# POST-BREEDING DENSITY AND HABITAT PREFERENCES OF THE AZORES WOODPIGEON, *Columba palumbus azorica*: AN INTER-ISLAND COMPARISON.

MEGAN DICKENS & VERÓNICA NEVES

DICKENS, M. & V. NEVES 2005. Post-breeding density and habitat preferences of the Azores Woodpigeon, *Columba palumbus azorica*: an inter-island comparison. *Arquipélago*. Life and Marine Sciences 22A: 61-69.

In this study we present a post-breeding estimate of the density of the Azores Woodpigeon, *Columba palumbus azorica* (Hartert & Ogilvie-Grant, 1905). During August 2003, seven of the nine islands of the Azores were surveyed using line transects and distance sampling. Distance analysis, stratified by the island of Terceira and the other islands combined, gives density estimates of 14.52 birds/km$^2$ on Terceira and 5.14 birds/km$^2$ on the other six islands. This indicates that woodpigeons are more abundant than previously thought. The woodpigeon in the Azores is likely to have recently gone through a period of growth. However, woodpigeon densities in the Azores are still much lower than those in mainland Europe. Populations in the Azores may now be limited by the availability of breeding habitat and over-winter food supply. The present survey highlights that there are strong differences between woodpigeon abundance on the different islands of the archipelago, notably with densities on the island of Terceira being higher than on any of the other islands surveyed. Analyses of habitat preferences and the availability of different habitat types suggest that inter-island habitat differences could be a major cause of variation in woodpigeon density across the archipelago.

*Megan Dickens (e-mail: m.dickens@lancaster.ac.uk), Department of Biological Sciences, Institute of Environmental and Natural Sciences, Lancaster University, Lancaster, LA1 4YQ, UK; Verónica Neves, Ornithology Unit, Graham Kerr Building, IBLS University of Glasgow, Glasgow G12 8QQ Scotland, UK.*

## INTRODUCTION

Island avifauna can be a conservation priority both because this group shows high levels of endemism and because island species are often highly vulnerable to extinction (KRESS 1998). The endemic Azores Woodpigeon *Columba palumbus azorica* (Hartert & Ogilvie-Grant, 1905) is presently included in Annex I (globally threatened species) of the EC Birds Directive. The population is thought to have been in decline over the last century and possibly reduced to around two hundred breeding pairs (BANNERMAN & BANNERMAN 1966). The most obvious threat to this species is habitat loss from the relatively recent and widespread conversion of woodland into pasture for dairy cows. Only around 2% of the native laurel forest remains on the islands (STATTERSFIELD et al. 1998) and other woodland areas consist of plantations of introduced species (for example, the Japanese Red Cedar *Cryptomeria japonica*), which may not provide suitable habitat for this bird. Despite the concern for this species, no detailed study of the population has been made. The present survey was part of an ornithological expedition to the Azores (NEVES et al. 2003). The aims were to compare post-breeding population densities on the different islands of the Azores archipelago and gain information on habitat use, in order to assess the vulnerability of island populations of the Azores Woodpigeon.

## MATERIAL AND METHODS

The survey method used was line transects with distance sampling (BIBBY et al. 1998). Transects were completed during August 2003. Seven of the nine islands of the Azores were included (see Fig. 1), omitting only the islands of Corvo and São Jorge (due to time constraints). 1 $km^2$ grid squares for the start point of transects were randomly chosen from 1:25000 maps of the islands. Within these squares transect routes could not usually be placed randomly due to lack of access to private land. As a consequence each transect consisted of a 2 km path, track or road (or a combination of these) through the area. Birds were counted along the transect in distance bands at right angles to the transect line. The distance bands were within 25 m, between 25 m and 100 m, between 100 m and 150 m, or birds recorded only in flight. Transects were walked in the morning and late afternoon thus avoiding the hottest part of the day when bird activity may be reduced. Birds were classified as juveniles or adults where possible (juveniles are distinguished by the absence of the adult's white neck patches). In order to describe habitat use, each transect was split into ten 200 m sections and birds were assigned to individual sections as they were observed. The primary and secondary habitat in each 200 m section was described according to a broad scale definition, for example deciduous woodland or grassland, based on the system used in the British Breeding Birds Survey (described in GREGORY & BAILLIE 1998).

