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Assessing bird communities by point counts: repeated sessions and their duration

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Abstract. The aim of this study was to provide optimal methodological criteria for the quantitative and qualitative estimates of bird communities inhabiting woodland areas using point counts. Results obtained from counts carried out once or twice during the same breeding season were compared and the optimal duration of each session was assessed. Data obtained in three different woodland areas, from a total of 46 point counts each lasting 20 min. and repeated twice in the breeding season were analyzed in 5-min. blocks. It was concluded that 10-min. sessions repeated twice in a breeding season can provide a good description of the passerine bird community. However, some rarer species of the breeding community under study, including some diurnal raptors, woodpeckers, and scarce passerines, could be underestimated with this duration.

Key words: bird census, point count duration, breeding season

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INTRODUCTION

The use of point counts is among the widespread methods for surveying breeding bird communities (Blondel 1985, Verner 1985, Bibby & Burgess 1992). Given a defined study area, the IPA (Indice Ponctuel d'Abondance) method in its original formulation (Blondel et al. 1970, 1981, Blondel 1983) consists of estimating the number of bird inhabiting an area by recording all visual and/or vocal contacts in 20-min. sessions carried out in a number of fixed locations, randomly scattered throughout the area. The counting sessions are carried out twice: at the beginning as well at the end of the breeding season. At a given spot the first census should occur around the height of the singing activity of early (e.g. resident) breeders such as tits, treecreepers, nuthatches, thrushes, and the second around the height of the singing activity of late (e.g. long distance) breeders such as the Golden Oriole *Oriolus oriolus*, the Nightingale *Luscinia megarhynchos*, etc.

The duration of point counts can lead to biases in the estimate of the birds at a single point. An optimal duration of 20 min. has been suggested to avoid the risk to miss or to underestimate the rarest species (Blondel et al. 1981, Blondel 1983). However, other authors proposed that a shorter duration may have advantages. For example, it could reduce the risk of counting the same individuals more than once within a session in addition to the fact that in the same time-period a larger area could be covered (Scott & Ramsey 1981, Fuller & Langslow 1984, Hutto et al. 1986, Verner 1988, Gates 1995). Point counts with very short-lasting sessions (3 or 5 min.) and performed only

once in the breeding season, have been used for quantifying bird communities in very large areas (Robbins 1978, Geissler & Noon 1981, Landmann 1990, Lynch 1995, Thompson & Schwalbach 1995). The period in which the survey is carried out and the frequency of repeated counts in the breeding season can also affect the characterization of the bird community (Bibby & Burgess 1992, Buskirk & McDonald 1995, Petit et al. 1995). According to Blondel et al. (1981) some residents are better detected at the beginning of the breeding season while some migrants later in the breeding season.

There are only few methodological papers which have dealt with the importance of both the duration and the frequency of point counts in censusing bird communities (see references above). The aim of this study was to assess the relative importance of these two factors by analyzing outcomes obtained with counting sessions of different duration in three different woodland areas during the breeding season.

STUDY AREA AND METHODS

Study area

The study was carried out in the Natural Reserve Monte Rufeno (42°47′N, 11°93′E), a 2900 ha woodland area in Northern Latium (Central Italy), a territory with a hilly morphology (300–600 m of altitude). Censuses using the IPA method (Blondel et al. 1981) have been performed in the following three areas:

1) deciduous woodland (DW) dominated by *Quercus cerris*;
2) mediterranean scrubland (MS) dominated by *Quercus ilex*;
3) artificial pine woodland (PW) dominated by *Pinus halepensis*, *P. pinaster* and *P. nigra*.

These three habitats represent the most common natural vegetation type in the Mediterranean area. Qualitative information on the bird communities of the study area was given by Calvario et al. (1991) and Papi et al. (1997).

