

Do common bird winter censuses produce similar results when conducted in the morning and in the afternoon?

Sergi Herrando, Joan Estrada, Lluís Brotons & Santi Guallar

Most large-scale common bird monitoring programmes are focussed on breeding populations and only few are conducted in winter. At least in the Mediterranean Basin, these programmes base their winter surveys only on morning censuses, a rule extrapolated from the guidelines applied during the breeding season. However, no specific studies have ever been conducted to ascertain whether winter censuses would give comparable results or not if carried out in the afternoon. In order to determine whether morning and afternoon results are equivalent in winter, we conducted a pilot study on 20 transects from the SOCC (Catalan Common Bird Survey) that cover the main climatic and geographical gradients in Catalonia. Afternoon censuses resulted in fewer contacts and fewer species. This pattern did not seem to be particularly influenced by the behaviour of the subset of species that move to roost sites after midday; our results suggest, rather, that the overall higher abundance and richness in morning censuses is affected by a general decrease in detectability in the afternoon in the case of the majority of species. The results of this study indicate that, at least in the Mediterranean Basin, it is not advisable to carry out common bird winter censuses in the afternoon.

Key words: census transects, bird abundance, daily variation, non-breeding season, Catalonia.

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Common bird surveys are one of the most widespread types of all large-scale monitoring programmes carried out in Europe and constitute an extraordinarily useful tool for producing good indicators of biodiversity (Gregory *et al.* 2005). Most of these monitoring projects are focussed on breeding populations and relatively few investigate temporal and spatial patterns during the winter, the exception being cases such as Finland (Koskimies & Väisänen 1991) and the Netherlands (SOVON Vogelonderzoek Nederland 2003). In the Western Mediterranean area, at least three areas currently possess large-scale

winter monitoring schemes: Andorra (Dalmau & Nicolau 2005), the Balearic Islands (Mayol 2005) and Catalonia (ICO 2007). These three monitoring programmes base their winter surveys on morning censuses, although no specific studies have ever been conducted to ascertain whether winter censuses might also be effective or not in the afternoon.

Since publishing the Catalan Breeding Bird Atlas 1999-2002 (Estrada *et al.* 2004), one of the main projects of the Catalan Ornithological Institute is the Catalan Winter Bird Atlas 2006-2009 (ICO 2006). As in the breeding bird

atlas, among the most important objectives of this new atlas is the generation of fine-resolution abundance maps (1x1 km square or similar). In light of recent advances in the mapping of bird abundance from data derived from common bird monitoring projects (e.g. Jiguet *et al.* 2005, Brotons *et al.* in press.), the goal is to generate abundance maps by combining bird abundance obtained along SOCC (Catalan Common Bird Survey) transects with a number of ecological and environmental variables. In this way, it will be possible to create predictive models of abundance for the whole of Catalonia in the same way as in the Catalan Breeding Bird Atlas 1999-2002 (Estrada *et al.* 2004, Brotons *et al.* in press). Therefore, it is crucial to obtain good data from a sufficient number of well-distributed SOCC transects over the next few years.

Currently, the SOCC methodology establishes 3-km linear transects that must be walked in a time-span of 2hr-2hr 30min, always in the first four hours after sunrise. This time-window is based on the daily patterns of detectability shown by birds; however, these patterns have been determined from work conducted in the spring, largely outside the Mediterranean region (e.g. Bibby *et al.* 2000). Some participants felt that, in spite of the fact that species detectability in the spring decreases markedly from mid-morning onwards as a consequence of a reduction in song frequency, patterns of detectability might be less variable in winter. It was commented that the general lack of territoriality or breeding behaviour might smooth out this daily pattern and that the activity or detectability of the birds might be also high in the mid-morning or the afternoon owing to low morning temperatures. If patterns of detectability do not significantly vary between early morning and late afternoon, surveys can be conducted in either part of the day. This would make the conducting of the censuses easier, since volunteers sometimes find it difficult to carry out censuses exclusively in the morning. Likewise, difficulties in reaching inaccessible areas would be partially overcome, and in some instances people would even be able to conduct two censuses in a single day.

Using these two Catalan projects as a framework, in this paper we explore the possibility of conducting winter common bird censuses in the afternoon as well as in the morning.