Statistical Analysis

Counts of birds in distance bands allows density estimates to be calculated using the Distance program (Distance 4.1. Release "2", THOMAS et al. 2003), which works on the principle that birds in further distance bands are less likely to be detected (BIBBY et al. 1998). Distance sampling techniques include an estimate of undetected birds when producing density estimates (for more details see BUCKLAND et al. 1993). As survey transects could not be placed randomly, estimated densities are applicable only to transects. Therefore, results are presented as densities on transects (for comparison between islands) not as numbers of birds.

Due to the low numbers of observations on all islands bar Terceira (Table 1), the data are not suitable for the separate analysis of density on each island. Instead, the distance analysis was carried out three times with the data grouped into the following subsets; (1) All of the islands surveyed (full data set), (2) Terceira, (3) The remaining 6 islands surveyed without the data from Terceira. Birds seen only in flight were discarded from the datasets before model creation. Where data from more than one island were included in the analysis (i.e. (1) and (3) above), the distance analysis was stratified by island.

The most appropriate models were chosen by eye (goodness of fit of the detection curve to the observed data) and by Akiake's information criterion (AIC). In all cases the most appropriate detection probability models were found using the half-normal key function with cosine adjustments, where the detection probability declines rapidly over distance from the transect line (Fig. 2). This detection function has been found to be appropriate for modelling the detection probability of several other species of birds where observations are in the form of interval data from line transects (e.g. WILKINSON et al. 2002, GREGORY & BAILLIE 1998).

Due to the low number of observations per island in the data, fitting individual detectability functions for each habitat type is not appropriate. To include a broad effect of habitat type on the estimation of density, a model was fitted with woodland/non-woodland as a covariate and compared to the full data set model described above (model (1)).

The habitat data was used to compare observations across habitat types, using data from all islands combined, to examine habitat preferences. Habitat preference was measured using Jacob's index (JACOBS 1974). This index allows habitat use to be examined in proportion to the availability of different habitats. The index (D) is calculated using the formula

$$D = (r - p)/(r + p - 2rp)$$

where r is the proportion of birds recorded in each habitat type and p is the proportion of each habitat type available. The index is bound by 1 and –1, where 1 indicates that there is a strong preference for the habitat type and –1 indicates strong avoidance.

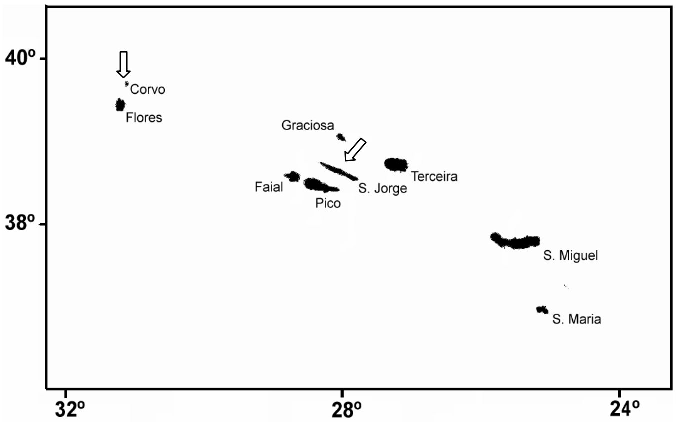


Fig. 1. Map of the Azores archipelago. Arrows indicate the islands where no surveys were conducted.

Table 1.
Survey effort on each island of the Azores archipelago with the number of woodpigeons observed and the encounter rate

| Island | Dates of survey | No of transects | No of Adults | No of Juveniles | Total encounter rate (n/km) |
|---|---|---|---|---|---|
| São Miguel | 04/8-10/8 | 20 | 13 | 1 | 0.35 |
| Santa Maria | 11/8-17/8 | 16 | 4 | 1 | 0.16 |
| Pico | 12/8-17/8 | 8 | 14 | 2 | 1.00 |
| Faial | 19/8-20/8 | 5 | 2 | 0 | 0.20 |
| Graciosa | 20/8-23/8 | 9 | 17 | 2 | 1.06 |
| Flores | 21/8-24/8 | 7 | 1 | 0 | 0.07 |
| Terceira | 25/8-28/8 | 16 | 52 | 3 | 1.72 |
| Total | | 81 | 103 | 9 | |