Census methods

We collected data during the breeding season of 1995 in 46 point counts, 200 m minimum distance from each other. 18 of points were in DW, 16 in MS and 12 in PW. For each non-fixed-width radius point count, during the breeding season two 20 min. sessions were carried out in exactly the same spot, the first between 15 March and 15 April; the second between 15 May and 15 June. As it fully conforms to the IPA method, we will refer to this set of data as the IPA values. Data were collected in the early morning in absence of rain, clouds or strong wind. To avoid the "observer effect" (Ramsey & Scott 1981), six observers (the authors) were involved in the data collection and regularly alternated in groups of two-three per point count. We attributed 1 point (i.e. one pair) to a singing bird, a pair, a family group, and a bird carrying food for young, while 0.5 point to observed individuals and to birds uttering vocalizations different from species song.

To allow comparisons between different point count duration, data were collected and analyzed in four 5-min. intervals.

For each species in each point count, we kept the highest number of pairs recorded, whatever the session. Usually the highest number of early breeders occurs in the first session and the highest number of late breeders (mostly migrants) in the second session. The abundance of one species or group of species in each of the three study habitats, as well as for the three habitats pooled together (46 point counts), was calculated as the mean number of pairs recorded in the different point counts.

The parameters considered to characterize the community were: richness (S); abundance (A) i.e. the sum of species abundance; diversity (H), by Shannon and Weaver (1963). Dominant species were those ones with relative frequency (*fi*) higher than 0,05 (Turcek 1956, Oelke 1980). The species accumulation curves (Verner & Ritter 1986) that show the increase of recorded species with point counts number have been calculated and plotted with the following:

$$S_m = S_o - \sum_{i=1}^{So} (1-p_i)^m$$

where S_m is the estimated number of species for a sample of m counts; S_o is the total number of species in the original sample; p_i is the proportion of counts during which species i was detected; and m is the number of counts in the sample to be estimated.

Data were analyzed by Wilcoxon signed ranks test (Siegel 1980). As regards the composition of bird community parameters (richness, abundance, and diversity), the differences among the three study environments were analysed by means of Friedmann test, using the 5-min. interval values as repeated measures. Moreover the same test was used to analyse for each breeding parameter the differences between the observed values in two successive 5-min. intervals.

Table 1. Parameters characterizing the bird communities of the three habitats studied as a function of point count duration. Data from the early and late breeding season are pooled. (Ab. — abundance, Rich. — richness, Div. — diversity) * — $p < 0.05$ for differences among the three study environments.

	Deciduous wood - DW			Med. Scrubland - MS			Pine woodland - PW			Pooled data		
	Ab.	Rich.	Div.	Ab.	Rich.	Div.	Ab.	Rich.	Div.	Ab.*	Rich.*	Div.*
5-min.	12.17	30	2.80	8.69	21	2.59	12.75	23	2.83	11.11	33	2.93
10-min.	15.97	31	2.88	11.53	25	2.68	17.87	26	2.92	14.92	34	2.97
15-min.	18.44	32	2.96	13.03	26	2.74	20.58	29	2.99	17.12	36	3.02
20-min.	20.11	32	3.00	14.22	28	2.81	22.21	31	3.04	18.61	37	3.07

RESULTS

Duration of the counting session

Pooling data from the early and late breeding season, the lowest values of richness, abundance, and diversity were observed in MS for all time periods (Table 1). This result as well as the differences between PW and DW evaluated by using the same parameters were obtained also with 5-min. counts (Table 1). In these latter counts, 80% of all species were detected, while 10 min. was the minimal amount of time needed to count 80% of the pairs (Fig. 1, see methods for symbols). For each breeding parameter the differences between the observed values in successive interval time were similar in the study environments (richness: $\chi^2_{3,2} = 3.8$, ns; abundance: $\chi^2_{3,2} = 4.7$, ns; diversity: $\chi^2_{3,2} = 0.5$, ns). The increase of abundance between the 5-min. and the 10-min. interval time was higher than between the following interval time ($\chi^2_{3,2} = 6.0$, $p < 0.05$), while no differences were observed for both richness ($\chi^2_{3,2} = 3.2$, ns) and diversity ($\chi^2_{3,2} = 3.8$, ns).