Methods

We designed a pilot study to test the differences between morning and afternoon common bird censuses in winter. SOCC collaborators were asked to repeat any of their two morning winter censuses in the afternoon. Above all, and in order to minimise temporal variations in detectability and/or real abundance, participants were asked to perform the additional afternoon census either on the same day as the morning census was conducted or on the afternoon of the previous day. The afternoon censuses started between 14:00-15:00 and finished between 16:00-17:30 (official time), around sunset in Catalonia during the winter solstice. Whenever necessary, the usual direction in which transects are walked was inverted in order to prevent a detectability bias caused by the low sun in the morning or afternoon. For further information on the SOCC methodology, see ICO (2003).

Once the data were compiled, we analysed the differences in abundance (number of individuals counted) and richness (number of species detected) between the morning and the

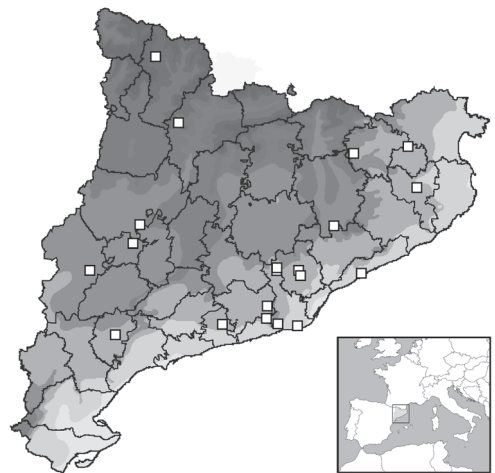


Figure 1. Locations (white squares) of the SOCC transects that have participated in the present study. The grey gamut depicts the gradient of average temperatures for December (darker grey indicates colder areas).

Localització dels itineraris SOCC (quadrats blancs) que han participat en aquest estudi. L'escala de color gris representa el gradient de temperatures mitjanes del mes de desembre (el color gris més fosc indica les àrees més fredes).

afternoon censuses. This was performed by comparing the means of the paired data by an ANOVA of repeated measures. Two environmental variables were added to this model in order to see if they had any effect on the observed patterns of abundance or richness. These variables were the average December temperature (used as an estimator of the environmental diversity in Catalonia in the winter) and the census month, that is, either December or January. Finally, we carried out a separate comparison between morning and afternoon counts for the subset of species recorded in the censuses that were considered to roost in the late afternoon (Little Egret *Egretta garzetta*, Cattle Egret *Bubulcus ibis*, Yellow-legged Gull *Larus michahellis*, Black-headed Gull *Larus ridibundus*, Woodpigeon *Columba palumbus*, White Wagtail *Motacilla alba*, Water Pipit *Anthus spinoletta*, Meadow Pipit *Anthus pratensis*, Fieldfare *Turdus pilaris*, Mistle Thrush *Turdus viscivorus*, Redwing *Turdus iliacus*, Magpie *Pica pica*, Jackdaw *Corvus monedula*, European Starling *Sturnus vulgaris*, Spotless Starling *Sturnus unicolor*, Common Reed Bunting *Emberiza schoeniclus*, Corn Bunting *Emberiza calandra*, Cirl Bunting *Emberiza cirlus*, Rock Bunting *Emberiza cia* and Yellowhammer *Emberiza citrinella*). This analysis allowed us to test whether the daily detectability patterns found for the overall bird community were affected by the behaviour of this particular group of species, which move to roost sites after midday and, consequently, might be less easy to detect in the afternoon. Richness data were untransformed in ANOVA analyses, whereas data on abundance were log transformed to fit normality (Sokal & Rohlf 1995). General linear models were used for testing hypotheses (Statistica Statsoft, Inc. 2004).

Results

The pilot study sampled 20 SOCC transects representing the principal climatic and geographical gradients in Catalonia, from 10 m to 1,800 m above sea level (Figure 1); 12 transects were conducted in December and eight in January.

The average abundance of birds was significantly higher in the morning censuses ($F_{1,19}=5.67$; $p=0.028$); there was no significant interaction with the month ($F_{1,18}=0$; $p=0.993$) or with the average December temperature of the transect area ($F_{1,17}=1.19$; $p=0.289$) (Table 1, Figure 2). However, the average abundance did not significantly differ between the morning and the afternoon for the subset of species that roost communally ($F_{1,19}=1.15$; $p=0.163$).

The results obtained for the species richness were similar: the observed richness was significantly higher in the morning censuses ($F_{1,19}=11.44$; $p=0.003$), but a significant interaction with the month was detected ($F_{1,18}=4.62$; $p=0.045$); no interaction with the mean temperature of December in the transect area was detected ($F_{1,17}=0.184$; $p=0.673$) (Table 1, Figure 3). Finally, richness did not significantly differ between the morning and the afternoon for the subset of species that roost communally ($F_{1,19}=1.06$; $p=0.315$).

