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SABAP2 SHOWS THAT THE COMMON MYNA *ACRIDOTHERES TRISTIS* IS USING THE TOWNS AND VILLAGES AS STEPPING STONES TO SPREAD ACROSS SOUTH AFRICA

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The Common Myna *Acridotheres tristis* is one of three bird species in a list of 100 species considered by the IUCN to be among the world's most harmful invasive species (Lowe 2000, pdf available, see references). Peacock *et al*. (2007, pdf available) reviewed the distribution and spread of the Common Myna in southern Africa, tracing the history back to the first introduction of escapees from the pet bird trade in Durban in 1902. The analyses in Peacock *et al.* (2007) were based largely on the 16 969 SABAP1 records (mainly observations made by atlasers during the period 1987–1991) (Craig 1997), supplemented by *ad hoc* records collected by the authors in the period from 1992 to 2006, just prior to the start of SABAP2 in July 2007.

The "range-change" map for the Common Myna, based on arithmetic changes in reporting rates between SABAP1 and SABAP2 shows the extent of the range expansion of the species over the two decades subsequent to SABAP1 (Fig 1). The quarter degree grid cells shaded blue in Fig 1 represent grid cells where the species was not recorded during SABAP1, but has been recorded during SABAP2. It shows that the species now occurs across all the northern provinces of South Africa; within South Africa, it is expanding westwards into the Northern Cape and the Eastern Cape.

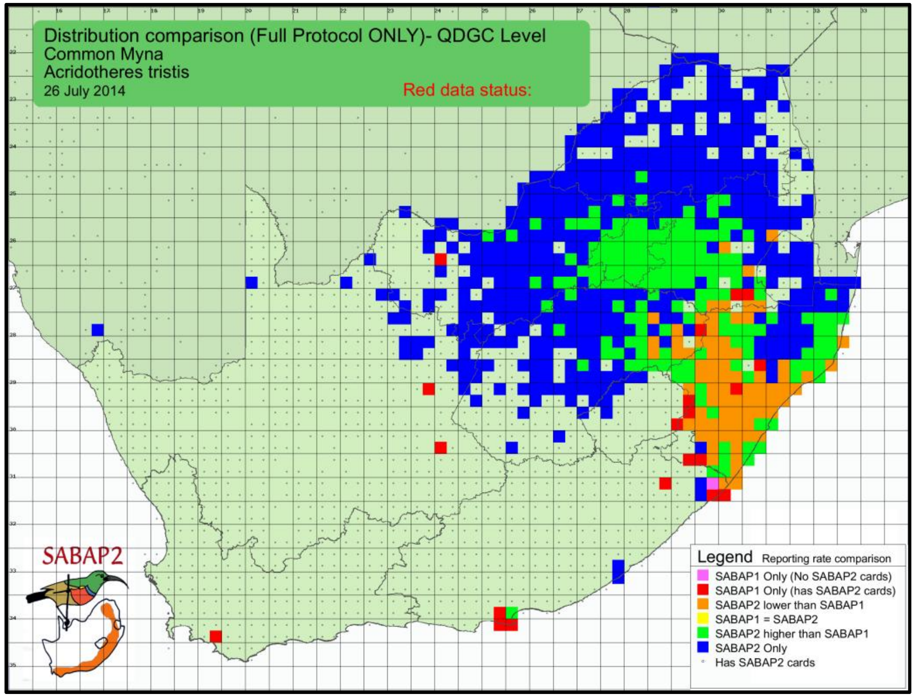

Fig 1 - Range-change map for Common Myna. The shading of the quarter degree grid cells is determined by an arithmetical comparison of reporting rates. In pentads shaded blue the species was recorded in SABAP2 but not in SABAP1 (potential colonization). In pentads shaded orange, the SABAP2 reporting rates were lower than those in SABAP1. In pentads shaded green, the SABAP2 reporting rates were higher than those in SABAP1. In pentads shaded red, the species was recorded in SABAP1, but not in SABAP2 (potential extinction). SABAP2 reporting rates were compiled by pooling checklists from all pentads with the quarter degree grid cell. In grid cells containing a dot the species was not recorded in either SABAP1 or SABAP2, although there is SABAP2 data available. In the grid cell shaded pink, Common Myna was recorded during SABAP1, but for which there is SABAP2 data.

The distribution map for the Common Myna (Fig 2), based on SABAP2 data only, shows reporting rates for pentads with four or more checklists (the caption to Fig 2 provides details of interpretation of the distribution map). Inspection of pentads with high reporting rates, shaded dark blue in Fig 2, shows that, apart from in Gauteng and coastal KwaZulu-Natal, they are scattered and isolated (Fig 1).

We asked the question whether these pentads with highest reporting rates coincide with centres of human settlement. The question was motivated by Peacock *et al*. 2007's observation that distribution and abundance of the Common Myna are closely related to that of concentrations of people. They noted that in South Africa, mynas are seldom observed away from human settlement, and were especially rare in predominantly untransformed areas.