Species accumulation curves for different interval-time census were similar: the accuracy in richness detection rapidly improved in the first 10 point counts, thereafter it gradually decreased until a plateau is reached when about 30 point counts were carried out (Fig. 2).

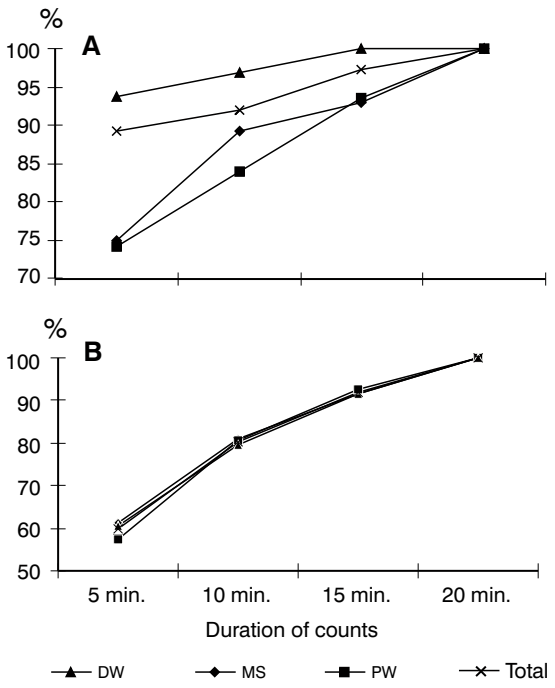

Fig. 1. Percentage of species (A) and pairs (B) censused as a function of point counts in three areas studied (DW MS, PW).

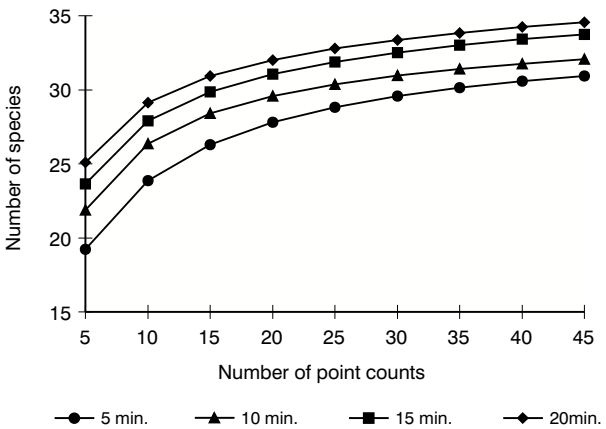

Fig. 2. Species accumulation curves for different interval-time census; three habitats pooled together.

Repeated and non-repeated counts

As compared to the results obtained for each breeding parameter with repeated sessions (Table 1), with 10-min. counts carried out during the second session the rank order of the values in the three study habitat was maintained; the low-

est values being always recorded in MS (richness: $\chi^2_{4,2} = 4.1$, ns; abundance: $\chi^2_{4,2} = 8.0$, $p < 0.05$; diversity: $\chi^2_{4,2} = 7.4$, $p < 0.05$). With 10-min. counts carried out in the first session, as regards abundance and diversity parameters, slight differences for the rank order of the values obtained in DW and PW were observed (data not shown).

With respect to 10-min-repeated-sessions counts, the number of species detected in single sessions was high. However, 70% of pairs were censused only in single sessions counts exceeding 15 min. (Fig. 3). With respect to the number of pairs censused in 20-min repeated counts (IPA values), the number of pairs detected by single 20-min. counts resulted in 63% and 70.4% for early and late spring respectively. No seasonal differences emerged, although counts performed late in the breeding season were closer to the IPA values (Fig. 3), an effect likely to be due to the presence of late breeders.

