

## Inferring temporal trends in the bird assemblage of the Bungawalbin Creek catchment: Reply to Totterman (Corella 41, 2017)

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*Received: 31 May 2017*

*Accepted: 4 June 2017*

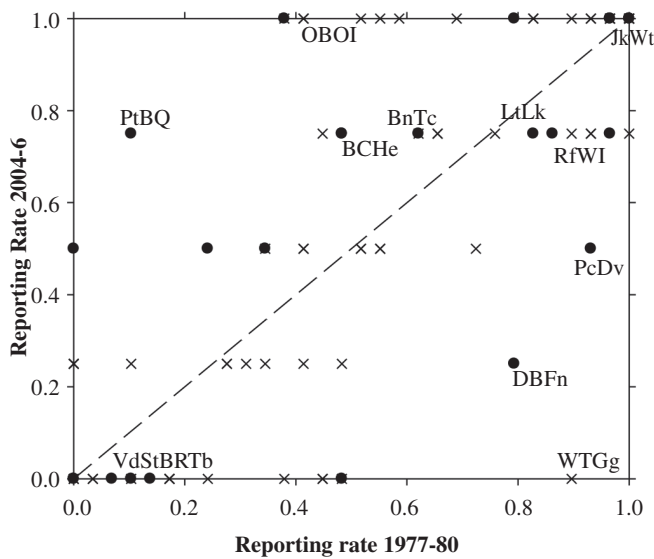
Gosper and Gosper (2016) describe the results of bird surveys across the dry sclerophyll forests and woodlands of the Bungawalbin Creek catchment in northern New South Wales, focussing on spatial and temporal variation in bird occurrence. The main conclusions were that: (1) the bird community had changed little between 1977-80 and 2004-6, (2) the area supported populations of a range of woodland birds that are either threatened or declining elsewhere, and (3) the area was a stronghold for several woodland bird species, but that there was evidence for lower recent reporting rates in a small number of species. Totterman (2017), in a comment on this paper, raises several issues that he thinks significant about our inference that some species may have declined.

By using the title “Have woodland birds declined in the Bungawalbin Creek catchment?” Totterman (2017) is making this question the thrust of his critique and, in so doing, implying that we are claiming this to be the case. This clearly is not the intent of our paper (see the Introduction of Gosper and Gosper (2016) for the actual aims), as the first three listed results (see Abstract and summary above) describe the intactness of the catchment’s bird assemblage (which is ignored by Totterman) and hence the paper overall does not suggest that woodland birds are declining in the Bungawalbin. Instead, Totterman (2018) focusses only on the fourth result i.e. lower reporting rates for six woodland species in 2004-6 compared to 1977-80, and the validity of this ‘finding’. If readers refer to the statements used in Gosper and Gosper (2016) (“Evidence for lower recent reporting rates...” in the Abstract; “we have identified that a number of species may have declined...” in the Results; “the experimental design...does not allow the causal factors...to be identified, as any shifts in reporting rates may also be influenced by different survey methods, variability of climate...” “appear to have declined...” both in the Discussion; and “has probably declined” in the summary of the status of the Varied Sittella), it is apparent that we consider that our data are indicative, but not conclusive, evidence of a decline in a small number of species.

Further to our contention that Totterman has misinterpreted the aims and conclusions of our paper, we will briefly respond to his two main criticisms: (i) a lack of standardisation in the survey areas and durations between the 1977-80 (Gosper 1992) and 2004-6 (Gosper and Gosper 2016) samples as a potential cause of observed differences in reporting rates; and (ii) an omission of a possible cause of difference in reporting rates.

We agree with Totterman (2017) that experimental design and methodology (including search areas and durations, but also other factors known to affect bird detection, such as vegetation density, weather and observer variation; Verner 1984), are ideally standardised in temporal comparisons. Yet this has rarely been the case in Australian woodland bird studies, with only 4 and 11 of the 44 studies of temporal trends in woodland birds assessed in Raynor *et al.* (2014) having had consistent effort and methods, respectively. It is to some extent an inevitable consequence of multi-decadal periods between surveys that it is difficult or impossible to standardise all relevant variables. Bird survey methods change with advances in scientific knowledge and contemporary trends, site features (other than those under investigation) unavoidably change, weather conditions vary, and different observers have varying abilities. This does not mean that temporal comparisons are impossible, nor that efforts should not be made to standardise survey variables where feasible. However, what is needed where standardisation is not possible is careful attention to experimental design and possible biases in statistical analyses, and where there are limitations, as in our study, caution in inferring differences. We were cautious in the detection of differences and interpretation of our results, as evidenced by the careful and explicit criteria used to discern possible declines, the stated recognition that survey methods may have contributed to differences in reporting rates, and the language we used to describe our findings.