Considering only pentads with four or more checklists by July 2014 and within South Africa, Lesotho and Swaziland, Common Mynas had been recorded in 1 814 pentads. The cut-off at four pentads is the same as that used in the production of Fig 2. The reporting rates for this species exceeded 90% in 320 of these pentads (17.6%). This percentage is close to the fraction 1/6th, the fraction of pentads shaded dark blue in Fig 1. We focus mainly on these 320 pentads. Using the pentad maps available on the SABAP2 website (http://sabap2.adu.org.za), we inspected the Google map for each of these 320 pentads; we classified each pentad into one of four categories: (1) pentads which were rural and totally untransformed; (2) pentads which were rural and untransformed, but had roads and some indication of human settlement (isolated farmhouses and stads); (3) pentads with indications of agricultural transformation, usually shown as removal of natural vegetation for the establishment of fields for crops, pivots, orchards; (4) pentads with human settlement somewhere in the pentad in the form of villages, towns, residential suburbs, cities, or a dense array of stads (eg in KwaZulu-Natal).

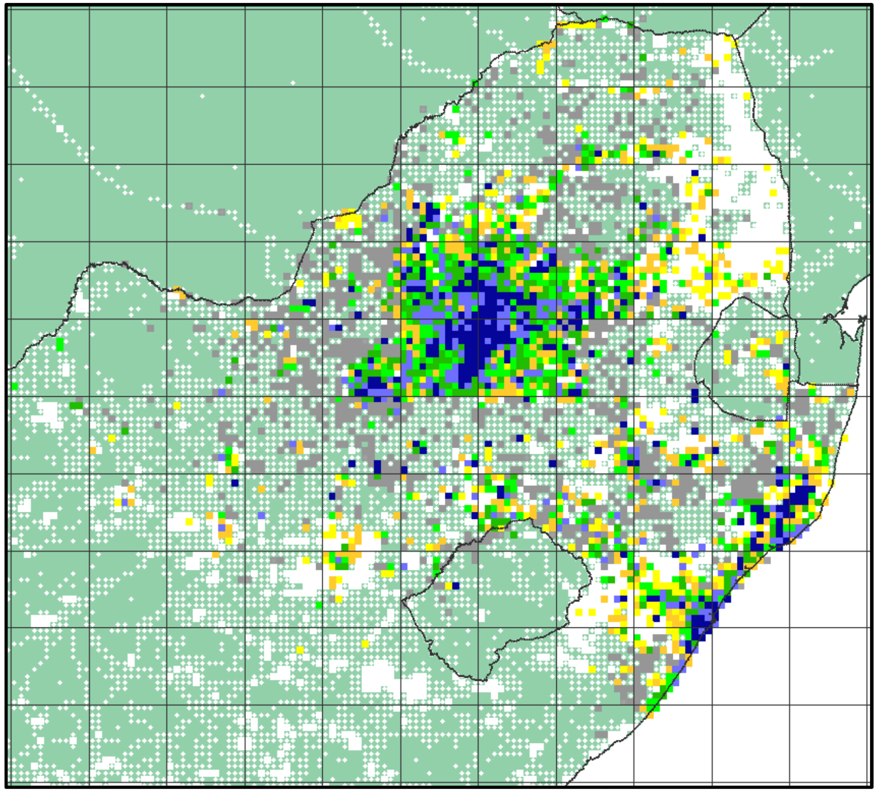

Fig 2 - Distribution map for Common Myna using SABAP2 data for northeastern South Africa. Pentads with four or more full-protocol checklists are displayed in colour, depending on reporting rate. For these pentads, the reporting rates were sorted, split into six categories of equal size; the pentads with the lowest one-sixth of reporting rates were shaded yellow, and subsequent sixths were shaded orange, light green, dark green, light blue, and the pentads with the highest one-sixth of reporting rates where shaded dark blue, representing the "core" of the distribution of the species. Pentads with white squares had at least four full-protocol checklists, representing at least eight hours of fieldwork; Common Myna had not been recorded and is probably absent. Pentads shaded grey had Common Myna present but with limited amounts of data (one, two or three full-protocol

checklists, ad hoc checklists, or incidental sightings so that reporting rate could not be estimated). Pentads with small white dots had limited amounts of data, with Common Myna not recorded, so the species is possibly absent. Pentads shaded turquoise did not have data, of any description, by July 2014. The map has 22°S, 22°E in the northwest corner, and 32°S, 33°E in the southeast corner, and the grid is a one-degree grid