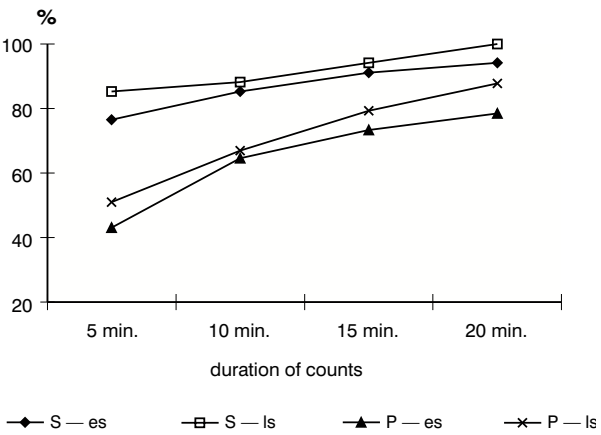

Fig. 3. Percentages of species (S) or pairs censused (P) in early (es) or late spring (ls) with different interval-time on respect to the species or pairs censused with repeated session and with cut-off 10 min; three habitats pooled together.

In 77.8% of all species, abundances were higher with repeated 10-min. counts than in 15-min. counts carried out once in late spring ($Z = 3.49$ $p = 0.0005$, $n = 36$). In 61.1% of species, abundances were higher with repeated 10-min. counts than in 20-min. counts late in the season ($Z = 1.97$, $p < 0.05$, $n = 36$). No differences in species abundances were found between 5-min. counts performed twice and single 10–20 min. counts carried out in late spring.

Single-species census

Corvus monedula and *Accipiter nisus* were recorded only early in the breeding season, while *Streptopelia turtur*, *Otus scops*, *Motacilla alba*, *Luscinia megarhynchos* and *Certhia brachydactyla*, only in late breeding season. Pooling together data from the early and late breeding season and from different study habitats the dominant species were the same in every 5-min. interval, i.e. *Sylvia atricapilla*, *Turdus merula*, *Erithacus rubecula*, *Parus major*, *Fringilla coelebs*, *Parus caeruleus*, *Phylloscopus collybita* and *Cuculus canorus.* Results were similar in single seasonal session: in late breeding season the only exception regards *Parus caeruleus* dominant exclusively with 20-min. point counts, while in the early breeding season *Cuculus canorus* was not dominant, but was *Garrulus glandarius.*

Pooling together data from the early and late breeding season and from different study habitats, 10 min. was the minimal amount of time needed to count 75% of pairs of the more com-

Table 2. Interval time in which at least 75% of pairs of each species was recorded. Species listed from the most common (*Sylvia atricapilla*) to the rarest (*Accipiter nisus*). Pooled data from the early and late breeding season and from different study habitats.

Species	Interval (min.)
Sylvia atricapilla	10
Turdus merula	10
Erithacus rubecula	10
Parus major	10
Fringilla coelebs	10
Parus caeruleus	10
Phylloscopus collybita	10
Cuculus canorus	10
Garrulus glandarius	10
Troglodytes troglodytes	10
Regulus ignicapillus	10
Aegithalos caudatus	15
Picus viridis	15
Columba palumbus	10
Lullula arborea	15
Corvus corone	20
Streptopelia turtur	15
Sylvia melanocephala	10
Sylvia cantillans	15
Phasianus colchicus	15
Carduelis carduelis	20
Carduelis chloris	15
Emberiza cirlus	15
Parus ater	5
Buteo buteo	15
Parus palustris	20
Oriolus oriolus	20
Picoides major	20
Corvus monedula	15
Sitta europaea	5
Serinus serinus	15
Certhia brachydactyla	5
Luscinia megarhynchos	15
Motacilla alba	15
Otus scops	20
Accipiter nisus	10

mon species (Table 2). However, some of the rarer species in the breeding community, such as some diurnal raptors (e.g. *Buteo buteo*), woodpeckers (e.g. *Picus viridis*, *Picoides major*), doves (e.g. *Streptopelia turtur*), and scarce passerines (e.g. *Parus palustris, Corvus corone*), were underestimated with this point duration (Table 2). In single seasonal session also a variety of common species were strongly underestimated: in early breeding season, for 58.1% of the censused species 20 min. point counts did not suffice to recording 75% of pairs (i.e. of the total obtained pooling early and late breeding season, see method), in late season the same result was observed for 55.9% of the censused species (Table 3).

