the best estimates of the average duration of primary moult for the individual bird is the number of days between the date on which 50% have started moult and the date on which 50% of the birds have completed moult.

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Birds in the air: a quality perspective

Pieter van Eeden

PO Box 13434, Norkem Park, 1613; email: pieter.vaneeden@iscor.com

Many trainee ringers, upon receiving their A-permit, continue to ring for the sake of ringing because the newly qualified ringer does not have a specific bird-ringing project to pursue. During the course of the Bird Ringers' Workshop and Conference held at Witsand, a few speakers indicated projects in which these ringers could participate. With this in mind, I would like to add another project to the list.

I did my university training in the occurrence and concentration of metals in selected freshwater birds and I work as a pollution ecologist doing impact assessments. I would therefore like to combine bird ringing with a study of environmental quality. I am moving away from my interest in water pollution into a field of which I know very little, but in which the average bird ringer can easily participate, and that is air quality.

Birds do not only use feathers for flying; they also use them as a route for excreting undesirable pollutants, especially metals, much in the same way as the liver and the kidneys are used to eliminate pollutants via faeces and urine. Scientists in Europe and America have effectively used bird feathers as indicators of air quality. For example, researchers (Garcia *et al.* 1988) have linked atmospheric lead concentrations with levels of lead in the lungs of Feral Pigeons found in Madrid, Spain (see table).

These researchers also found a gradual increase in the lead concentrations in the bones of the Feral Pigeons from rural areas to urban areas with a high traffic density. Also, the lead levels in bones of female pigeons were usually higher than in those of male pigeons. This is due to the fact that female pigeons need to actively accumulate calcium for eggshell formation. The carrier protein is unable to recognise the difference between calcium and lead. Research was conducted in Poland (Sawicka-Kapusta *et al.* 1986) on three species of tit occurring in forests heavily polluted by metal smelters, forests polluted by industry and a forest with no pollution. The results indicated gradual increases of

Area	n	Atmospheric lead ug/m^3	Lung lead levels ug/g dry weight
Rural	6	not detectable	0.6
Urban (L)	25	0.71	7.0
Urban (M)	15	0.86	7.7
Urban (H)	36	1.44	11.2

The L, M and H refer to low, medium and high traffic density.

metals in the tit's livers, bones and feathers as levels of pollution increased. These types of research are based on the capture and killing of the birds, so-called 'destructive analyses'.

However, similar research using only feathers as biological indicators of metal pollution, thus obviating the killing of the birds (so-called 'non-destructive analyses'), is also valid. The external rectrices (R6) of Magpies *Pica pica* were collected from various polluted sites in Poland (Dmowski & Golimowski, 1993). Statistically significant increases were found between the metal content of the feathers and the metal content of the surrounding air.

So where does this leave the average bird ringer in South Africa? Well, for one, I am busy collecting mensural data of three species of birds from various places in South Africa in order to establish whether there are any significant differences between localities or over time. However, I suspect that this desktop study might not indicate a connection with air quality due to possible race differences and the fact that sufficient data stretching back for at least ten years is just not available. I am, however, sure that a study similar to the one conducted by Dmowski & Golimowski (1993) in Poland can be made to work in South Africa. There is a possibility that Eskom might fund such a project. Furthermore, it is quite simple and easy to remove a particular feather from commonly caught and ringed birds such as the Laughing Dove, Masked Weaver or Fiscal Shrike, to label the feather samples and then to post them to me. I will then have them analysed for metals.

You might ask: so what? What will this prove and how will I benefit? Well, the impact that lead-containing petrol has on the environment is a good example. Has there been a decline in atmospheric lead levels due to the introduction of unleaded petrol? Who knows? If so, the results of this project can be taken to the Minerals and Energy Affairs Department and used as an argument for the lowering of the price of unleaded petrol! With the way the petrol price is rocketing upwards, I would certainly appreciate a substantial decrease in the price of unleaded petrol!

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