per als ocells nidificants a Catalunya entre 2002 i 2012.*

Category	RLI (or re-RLI) value	Temporal trend of RLI (or re-RLI) in 2002–2012
Very bad	< 0.6	< -0.05 %
Bad	0.6 - 0.8	-0.05% to 0%
Regular	0.8 - 0.9	—
Good	0.9 - 0.95	0% to +0.05%
Very good	> 0.95	> +0.05%

RLI and re-RLI

There are only two ways of dealing with the above-mentioned factors that influence the RLI assessment: (1) constrain the analysis to the subset of species for which the two assessments of Red List categories are currently comparable

(i.e. with genuine changes in status) or (2) re-evaluate the species affected by these potential sources of bias using the same criteria and knowledge. Bubb *et al.* (2009) suggested that, in general, a conservative approach should be adopted and genuine status changes should only be identified if adequate supporting evidence and justification can be provided. Nevertheless, we applied both solutions and found that both provided similar results, suggesting that these approaches are consistent.

RLI interpretation

The RLI is an index that deals with one of the most essential factors affecting biodiversity conservation: the risk of extinction in species. In this sense, RLIs are widely recognized as an important component of the set of indices needed for monitoring progress toward the goal of halting the global loss of biodiversity (Rodrigues *et al*. 2006). However, the RLI does not capture particularly well the deteriorating situation of many slowly declining common species and the concurrent degradation of the ecological function of these species in ecosystems (Butchart *et al.* 2007). Indices based on population trends are more suitable for this purpose (Gregory *et al.* 2005, Loh *et al.* 2005). In Catalonia, the second package of indices is currently based on the Common Bird Survey as indicators of habitat and/or climate change (ICO 2013).

As recommended by the IUCN (Bubb *et al.* 2009), it would be interesting to study in depth the factors that have led to the changes in the RLI in Catalonia over the last 10 years. Among the potential positive factors to be explored are the role of wetland protection, whereas the potential negative factors would include agricultural intensification, vegetation encroachment and climate change (Estrada *et al.* 2004, ICO 2013). Finally, it would also be opportune to study future scenarios in light of various changes in these main driving factors.

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Resum

Canvis en l'estatus de conservació dels ocells nidificants a Catalunya (NE península Ibèrica) en el període 2002–2012

La primera avaluació de l'estat de conservació dels ocells reproductors de Catalunya es va dur a terme l'any 2002 a partir de la situació que mostraven les poblacions de les espècies ençà i els canvis ocorreguts des dels anys 80 del darrer segle. Recentment, s'ha fet una actualització de l'estat de conservació a partir de les estimes poblacionals i distribucions l'any 2012 i dels canvis ocorreguts en el període 2002–2012. Ja que ambdues avaluacions s'han fet seguint els criteris de la Unió Internacional per a la Conservació de la Natura (IUCN), ens ha estat possible l'estudi del canvi d'estatus aplicant l'Índex de la Llista Vermella (RLI), l'indicador recomanat per aquest organisme internacional per determinar els canvis en l'estatus de conservació. Un factor clau d'aquest metodologia és distingir els canvis reals d'aquells associats a canvis en el grau de coneixement de les espècies o modificacions en els criteris d'avaluació. Un cop això es va tenir en consideració, es va aplicar l'algoritme del RLI per a 155 espècies (67% de les espècies nidificants a Catalunya) per al 2002 i 2012. Aquest índex va mostrar una millora del 4% en aquest període. A més, i com a procediment alternatiu, es van reavaluar els estatus 2002 amb criteris i dades actualitzades i es va aplicar el mateix algoritme per a calcular un segon índex, anomenat re-RLI, per a 232 espècies (totes les espècies nidificants). Aquest segon índex també va millorar (5%) durant aquesta dècada. Aquests resultats suggereixen una millora general en l'estat de conservació dels ocells nidificants a Catalunya en els darrers 10 anys.