Discussion

This pilot study shows that morning and afternoon common bird winter censuses yield significantly different results. Afternoon censuses gave fewer contacts and fewer species, therefore indicating that, at least in the Mediterra-

Table 1. Basic statistics of the morning and afternoon censuses in relation to the dependent variables, richness and abundance (n=20 SOCC transects).
Resultats bàsics per als censos de matí i tarda en relació amb les variables dependents abundància i riquesa (n=20 itineraris SOCC).

		Mean	Minimum	Maximum	SD
Abundance	Morning	422	52	1,568	450
	Afternoon	370	42	1,922	464
Richness	Morning	24.1	12	40	10.0
	Afternoon	21.0	6	37	9.8

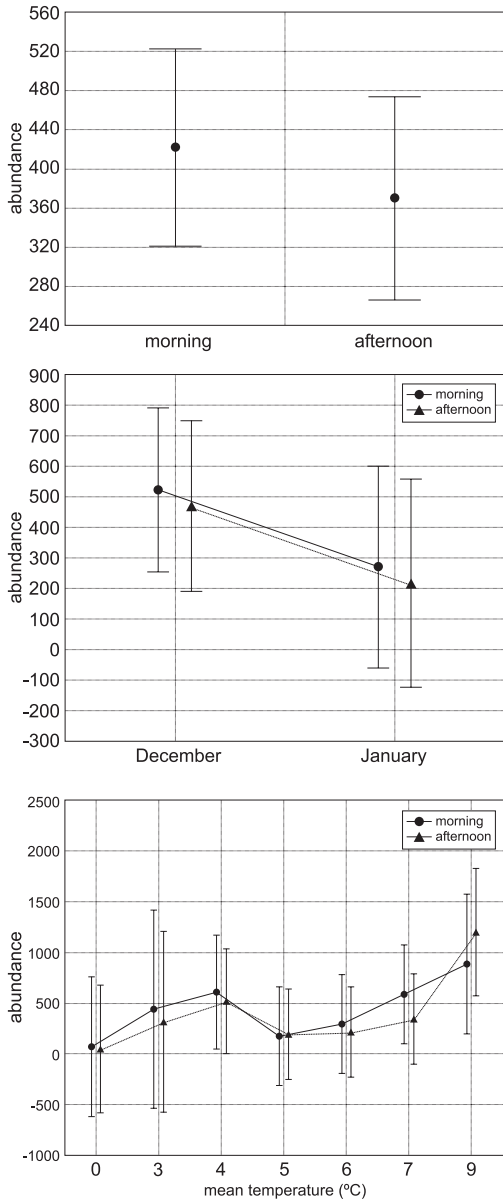


Figure 2. Top: Mean values (\pm SE) of bird abundance (in individuals/linear km) of the morning and afternoon censuses. Middle: Differences in abundance between December and January. Bottom: Differences in abundance with the average temperature for December, which is used as an estimator of the environmental diversity in the study area.
Dalt: Valors mitjans (\pm SE) d'abundància d'ocells (en individus/km lineal) per als censos de matí i de tarda. Mig: Diferències d'abundància en funció del mes (desembre o gener). Baix: Diferències d'abundància en funció de la temperatura mitjana del mes de desembre, utilitzada com a estimador de la diversitat ambiental de l'àrea d'estudi.

