Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL
enquiries@ceh.ac.uk
www.ceh.ac.uk

Predatory Bird Monitoring Scheme
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Can post mortem data be used to monitor population health in the barn owl?

ABSTRACT: We investigated whether post-mortem observations could be used to determine and monitor population health indices for barn owls, *Tyto alba*. We were able to establish baseline "norms" in the form of Shewhart charts. For the majority of health indices considered it was necessary to present results separately for males and females. For most indices there were no differences between age classes and so combined indices for adult and first-year birds were presented.

L. A. Walker*, E.D. Potter, J.S Chaplow, M.G. Pereira, A. Tongue, & R. F. Shore

Centre for Ecology & Hydrology, Lancaster
Environment Centre , Lancaster, LA1 4AP, UK
*Corresponding author: leew@ceh.ac.uk

Introduction

The Predatory Bird Monitoring Scheme (PBMS; http://pbms.ceh.ac.uk/) is national long-term project that monitors contaminant residues in a range of avian predator species. Each bird that is submitted to the scheme is given a post-mortem examination during which approximately 60 macroscopic observations and measurements are made. The information gathered during this examination could potentially be used to monitor health status of the birds at the time of their death

We examined whether control charts (Shewhart charts) could be used to establish average and prediction intervals for a range of candidate health indices in birds collected between 1995 and 2015.

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Health indices examined

Where minimum sample sizes (5) were not available for individual years data were combined with subsequent years.

Sex, and Age ratio – annual proportion of birds that were female and first-years (fledged same or previous year), respectively.
Proportion starved or diseased – annual proportion of birds that had died due to starvation and/or disease(Fig. 1).

Body weight – annual median body weight (post frozen).

Fat Score - a non-linear fat score based on the fat deposits in the carcass. Birds categorized as "low" (score 0-1) or "high" (2-5).

Condition Index – annual median quantitative measure standardizing body weight accounting for body size (Equation 1).

Fluctuating Asymmetry - Fluctuating asymmetry (FA), the random deviation from perfect symmetry in bilaterally paired structures has been shown to be a potential population health index in other raptor species using 10th primary feather weight as the trait.

| Equation 1 |
| --- |
| $CI = (Body_{wt} - Gizz_{wt}) \div Sternum\ Diag.^3$ |
| where |
| $Body_{wt}$ = Whole body weight (g) |
| $Gizz_{wt}$ = Wet weight of gizzard contents (g) |
| Sternum Diag. = Distance between posterior point of the sternum keel plate and the distal point of the clavical (mm) |

Examples of results

- Generally it was possible to establish Shewhart charts for the indices studied with combined charts for adults and first-year birds but with separate charts for each sex (Table 1).

- Fluctuating asymmetry could not be used because the data showed kurtosis tending towards a peaked distribution (data not shown).

Table 1. Summary of whether it was possible to establish a Shewhart chart for each indices studied, whether age and/or sex specific charts were necessary and whether there was a time trend in the indices over the study period.