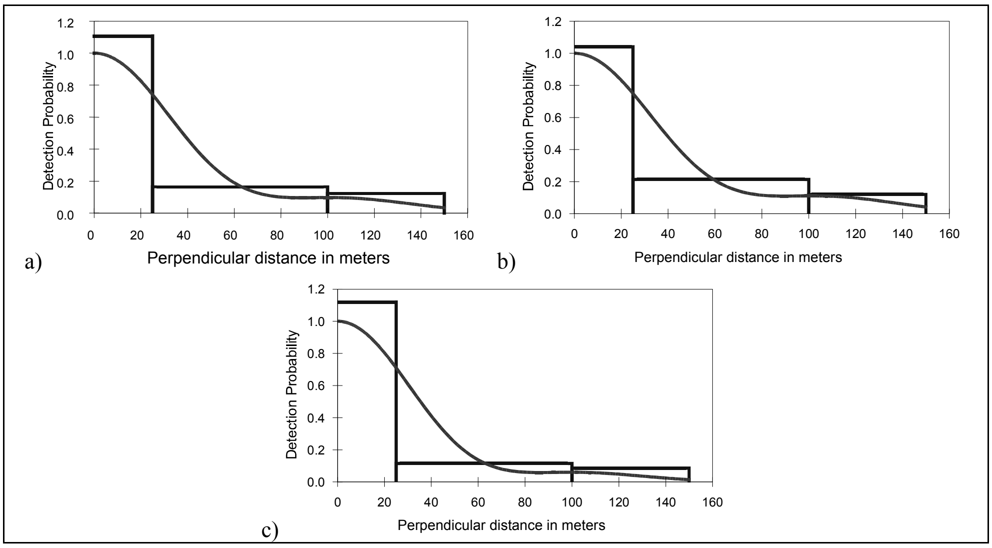


Fig. 2. Histogram of Azores Woodpigeons observed in each perpendicular distance band from the transect line and the fitted detection curve (line) from a model using a half-normal and cosine detection function for (a) all surveyed islands, (b) all surveyed islands bar Terceira, (c) Terceira. Note that in all cases detection declines sharply after the first distance band (over 25m from the transect line). Vertical bars are scaled to match the detection probability curve.

## RESULTS

Eighty-one transects were completed, representing a total effort of 162 km. In total, 112 woodpigeons were observed, and birds were recorded on all of the surveyed islands. There were large differences in the encounter rate of woodpigeons on the different islands (Table 1). Most obviously, Terceira had a much higher encounter rate than any of the other islands. Flores, Faial and Santa Maria are noticeable for having low encounter rates. Very few juvenile woodpigeons were recorded on any of the islands (Table 1), but in many cases birds were not seen well enough to state whether or not they had the diagnostic white neck patches, so we would expect the number of juveniles to be greatly underestimated. We would caution against making inferences on the proportion of juveniles in the population from our data.

### Estimates of woodpigeon density on the islands of the Azores

Summing the total AIC from the separate Terceira and other islands analyses gives 161.19 (Table 2). As this is less than the total AIC for all islands combined (182.17, Table 2), there is strong support for the stratified analysis. Including habitat as a covariate did not improve the model (AIC = 208.87, Table 2). From the best combination of models, densities on transects from Terceira were estimated to be 14.52 birds per km$^2$, while woodpigeon densities on transects from the other islands surveyed were estimated to be much lower, at 5.14 birds per km$^2$, adults and juveniles pooled.

### Habitat preferences

Woodpigeons were observed in all of the habitat types that the survey described. The proportion of each habitat type as the major habitat in each 200m section of the transects (across all islands) is shown in Table 3. Woodpigeon observations were more common than expected in areas of transects where the major habitat type was deciduous or coniferous woodland, or arable land (Table 3, Fig. 3) suggesting preference for these habitat types. There were fewer observations than expected in areas where the major habitat was recorded as urban or scrub, suggesting avoidance. Other habitats (mixed woodland, pasture and boundary features with trees) were not linked to strong preference or avoidance.