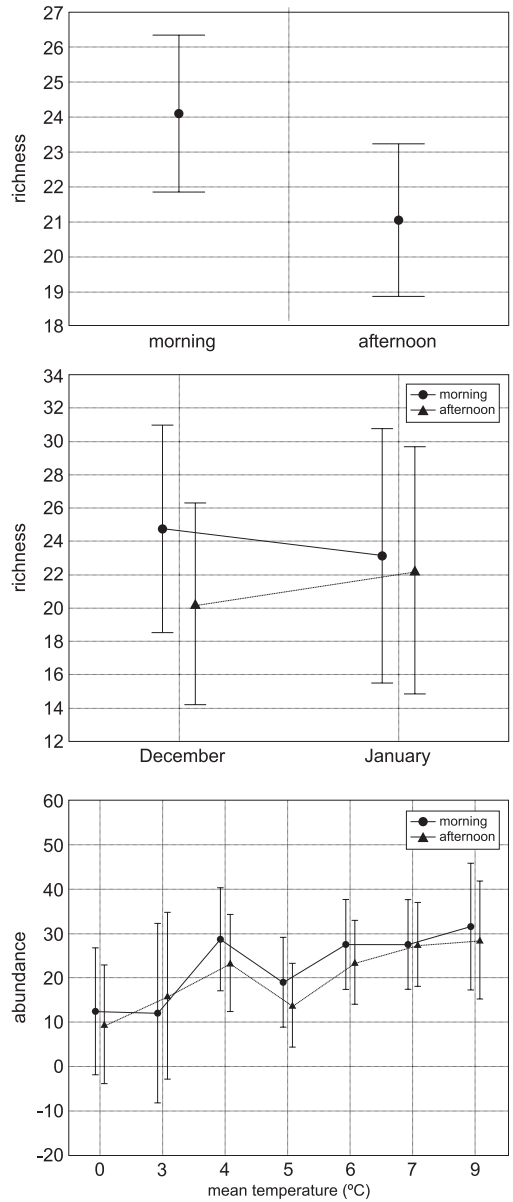


Figure 3. Top: Mean values (\pm SE) of bird richness (in number of species) of the morning and afternoon censuses. Middle: Differences in richness between December and January. Bottom: Differences in richness with the average temperature for December, which is used as an estimator of the environmental diversity in the study area.
Dalt: Valors mitjans (\pm SE) de riquesa d'ocells (en nombre d'espècies) per als censos de matí i tarda. Mig i baix: Diferències de riquesa en funció del mes (desembre o gener) i de la temperatura mitjana del mes de desembre, utilitzada com a estimador de la diversitat ambiental de l'àrea d'estudi.

nean Basin, it is not advisable to extend the usual morning schedules of winter censuses to afternoons.

Differences between the morning and the afternoon censuses were not found for the subset of species that roost communally. Therefore, the pattern observed for the complete set of species does not seem to be particularly influenced by the behaviour of the subset of species that move to roost sites after midday. On the contrary, our results rather suggest that the overall higher abundance and richness in morning censuses is affected by a general loss of detectability in the afternoon for the majority of the species concerned.

The biological meaning of the overall observed patterns is probably related, as is the case in the breeding season, to the existence of distinctive circadian rhythms. Considering that the main factor that influences species detectability is activity, these results suggest that winter bird activity is highest early in the morning. Probably, the early hours are key for obtaining resources after the long winter nights, especially in Passeriformes (e.g. Blem 1990, Broggi & Brotons 2001).

Although the main environmental gradients in Catalonia (analysed by means of average December temperatures) did not affect the general patterns observed in this study, it is interesting to note the differences in richness between December and January. These differences were not caused by any contrast in weather variables, since rain, visibility and wind force were not significantly different between these two months (analyses not shown), and may indicate the existence of between-month changes in bird distribution during the winter due, for example, to the nomadic behaviour that many bird species exhibit.

The small sample size of this study (20 transects) provides very low statistical power. Therefore, the probability of rejecting the null hypothesis (that there are no differences between the abundance and richness observed in the morning and in the afternoon) when is false (that there are differences) is low. Hence, the outcome of these tests must be analysed with care, especially in the case of those involving the subset of species that roost communally.

This pilot study suggests that, at least in the Mediterranean Basin, winter common bird cen-

suses should be conducted only in the morning. Therefore, the SOCC surveys for the Catalan Winter Bird Atlas 2006-2009 will only be conducted in this period. We think that our findings could be extrapolable to other census methodologies and even to birdwatching in general.

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Resum

Els censos hivernals d'ocells comuns donarien resultats similars si es fessin a la tarda en comptes del matí?

La majoria dels programes de seguiment d'ocells comuns a gran escala centren els seus esforços en les poblacions nidificants i només uns pocs es duen a terme també a l'hivern. Almenys a la conca mediterrània occidental, aquests programes hivernals basen exclusivament els censos en comptatges matinals, una norma extrapolada de les que s'apliquen habitualment durant la temporada de nidificació. No obstant això, no s'han realitzat estudis específics per determinar si aquests censos hivernals donarien resultats similars si es fessin a la tarda.

Dins d'aquest marc conceptual, és important destacar la importància dels censos d'ocells comuns en el projecte d'*Atles dels ocells de Catalunya a l'hivern 2006-2009* on, tant els mapes d'abundància com les estimacions poblacionals es basaran, en bona part, en les dades obtingudes mitjançant els transectes del Seguiment d'Ocells Comuns a Catalunya (SOCC). Si els patrons de detectabilitat no variessin significativament entre les primeres i les darreres hores del dia els comptatges del SOCC es podrien fer independentment als matins i a les tardes. Això augmentaria notablement les possibilitats de realitzar els censos, ja que sovint els participants voluntaris tenen limitacions d'índole variada per fer comptatges exclusivament durant el matí: meteorologia adversa, dificultat d'arribar a temps a zones poc accessibles, flexibilitat horària, etc. A més, en alguns casos fins i tot podria permetre que en un mateix dia es fessin 2 censos.