Table 3. Number of species in each 5 min. interval time for which 75% of pairs were recorded in early and late breeding season. R — remaining species.

Season	Time (min)				R	Total
	5	10	15	20		
Early	1	3	5	4	18	31
Late	1	2	7	5	19	34

DISCUSSION

Point count method is worldwide used to a rapid assessment of bird community composition, above all when large territories are involved (e.g. Verner 1985, Bibby & Burgess 1992). However, its use has been questioned by a few authors, because figures obtained with this method are only poorly comparable between species differing in their ecology (Verner 1985, Tomiałojć & Verner 1990). Such data reflect community composition in a greatly deformed proportions (Tomiałojć & Verner 1990), though they may be indeed fairly good as within-species comparisons for monitoring purposes and to a lesser extent for within-species inter-habitat comparisons of relative abundance. Moreover Verner (1985) concluded that, among the indexes describing the bird community, the richness one seem to give the more reliable results.

Our findings indicate that either monitoring single species or investigating the composition of a breeding bird community by means of point counts, a higher attention has to be devoted to the point-duration and session factors. In particular our analyses induce to conclude that:

1) 10-min. point counts repeated twice within the same breeding season provide a good characterization of the bird community of a given area; however, studies with emphasis on/ or in communities with non-Passeriformes may require a longer duration.

2) Sessions performed once in the breeding season can give a good qualitative assessment of a community. However there is a strong risk of underestimating the abundance of pairs and missing either late migrants if the census occurs too early or early breeders if the census occurs late in the breeding season.

3) When the interest of the investigation focus on the relative differences among habitats within a given area assessed by means of breeding-community parameters, repeated sessions method with 5-min. point counts could yield reliable results; or alternatively, one 10-min. session in late spring. This latter option may be more convenient since counts are carried out more rapidly and during the season with more stable weather conditions.

A final remark is that our conclusions are based on data collected by 5-min. interval census, further studies should be dedicated investigating the increase in accuracy of results by shorter time-interval census.

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STRESZCZENIE

[Liczenia awifauny lęgowej metodą punktową: liczba liczeń i czas ich trwania]

Punktowa metoda liczeń przyjęła się w badaniach ilościowych awifauny lęgowej, jednak tylko nieliczne prace zajmowały się znaczeniem jakie dla reprezentatywności wyników ma czas trwania poszczególnych liczeń i częstość ich powtarzania. Celem badań, przeprowadzonych w rezerwacie Monte Rufeno w środkowej części Włoch, było określenie znaczenia tych dwóch parametrów metodycznych. Materiał zebrano w 46 punktach liczeń zlokalizowanych w trzech odmiennych środowiskach zadrzewionych — w lesie liściastym (DW), zaroślach śródziemnomorskich (MS) oraz na plantacji sosnowej (PW). Każde 20-minutowe liczenie było powtarzane dwukrotnie w ciągu sezonu lęgowego, a wyniki analizowano wydzielając odcinki 5- i 10-minutowe (Tab. 1). Stwierdzono, że dwa 10-minutowe liczenia w sezonie dają dobry obraz w odniesieniu do większości ptaków wróblowych (Fig. 1). W obrazie całości zespołu niektóre rzadsze gatunki, m.in. niektóre dzienne drapieżniki, dzięcioły i rzadkie wróblowe — miały przy tym czasie liczenia zaniżoną wykrywalność (Tab. 2). Liczenia jednorazowe w późnej porze sezonu lęgowego wykazały znaczne różnice trzech rozpatrywanych parametrów składu gatunkowego (Tab. 1) między zespołami ptaków badanych środowisk, w porównaniu z wynikami liczeń powtarzanych. W pojedynczych liczeniach również wykrywalność pospolitych gatunków była znacznie zaniżona (Tab. 3, Fig. 3). Niezależnie od czasu trwania liczeń, reprezentatywność obrazu składu gatunkowego wzrastała szybko w sumarycznych wynikach z pierwszych dziesięciu punktów liczeń, a przy zwiększaniu liczby punktów do 30 — wyrównywała się (Fig. 2).