Resumen

Cambios en el estatus de conservación de las aves nidificantes de Cataluña (NE península Ibérica) en el periodo 2002–2012

La primera evaluación del estatus de conservación de las aves reproductoras de Cataluña se llevó a cabo en el año 2002 a partir de la situación que mostraban las

poblaciones de las especies en aquel momento y de los cambios ocurridos desde los años 80 del último siglo. Recientemente, se ha hecho una actualización del estado de conservación de las aves para el periodo 2002–2012. Debido a que ambas evaluaciones se han realizado siguiendo los criterios de la Unión Internacional para la Conservación de la Naturaleza (IUCN), nos ha sido posible el estudio del cambio de estatus aplicando el Índice de Lista Roja (RLI), el indicador recomendado por este organismo internacional para determinar los cambios en el estatus de conservación. Un factor clave de esta metodología es distinguir los cambios reales de aquellos artefactuales asociados a cambios en el grado de conocimiento de las especies o modificaciones en los criterios de evaluación. Una vez esto se tuvo en consideración, se aplicó el algoritmo del RLI para 155 especies (67% de las especies reproductoras en Cataluña) para el 2002 y 2012. Este índice mostró una mejora del 4% en este periodo de 10 años. Además, y como procedimiento alternativo, se reevaluaron los estatus 2002 con criterios y datos actualizados y se aplicó el mismo algoritmo para calcular un segundo índice, llamado re-RLI, para 232 especies (todas las especies reproductoras). Este segundo índice también mejoró (5%) durante esta década. Estos resultados sugieren una mejora general en el estado de conservación de las aves reproductoras en Cataluña en los últimos 10 años.

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Appendix

Results of the conservation status assessments conducted in 2002 (Estrada *et al.* 2004) and 2012 (Anton *et al.* 2013) and their inclusion/exclusion in the calculated RLI; the species excluded are those for which the two assessments are not comparable due to changes in criteria or level of knowledge at the time of the respective assessments. The final column indicates the status of species in 2002 according to a re-evaluation of the Red List categories carried out in the present study for the species excluded in RLI (marked with *). These categories were then used to generate the re-RLI, which included information on changes in status in 2002–2012 for all species. See Material and methods for details.

*Resultat de les avaluacions d'estatus de conservació realitzades l'any 2002 (Estrada et al. 2004) i el 2012 (Anton et al. 2013) i inclusió/exclusió del càlcul del RLI; les espècies excloses són aquelles per a les quals no es poden comparar ambdues avaluacions a causa de canvis de criteri o de grau de coneixement en el moment de realitzar les respectives avaluacions. La darrera columna indica l'estatus de les espècies l'any 2002 d'acord amb una reavaluació de les categories de Llista Vermella realitzada en aquest estudi per a les espècies excloses del RLI (marcades amb *); aquestes categories van ser emprades per generar el re-RLI, el qual inclou informació sobre el canvi d'estatus en el període 2002-2012 per a totes les espècies. Vegeu Material i mètodes per a més detalls.*

Common name	*Latin name*	Status 2002	Status 2012	Inclusion/exclusion in RLI	Status 2002 re-evaluated (*) for inclusion in re-RLI
Mute Swan	*Cygnus olor*	NE	NA	Excluded: Changing criteria	NA*
Ruddy Shelduck	*Tadorna tadorna*	VU	NT	Included	VU
Gadwall	*Anas strepera*	NT	NT	Included	NT
Eurasian Teal	*Anas crecca*	VU	NA	Excluded: Changing criteria	NA*
Mallard	*Anas platyrhynchos*	LC	LC	Included	LC
Garganey	*Anas querquedula*	VU	CR	Excluded: Changing criteria	CR*
Northern Shoveler	*Anas clypeata*	VU	EN	Excluded: Changing criteria	EN*
Marbled Duck	*Marmaronetta angustirostris*		NE	Excluded: New breeder	Non breeder*
Red-crested Pochard	*Netta rufina*	VU	VU	Included	VU
Common Pochard	*Aythya ferina*	VU	VU	Excluded: Changing criteria	EN*
Rock Ptarmigan	*Lagopus muta*	VU	VU	Included	VU
Capercaillie	*Tetrao urogallus*	EN	VU	Excluded: Changing criteria	VU*
Red-legged Partridge	*Alectoris rufa*	VU	LC	Excluded: Changing knowledge	VU*
Grey Partidge	*Perdix perdix*	EN	VU	Included	EN
Quail	*Coturnix coturnix*	DD	LC	Excluded: Changing knowledge	DD*
Pheasant	*Phasianus colchicus*	NE	NA	Excluded: Changing criteria	NA*
Little Grebe	*Tachybaptus ruficollis*	LC	NT	Included	LC
Great Crested Grebe	*Podiceps cristatus*	NT	NT	Included	NT
Black-necked Grebe	*Podiceps nigricollis*	NT	NA	Excluded: Changing criteria	NA*
Storm Petrel	*Hydrobates pelagicus*	EN	Non breeder	Excluded: Changing criteria	Non breeder*
Cormorant	*Phalacrocorax carbo*		NA	Excluded: New breeder	NA*
Shag	*Phalacrocorax aristotelis*	EN	VU	Included	EN