Per testar les possibles diferències entre els censos d'ocells comuns hivernals de matí i de tarda es va realitzar un estudi pilot amb 20 itineraris SOCC distribuïts de tal manera que cobrissin els principals gradients climàtics i geogràfics de Catalunya (Figura 1). Amb l'objectiu de minimitzar altres variacions temporals en la detectabilitat i/o abundància real dels individus, els censos de tarda es van fer durant el mateix dia que els de matí o bé la tarda del dia anterior. Els censos de tarda es van iniciar entre les 14:00-15:00 h i van finalitzar entre les 16:00-17:30 h (horari oficial).

Comparant les mitjanes de dades aparellades dels dos censos es va trobar que l'abundància (nombre d'individus comptats) i riquesa (nombre d'espècies detectades) observades en els censos de matí van ser significativament superiors als de la tarda (respectivament $F_{1,19}=5,67$; $p=0,028$ i $F_{1,19}=11,44$; $p=0,003$). No es va detectar cap efecte significatiu produït per la temperatura mitjana de desembre de la zona on estava situat l'itinerari ($F_{1,17}=1,19$; $p=0,289$); tampoc no es van trobar efectes significatius entre el mes i l'abundància ($F_{1,18}=0$; $p=0,993$), però sí entre la riquesa i el mes ($F_{1,18}=4,62$; $p=0,045$). D'altra banda, les diferències entre els censos de matí i de tarda van desaparèixer quan es van analitzar les dades per al subconjunt d'espècies que fan dormidors ($F_{1,19}=1,15$; $p=0,163$ en el cas de l'abundància i $F_{1,19}=1,06$; $p=0,315$ en el cas de la riquesa).

Aquest estudi pilot mostra que la realització dels censos SOCC al matí o a la tarda produeix resultats significativament diferents i que aquests són independents dels principals gradients ambientals que hi ha a Catalunya durant l'hivern. A més, l'absència de diferències entre matí i tarda per al subconjunt d'espècies que fan dormidors suggereix que el fet que per al conjunt de la comunitat ornítica es detectin més ocells al matí que a la tarda no és degut al comportament particular d'aquest subconjunt d'espècies, sinó que més aviat es tracta d'un patró general.

En síntesi, els resultats d'aquest treball indiquen que, almenys a la conca mediterrània, no és aconsellable que els censos d'ocells comuns que es portin a terme a l'hivern es realitzin també a les tardes.

Resumen

¿Los censos invernales de aves comunes darían resultados semejantes si se hicieran por la tarde en vez de por la mañana?

La mayoría de los programas de seguimiento de aves comunes a gran escala centran sus esfuerzos en las poblaciones reproductoras y sólo unos pocos se lle-

van a cabo también en invierno. Por lo menos en la cuenca mediterránea occidental, estos programas invernales se basan exclusivamente en censos matinales, una norma extrapolada de las que se aplican habitualmente durante la temporada reproductora. A pesar de ello, no se han realizado estudios específicos para determinar si estos censos invernales darían resultados similares si se hicieran por la tarde. Dentro de este marco conceptual, es importante destacar la importancia de los censos de aves comunes en el proyecto del *Atlas de las aves de Cataluña en invierno 2006-2009*, donde, tanto los mapas de abundancia como las estimas poblacionales provendrán, en buena medida, de los datos obtenidos a partir de los transectos del *Seguimiento de Aves Comunes en Cataluña* (SOCC). Para determinar si se obtienen los mismos resultados por las mañanas que por las tardes se efectuó un estudio piloto con 20 itinerarios SOCC que cubrieran los principales gradientes climáticos y geográficos de Cataluña. Las riquezas y abundancias observadas mostraron diferencias significativas entre estos dos periodos del día, independientemente del gradiente geográfico. La ausencia de diferencias entre mañana y tarde para el subconjunto de especies que hacen dormideros sugiere que el hecho de que para el conjunto de la comunidad se detecten más aves por la mañana que por la tarde no es debido al comportamiento particular de este subconjunto de especies, sino que más bien se trata de un patrón general. En síntesis, los resultados de este trabajo indican que, por lo menos en la cuenca mediterránea, no es aconsejable que los censos de aves comunes que se lleven a cabo en invierno se realicen también por las tardes.

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