Totterman (2017) makes a valid point (supported by data in his Fig. 1) that reporting rates may have been lower, on average, for the shorter and smaller 2004-6 surveys than for the longer and larger 1977-80 surveys. Whilst the overall reporting rate comparison between 2004-6 and 1977-80 did contribute to our identification of species that may have declined, it was only one of the criteria used, the others being reporting rates at the re-sampled sites and incidental records over the intervening and recent period. Our focus on the greatest disparities in reporting rates (both overall and at re-sampled sites) and relative differences among species suggests that possibly slightly lower reporting rates, on average, in recent surveys are unlikely to have been the main cause of the differences in reporting rates observed between 1977-80 and 2004-6. In comparisons of reporting rates from the 150-180 minute 1977-80 surveys and 120 minute combined surveys at those sites re-sampled in 2004-6, there is no consistent trend indicating bias (Fig. 1).



**Figure 1.** Reporting rates at a re-sampled site, comparing 150-180 minute surveys in 1977-80 and combined 120 minute surveys in 2004-6, for Royal Camp State Forest. Although there is much variability, there are also many cases of overlain data points of species with the same combination of reporting rates (e.g. 1.0 and 1.0), such that there is no indication of bias from a 1:1 line of agreement. ●, woodland birds considered threatened, declining or at risk in NSW woodlands (see Table 3 in Gosper and Gosper 2016); x, remaining species. The locations of species of particular interest as identified in Gosper and Gosper (2016) are marked, noting that this figure shows the results from only one re-sampled site and without the additional context of overall reporting rates and incidental records:

(a) woodland birds for which the Bungawalbin remains a stronghold - PtBQ = Painted Button-quail (scientific names in Gosper and Gosper 2016), LtLk = Little Lorikeet, BnTc = Brown Treecreeper, BChE = Black-chinned Honeyeater.

(b) woodland birds that may have declined across the region between 1977-80 and 2004-6 - PcDv = Peaceful Dove, BRTb = Buff-rumped Thornbill; RfWI = Rufous Whistler; DBFn = Double-barred Finch, VdSt = Varied Sittella, JkWt = Jacky Winter (noting that several possibly declining species did not consistently show lower reporting rates at all re-sampled sites, e.g. Jacky Winter at Royal Camp; see Gosper and Gosper 2016).

(c) other species with noticeably higher (OBOI = Olive-backed Oriole) or lower (WTGg = White-throated Gerygone) reporting rates in 2004-6 c.f. 1977-80.

Thus, there is no evidence that comparisons of reporting rates among re-sampled sites, which formed part of our assessment of temporal trends in the status of woodland birds, are biased. We believe our approach remains a useful way forward, given the data available and their limitations, even if our results were indicative rather than definitive, which we made clear in our description of them. We identified several species that may have declined, flagging them as important subjects for further monitoring and research.

Totterman (2017) argues that temporal variation associated with the millennium drought may be a factor in explaining differences in reporting rates of birds in the Bungawalbin catchment, implying that differences in reporting rates in Gosper and Gosper (2016) may be part of a cyclical process. We agree that this is a plausible hypothesis, but it is not a justified criticism of Gosper and Gosper (2016), as we did not specify whether we regarded differences in reporting rates to represent monotonic and continuing declines or differences associated with cyclic processes. Further, we even cite climate variability as one of several factors that may have contributed to our results.

In conclusion, Totterman (2017) has brought increased focus on the challenges of assessing temporal trends in bird occurrence from historical and recent records and made a useful contribution as to the effect of survey area and duration on reporting rates. However, we argue that his critique misrepresents the thrust of our paper and does not present any arguments which indicate that the carefully worded conclusions in our paper (Gosper and Gosper 2016) are not valid.

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