Common name	*Latin name*	Status 2002	Status 2012	Inclusion/exclusion in RLI	Status 2002 re-evaluated (*) for inclusion in re-RLI
Bittern	*Botaurus stellaris*	CR	EN	Excluded: Changing criteria	EN*
Little Bittern	*Ixobrychus minutus*	NT	LC	Excluded: Changing criteria	LC*
Night Heron	*Nycticorax nycticorax*	NT	LC	Excluded: Changing criteria	LC*
Squacco Heron	*Ardeola ralloides*	NT	NT	Included	NT
Cattle Egret	*Bubulcus ibis*	NT	LC	Excluded: Changing criteria	LC*
Little Egret	*Egretta garzetta*	NT	LC	Excluded: Changing criteria	LC*
Great Egret	*Egretta alba*	NE	EN	Included	NE
Grey Heron	*Ardea cinerea*	NT	LC	Included	NT
Purple Heron	*Ardea purpurea*	NT	VU	Included	NT
White Stork	*Ciconia ciconia*	NT	NT	Included	NT
Glossy Ibis	*Plegadis falcinellus*	VU	NT	Excluded: Changing criteria	NE*
Greater Flamingo	*Phoenicopterus roseus*	EN	NT	Excluded: Changing criteria	NT*
Honey Buzzard	*Pernis apivorus*	NT	VU	Excluded: Changing criteria	VU*
Black-winged Kite	*Elanus caeruleus*	NT	EN	Excluded: Changing criteria	NE*
Black Kite	*Milvus migrans*	VU	NT	Included	VU
Red Kite	*Milvus milvus*	EN	EN	Excluded: Changing criteria	CR*
Lammergeier	*Gypaetus barbatus*	EN	EN	Included	EN
Egyptian Vulture	*Neophron percnopterus*	EN	EN	Included	EN
Griffon Vulture	*Gyps fulvus*	NT	LC	Included	NT
Black Vulture	*Aegypius monachus*		NE	Excluded: New breeder	Non breeder*
Short-toed Eagle	*Circaetus gallicus*	NT	NT	Included	NT
Marsh Harrier	*Circus aeruginosus*	VU	VU	Included	VU
Hen Harrier	*Circus cyaneus*	EN	EN	Included	EN
Montagu's Harrier	*Circus pygargus*	EN	VU	Excluded: Changing criteria	EN*
Goshawk	*Accipiter gentilis*	NT	NT	Included	NT
Sparrowhawk	*Accipiter nisus*	LC	LC	Included	LC
Common Buzzard	*Buteo buteo*	NT	LC	Included	NT
Lessser Spotted Eagle	*Aquila pomarina*		NA	Excluded: New breeder	NA*
Goleen Eagle	*Aquila chrysaetos*	NT	VU	Excluded: Changing criteria	VU*
Booted Eagle	*Aquila pennata*	NT	VU	Excluded: Changing criteria	VU*
Bonelli's Eagle	*Aquila fasciata*	EN	CR	Excluded: Changing knowledge	CR*
Lesser Kestrel	*Falco naumanni*	EN	VU	Excluded: Changing criteria	VU*
Common Kestrel	*Falco tinnunculus*	LC	LC	Included	LC
Eurasian Hobby	*Falco subbuteo*	NT	NT	Included	NT
Peregrine Falcon	*Falco peregrinus*	NT	NT	Included	NT
Water Rail	*Rallus aquaticus*	NT	LC	Included	NT
Little Crake	*Porzana parva*	DD	Non breeder	Excluded: Changing criteria	Non breeder*