For these 320 pentads, the median number of checklists available was 12 (lower quartile 7, upper quartile 31 and range 4–857). A reporting rate exceeding 90% was attained when pentads with 4–9 checklists had Common Myna recorded on every checklist, when pentads with 10–19 checklists had Common Myna recorded on every checklist except one, etc. The pentad with the largest number of checklists and with 100% reporting rate was pentad 2940_3100 in KwaZulu-Natal (and includes the northern Durban suburbs of Umhlanga and Phoenix); this pentad had 98 checklists and Common Myna was recorded on all of them. Three pentads had more than 600 checklists, with Common Myna reported on more than 90% of them: pentad 2605_2755 (Gauteng, Randburg southwest towards Roodepoort) had 857 checklists, with Common Myna recorded on 843 (reporting rate 98.4%); pentad 2605_2800 (Gauteng, Sandton and Houghton Estate) had Common Myna recorded on 824 of 854 checklists (96.5%); and pentad 2540_2815 (Gauteng, eastern Pretoria suburbs of Silverton and Montana Park) had Common Myna recorded on 572 of 608 checklists (94.1%).

318 of the 320 pentads with Common Myna reporting rates exceeding 90% were in South Africa, with one each in Lesotho and Swaziland (Table 1). 315 of the 320 pentads (98.4%) were classified as being either agricultural or as having human settlements (categories (3) and (4) above); and 278 out of 320 (86.9%) were classified as having human settlements (category (4)). Five of the 320 pentads were classified as rural, apart from a few roads and farmhouses (category (2)). None of the 320 pentads was entirely rural and untransformed (category(1)) (Table 1).

All 270 pentads in Gauteng had seven or more checklists by July 2014, and so would have been considered for this analysis. Common Mynas were recorded in 268 of the 270 pentads in Gauteng; the exceptions were pentads 2510_2845 and 2515_2840 in the northeastern corner of the province (both with seven checklists); inspection of the Google maps indicates that they would both have been classified as rural, apart from a few roads and farmhouses (category (2)).

We inspected the distribution, on a pentad scale, of the Common Myna across the provinces Limpopo, North-West and Free State against the background of the Google maps for the provinces. These are the three provinces into which the range expansion took place mostly after the end of SABAP1 in 1991 (Fig 1). This inspection revealed that every town named on the Google map had Common Mynas present by July 2014.

The analyses and discussion above provide an explanation for the scattered nature of the distribution of dark blue pentads in Fig 2, the pentads with the highest one-sixth of reporting rates. These pentads would have coincided closely with the 320 pentads included in Table 1, with reporting rates 90%–100%. The overwhelming majority of these pentads are shown to be associated with human activities, especially suburbanization and agricultural transformation to arable crops.

These results support the hypotheses contained in Peacock *et al.* (2007) that the distribution of the Common Myna is closely tied to that of humans. With the SABAP2 data available on a finer scale than what was available to them, we were able to provide a stronger confirmation of this hypothesis than they were able to do using data collected on the quarter degree grid scale of SABAP1. It is thus clear, without doing any statistical analyses, that the Common Myna is using the towns and villages as stepping stones to spread across South Africa.

One of the striking features of Fig 1 is the decline in reporting rates for Common Mynas in SABAP2 compared to SABAP1 over much of KwaZulu-Natal; this is reflected in the quarter degree grid cells shaded orange in the range-change map of Fig 1. However, this might be a consequence of the difference in scale between SABAP1 and SABAP2. During SABAP1, observers would tend to have visited a town or village in a quarter degree grid cell, if one was present, and recorded the species that were observed in it; they would have added the bird species characteristic of suburban habitats, including the Common Myna. However, for SABAP2, that town is most likely to have fallen into a single pentad, with a high reporting rate for Common Myna similar to that obtained by SABAP1 for the quarter degree grid cell. The computation of the reporting rate for SABAP2 for Fig 1 was undertaken by pooling all checklists for the (usually) nine pentads in the quarter degree grid cell. If these pentads had low or zero reporting rates for Common Myna, the overall SABAP2 reporting rate for the species in the quarter degree grid cell would be smaller than that for SABAP1. This can be visualized, to some extent by examining, in Fig 2, the areas, mostly in the interior of KwaZulu-Natal, shaded orange in Fig 1. This inspection shows that many of the pentads shaded dark blue in the interior of KwaZulu-Natal are surrounded by pentads showing low reporting rates for Common Myna.

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Table 1. Classification of pentads with high concentrations of Common Mynas into three categories (see text for definitions). The 320 classified pentads were within South Africa, Lesotho and Swaziland, and had at least four full-protocol SABAP2 checklists by July 2014, and had reporting rates for Common Myna greater than or equal to 90%.

Province	(1) Untrans-formed, rural	(2) Rural, road, farmhouse	(3) Agricultural	(4) Human settlement	Total
Free State	0	0	3	28	31
Gauteng	0	0	10	91	101
KwaZulu-Natal	0	3	3	67	73
Limpopo	0	1	2	10	13
Mpumalanga	0	0	9	37	46
Northern Cape	0	0	0	1	1
North West	0	0	10	43	53
Lesotho	0	0	0	1	1
Swaziland	0	1	0	0	1
Total	**0**	**5**	**37**	**278**	**320**