Population Health Index	Shewhart Possible	Age specific	Sex specific	Time trend
Sex ratio	Yes	No	N/A	No
Age ratio	Yes	N/A	Yes	No
% starved or diseased	Yes	Yes	Yes	Partial (Fig 1.)
Body wt.	Yes	No	Yes	No
Fat Score	Yes	No	Yes	No
Condition Index	Yes	No	Yes	No
Fluctuating Asymmetry	No	N/A	N/A	N/A
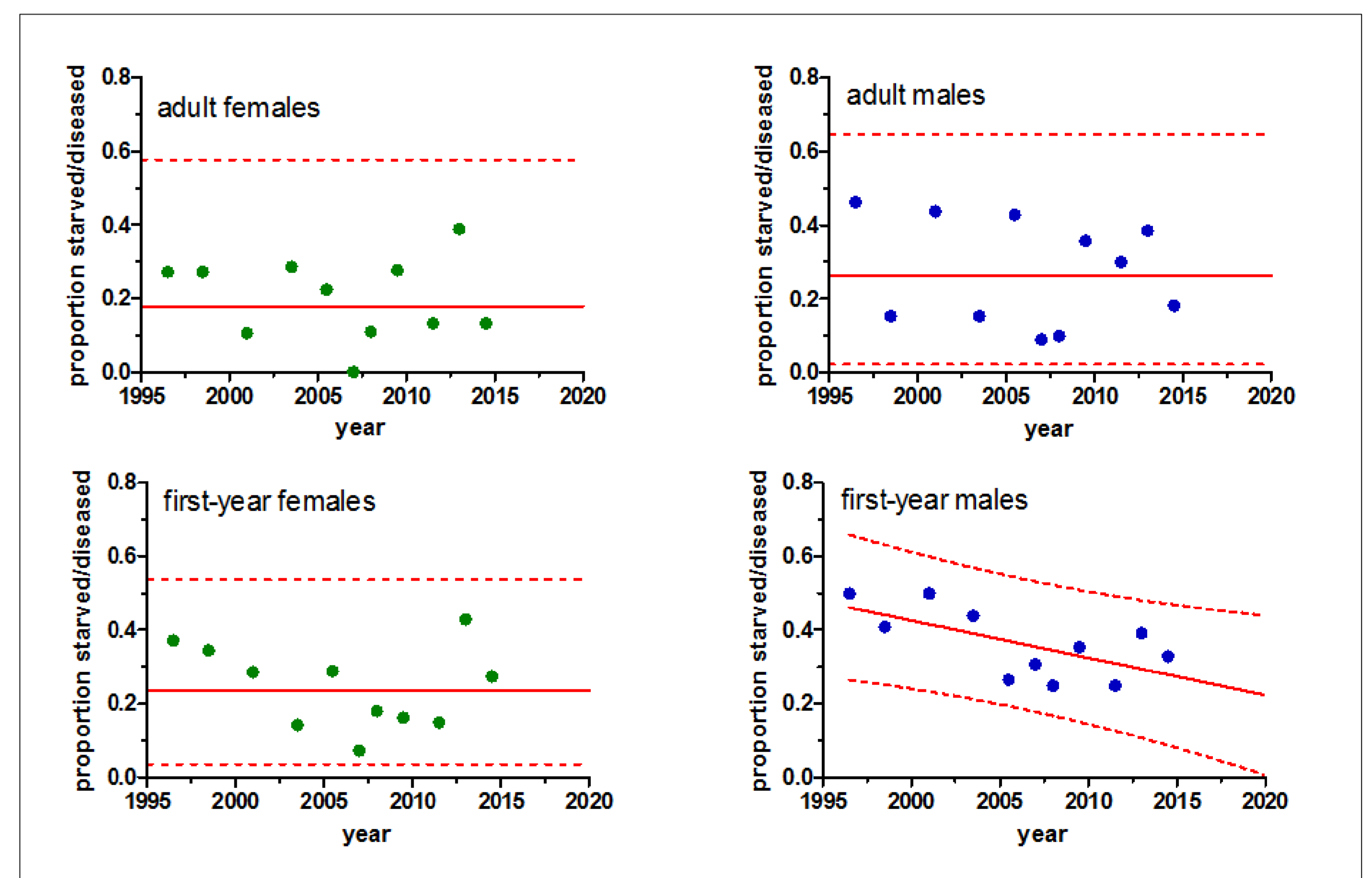
Figure 1. The proportion of female (●) and male (●) adult and first year barn owls that had died due to starvation or disease in each year of the monitoring scheme. The red solid line indicates the mean and 95th percentile prediction interval (dashed red lines).

Conclusions

- The proposed population health indices generally can be established for barn owls.

- Exceedance of the 95% prediction intervals may indicate early population changes in the population recruitment and survival, mortality rates, nutritional status, or signs of physiological stress.

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