Common name	*Latin name*	Status 2002	Status 2012	Inclusion/exclusion in RLI	Status 2002 re-evaluated (*) for inclusion in re-RLI
Baillon's Crake	*Porzana pusilla*	EN	NA	Excluded: Changing criteria	NA*
Moorhen	*Gallinula chloropus*	NT	LC	Included	NT
Purple Swamphen	*Porphyrio porphyrio*	NT	NT	Included	NT
Eurasian Coot	*Fulica atra*	LC	LC	Included	LC
Red-knobbed Coot	*Fulica cristata*		NE	Excluded: New breeder	Non breeder*
Little Bustard	*Tetrax tetrax*	EN	EN	Included	EN
Oystercatcher	*Haematopus ostralegus*	VU	VU	Included	VU
Black-winged Stilt	*Himantopus himantopus*	LC	LC	Included	LC
Avocet	*Recurvirostra avosetta*	NT	VU	Included	NT
Stone Curlew	*Burhinus oedicnemus*	VU	VU	Included	VU
Collares Pratincole	*Glareola pratincola*	EN	EN	Included	EN
Little Ringed Plover	*Charadrius dubius*	LC	LC	Included	LC
Kentish Plover	*Charadrius alexandrinus*	VU	LC	Included	VU
Dotterel	*Charadrius morinellus*	CR	NA	Excluded: Changing criteria	NA*
Lapwing	*Vanellus vanellus*	VU	NE	Excluded: Changing criteria	Non breeder*
Woodcock	*Scolopax rusticola*	VU	VU	Included	VU
Redshank	*Tringa totanus*	EN	EN	Included	EN
Common Sandpiper	*Actitis hypoleucos*	VU	EN	Excluded: Changing criteria	VU*
Slender-billed Gull	*Chroicocephalus genei*	VU	VU	Included	VU
Black-headed Gull	*Chroicocephalus ridibundus*	NT	NT	Included	NT
Mediterranean Gull	*Ichthyaetus melanocephalus*	NE	EN	Included	NE
Audouin's Gull	*Icthyaetus audouinii*	VU	VU	Included	VU
Lesser Black-backed Gull	*Larus fuscus*	VU	EN	Included	VU
Yellow-legged Gull	*Larus michahellis*	LC	LC	Included	LC
Gull-billed Tern	*Gelochelidon nilotica*	VU	NT	Included	VU
Lesser-Crested Tern	*Sterna bengalensis*	EN	NA	Excluded: Changing criteria	NA*
Sandwich Tern	*Sterna sandvicensis*	VU	VU	Included	VU
Roseate Tern	*Sterna dougallii*	NE	NA	Excluded: Changing criteria	NA*
Common Tern	*Sterna hirundo*	VU	VU	Included	VU
Little Tern	*Sternula albifrons*	EN	EN	Included	EN
Whiskered Tern	*Chlidonias hybrida*	VU	NT	Excluded: Changing criteria	NT*
Black-bellied Sandgrouse	*Pterocles orientalis*	CR	CR	Included	CR
Pin-tailed Sandgrouse	*Pterocles alchata*	CR	EN	Included	CR
Rock Dove	*Columba livia*	LC	LC	Included	LC
Stock Dove	*Columba oenas*	NT	LC	Included	NT
Wood Pigeon	*Columba palumbus*	LC	LC	Included	LC
Collared Dove	*Streptopelia decaocto*	LC	LC	Included	LC
Turtle Dove	*Streptopelia turtur*	VU	LC	Included	VU
Rose-ringed Parakeet	*Psittacula krameri*	NE	NA	Excluded: Changing criteria	NA*

Common name	*Latin name*	Status 2002	Status 2012	Inclusion/exclusion in RLI	Status 2002 re-evaluated (*) for inclusion in re-RLI
Monk Parakeet	*Myiopsitta monachus*	NE	NA	Excluded: Changing criteria	NA*
Blue-crowned Parakeet	*Aratinga acuticaudata*	NE	Not established	Excluded: Changing criteria	Not established*
Mitred Parakeet	*Aratinga mitrata*	NE	Not established	Excluded: Changing criteria	Not established*
Red-masked Parakeet	*Aratinga erythrogenys*	NE	Not established	Excluded: Changing criteria	Not established*
Great Spotted Cuckoo	*Clamator glandarius*	VU	LC	Included	VU
Common Cuckoo	*Cuculus canorus*	LC	LC	Included	LC
Barn Owl	*Tyto alba*	NT	VU	Excluded: Changing criteria	VU*
Scops Owl	*Otus scops*	NT	VU	Included	NT
Eagle Owl	*Bubo bubo*	LC	NT	Excluded: Changing criteria	NT*
Little Owl	*Athene noctua*	NT	LC	Included	NT
Tawny Owl	*Strix aluco*	LC	LC	Included	LC
Long-eared Owl	*Asio otus*	DD	NT	Excluded: Changing knowledge	DD*
Tengmalm's Owl	*Aegolius funereus*	VU	VU	Included	VU
Nightjar	*Caprimulgus europaeus*	LC	LC	Included	LC
Red-necked Nightjar	*Caprimulgus ruficollis*	LC	NT	Excluded: Changing knowledge	LC*
Alpine Swift	*Apus melba*	LC	LC	Included	LC
Swift	*Apus apus*	LC	LC	Included	LC
Pallid Swift	*Apus pallidus*	LC	LC	Included	LC
Kingfisher	*Alcedo atthis*	VU	LC	Excluded: Changing criteria	LC*
Bee-eater	*Merops apiaster*	LC	LC	Included	LC
Roller	*Coracias garrulus*	VU	NT	Included	VU
Hoopoe	*Upupa epops*	LC	LC	Included	LC
Wryneck	*Jynx torquilla*	NT	LC	Included	NT
Green Woodpecker	*Picus viridis*	LC	LC	Included	LC
Black Woodpecker	*Dryocopus martius*	NT	VU	Excluded: Changing criteria	VU*
Great Spotted Woodpecker	*Dendrocopos major*	LC	LC	Included	LC
Middle Spotted Woodpecker	*Dendrocopos medius*	EN	VU	Included	EN
Lesser Spotted Woodpecker	*Dendrocopos minor*	NT	VU	Excluded: Changing criteria	VU*
Dupont's Lark	*Chersophilus duponti*	CR	RE	Included	CR
Calandra Lark	*Melanocorypha calandra*	NT	LC	Included	NT
Short-toed Lark	*Calandrella brachydactyla*	EN	CR	Included	EN
Lesser Short-toed Lark	*Calandrella rufescens*	VU	VU	Included	VU
Crested Lark	*Galerida cristata*	NT	LC	Included	NT
Thekla Lark	*Galerida theklae*	LC	LC	Included	LC
Woodlark	*Lullula arborea*	LC	LC	Included	LC
Skylark	*Alauda arvensis*	LC	LC	Included	LC
Sand Martin	*Riparia riparia*	NT	LC	Included	NT
Crag Martin	*Ptyonoprogne rupestris*	LC	LC	Included	LC

Common name	*Latin name*	Status 2002	Status 2012	Inclusion/exclusion in RLI	Status 2002 re-evaluated (*) for inclusion in re-RLI
Barn Swallow	*Hirundo rustica*	LC	LC	Included	LC
Red-rumped Swallow	*Cecropis daurica*	NT	NT	Included	NT
House Martin	*Delichon urbicum*	LC	LC	Included	LC
Tawny Pipit	*Anthus campestris*	LC	LC	Included	LC
Tree Pipit	*Anthus trivialis*	LC	VU	Excluded: Changing knowledge	VU*
Water Pipit	*Anthus spinoletta*	LC	VU	Excluded: Changing knowledge	NT*
Yellow Wagtail	*Motacilla flava*	LC	VU	Excluded: Changing knowledge	VU*
Grey Wagtail	*Motacilla cinerea*	NT	VU	Excluded: Changing knowledge	NT*
White Wagtail	*Motacilla alba*	LC	LC	Included	LC
Dipper	*Cinclus cinclus*	NT	LC	Excluded: Changing criteria	LC*
Wren	*Troglodytes troglodytes*	LC	LC	Included	LC
Dunnock	*Prunella modularis*	LC	LC	Included	LC
Alpine Accentor	*Prunella collaris*	LC	LC	Included	LC
Rufous Bush Robin	*Cercotrichas galactotes*	CR	Non breeder	Excluded: Changing criteria	Non breeder*
Robin	*Erithacus rubecula*	LC	LC	Included	LC
Nightingale	*Luscinia megarhynchos*	LC	LC	Included	LC
Black Redstart	*Phoenicurus ochruros*	LC	LC	Included	LC
Redstart	*Phoenicurus phoenicurus*	CR	VU	Included	CR
Whinchat	*Saxicola rubetra*	NT	VU	Excluded: Changing criteria	LC*
Stonechat	*Saxicola rubicola*	LC	VU	Excluded: Changing knowledge	LC*
Wheatear	*Oenanthe oenanthe*	NT	LC	Included	NT
Black-eared Wheatear	*Oenanthe hispanica*	NT	LC	Included	NT
Black Wheatear	*Oenanthe leucura*	NT	VU	Included	NT
Rock Thrush	*Monticola saxatilis*	LC	VU	Excluded: Changing criteria	VU*
Blue Rock Thrush	*Monticola solitarius*	LC	LC	Included	LC
Ring Ouzel	*Turdus torquatus*	LC	LC	Included	LC
Blackbird	*Turdus merula*	LC	LC	Included	LC
Song Thrush	*Turdus philomelos*	LC	LC	Included	LC
Mistle Thrush	*Turdus viscivorus*	LC	LC	Included	LC
Cetti's Warbler	*Cettia cetti*	LC	LC	Included	LC
Zitting Cisticola	*Cisticola juncidis*	LC	LC	Included	LC
Savi's Warbler	*Locustella luscinioides*	EN	EN	Included	EN
Moustached Warbler	*Acrocephalus melanopogon*	VU	EN	Excluded: Changing criteria	EN*
Reed Warbler	*Acrocephalus scirpaceus*	LC	LC	Included	LC
Great Reed Warbler	*Acrocephalus arundinaceus*	LC	LC	Included	LC
Melodious Warbler	*Hippolais polyglotta*	LC	LC	Included	LC
Blackcap	*Sylvia atricapilla*	LC	LC	Included	LC
Garden Warbler	*Sylvia borin*	LC	LC	Included	LC
Orphean Warbler	*Sylvia hortensis*	LC	LC	Included	LC

Common name	*Latin name*	Status 2002	Status 2012	Inclusion/exclusion in RLI	Status 2002 re-evaluated (*) for inclusion in re-RLI
Whitethroat	*Sylvia communis*	DD	LC	Excluded: Changing knowledge	DD
Spectacled Warbler	*Sylvia conspicillata*	VU	VU	Included	VU
Dartford Warbler	*Sylvia undata*	LC	LC	Included	LC
Subalpine Warbler	*Sylvia cantillans*	LC	LC	Included	LC
Sardinian Warbler	*Sylvia melanocephala*	LC	LC	Included	LC
Bonelli's Warbler	*Phylloscopus bonelli*	LC	LC	Included	LC
Chiffchaff	*Phylloscopus collybita*	LC	VU	Included	LC
Goldcrest	*Regulus regulus*	LC	LC	Included	LC
Firecrest	*Regulus ignicapilla*	LC	LC	Included	LC
Pied Flycatcher	*Muscicapa striata*	NT	LC	Included	NT
Spotted Flycatcher	*Ficedula hypoleuca*	DD	Non breeder	Excluded: Changing criteria	Non breeder*
Red-billed Leiothrix	*Leiothrix lutea*	NE	NA	Excluded: Changing criteria	NA*
Bearded Reedling	*Panurus biarmicus*	EN	EN	Included	EN
Long-tailed Tit	*Aegithalos caudatus*	LC	LC	Included	LC
Blue Tit	*Cyanistes caeruleus*	LC	LC	Included	LC
Great Tit	*Parus major*	LC	LC	Included	LC
Crested Tit	*Lophophanes cristatus*	LC	LC	Included	LC
Coal Tit	*Periparus ater*	LC	LC	Included	LC
Marsh Tit	*Poecile palustris*	LC	LC	Included	LC
Nuthatch	*Sitta europaea*	LC	LC	Included	LC
Wallcreeper	*Tichodroma muraria*	VU	VU	Included	VU
Treecreeper	*Certhia familiaris*	NT	LC	Excluded: Changing criteria	NT*
Short-toed Treecreeper	*Certhia brachydactyla*	LC	LC	Included	LC
Penduline Tit	*Remiz pendulinus*	LC	VU	Excluded: Changing knowledge	LC*
Golden Oriole	*Oriolus oriolus*	LC	LC	Included	LC
Red-backed Shrike	*Lanius collurio*	LC	NT	Excluded: Changing knowledge	LC*
Lesser Grey Shrike	*Lanius minor*	CR	CR	Included	CR
Iberian Grey Shrike	*Lanius meridionalis*	VU	EN	Included	VU
Woodchat Shrike	*Lanius senator*	NT	LC	Included	NT
Jay	*Garrulus glandarius*	LC	LC	Included	LC
Magpie	*Pica pica*	LC	LC	Included	LC
Alpine Chough	*Pyrrhocorax graculus*	LC	EN	Excluded: Changing knowledge	LC*
Red-billed Chough	*Pyrrhocorax pyrrhocorax*	NT	LC	Excluded: Changing knowledge	NT*
Jackdaw	*Corvus monedula*	VU	LC	Included	VU
Carrion Crow	*Corvus corone*	LC	LC	Included	LC
Raven	*Corvus corax*	LC	LC	Included	LC
Common Starling	*Sturnus vulgaris*	LC	LC	Included	LC
Spotless Starling	*Sturnus unicolor*	LC	LC	Included	LC
House Sparrow	*Passer domesticus*	LC	NT	Excluded: Changing knowledge	NT*
Spanish Sparrow	*Passer hispaniolensis*	RE	Non breeder	Excluded: Changing criteria	Non breeder*
Tree Sparrow	*Passer montanus*	NT	LC	Included	NT
Rock Sparrow	*Petronia petronia*	LC	LC	Included	LC

Common name	*Latin name*	Status 2002	Status 2012	Inclusion/exclusion in RLI	Status 2002 re-evaluated (*) for inclusion in re-RLI
Snowfinch	*Montifringilla nivalis*	EN	EN	Included	EN
Red-billed Quelea	*Quelea quelea*	NE	Non breeder	Excluded: Changing criteria	Non breeder*
Common Waxbill	*Estrilda astrild*	NE	NA	Excluded: Changing criteria	NA*
Black-rumped Waxbill	*Estrilda troglodytes*	NE	Not established	Excluded: Changing criteria	Not established*
Chaffinch	*Fringilla coelebs*	LC	LC	Included	LC
Serin	*Serinus serinus*	LC	NT	Excluded: Changing knowledge	NT*
Citril Finch	*Serinus citrinella*	LC	LC	Included	LC
Greenfinch	*Chloris chloris*	LC	VU	Excluded: Changing knowledge	LC*
Goldfinch	*Carduelis carduelis*	LC	VU	Excluded: Changing knowledge	LC*
Siskin	*Carduelis spinus*	NT	VU	Excluded: Changing criteria	VU*
Linnet	*Carduelis cannabina*	LC	VU	Excluded: Changing knowledge	VU*
Common Crossbill	*Loxia curvirostra*	LC	NT	Excluded: Changing knowledge	LC*
Bullfinch	*Pyrrhula pyrrhula*	LC	EN	Excluded: Changing knowledge	VU*
Hawfinch	*Coccothraustes coccothraustes*	NT	NT	Included	NT
Yellowhammer	*Emberiza citrinella*	NT	LC	Excluded: Changing criteria	NT*
Cirl Bunting	*Emberiza cirlus*	LC	LC	Included	LC
Rock Bunting	*Emberiza cia*	LC	NT	Excluded: Changing knowledge	NT*
Ortolan Bunting	*Emberiza hortulana*	LC	LC	Included	LC
Reed Bunting	*Emberiza schoeniclus*	CR	EN	Included	CR
Corn Bunting	*Emberiza calandra*	LC	LC	Included	LC