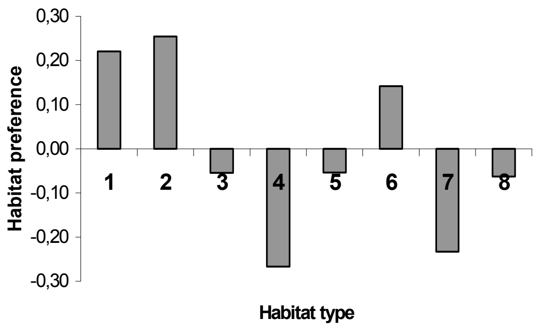


Fig. 3. Habitat preferences for each major habitat type, calculated by Jacob's index. Bar numbers refer to habitat types as follows; (1) Deciduous woodland, (2) Coniferous woodland, (3) Mixed woodland, (4) Scrub, (5) Pasture, (6) Arable, (7) Urban, (8) Boundary with trees (numbers also correspond to those used in Table 3). The index is bound by 1 and –1, where 1 indicates that there is a strong preference for the habitat type and –1 indicates strong avoidance.

Table 2.
Density estimates for the Azores woodpigeon. Results are presented for three different groupings of data from the islands of the Azores (excluding the islands of Corvo and São Jorge) and for the whole data set with habitat type (woodland/non-woodland) as a covariate in the analysis.

| Area | E (km) | n | Enc. rate (95% CI) | AIC | ESW (m) (95% CI) | D (95% CI) |
|---|---|---|---|---|---|---|
| Azores | 162 | 86 | 0.53 (0.39-0.78) | 182.17 | 46.12 (36.31-58.59) | 6.02 (3.98-9.12) |
| Terceira | 32 | 38 | 1.19 (0.74-1.90) | 73.78 | 40.90 (29.17-57.36) | 14.52 (8.32-25.38) |
| Azores without Terceira | 130 | 48 | 0.37 (0.23-0.59) | 87.41 | 43.12 (31.09-59.87) | 5.14 (2.78-9.48) |
| Azores with habitat as a covariate | 162 | 86 | 0.53 (0.39-0.78) | 208.87 | 65.78 (55.74-77.63) | 4.55 (1.66-12.45) |

*E*, (effort) length in km covered by transects; *n*, number of observations; Enc. rate, Encounter rate, birds seen per km; *AIC*, Akaike's information criterion, *ESW*, effective strip width; *D*, density (birds/km$^2$).

Table 3
Habitat preference as measured by Jacob's index for each of the habitat types recorded as the major habitat in 200m sections of transects (across all surveyed islands)

| Habitat | Availability | Observations | Jacob's Index |
|---|---|---|---|
| 1. Deciduous woodland | 0.07 | 0.11 | 0.22 |
| 2. Coniferous woodland | 0.05 | 0.09 | 0.25 |
| 3. Mixed woodland | 0.13 | 0.12 | -0.06 |
| 4. Scrub | 0.05 | 0.03 | -0.27 |
| 5. Pasture | 0.44 | 0.41 | -0.05 |
| 6. Arable | 0.09 | 0.11 | 0.14 |
| 7. Urban | 0.04 | 0.02 | -0.23 |
| 8. Boundary with trees | 0.12 | 0.10 | -0.06 |

Although transects themselves were not placed randomly, their location was obtained by choosing 1 $km^2$ grid squares at random (see Materials and methods section). As a result the proportions of habitat types seen within transects would be expected to broadly represent the relative proportions of habitat types available on each island. On those islands where few woodpigeons were observed, transects showed lower proportions of arable and deciduous or coniferous woodland habitats (the islands of Flores, Faial and Santa Maria, Fig. 4). In comparison, transects on the islands of Pico, Terceira and Graciosa, where most woodpigeons were observed, had larger proportions of arable and deciduous or coniferous woodland habitats.

## DISCUSSION

### Inter-island comparison of woodpigeon density

The results highlight strong differences between woodpigeon densities on the different islands of the archipelago. There may be several reasons for this occurring. The islands differ in the number of human inhabitants and the resulting proportion of land utilised as farmland, woodland and urban environments. Habitat preferences may help to explain the inter-island differences in the densities of woodpigeons on transects. There is also the suggestion that hunting may still occur on the island of São Miguel, where it has been a typical practice in the past. This may explain the apparent low densities of birds on this island. Alternatively numbers may not have yet fully recovered in those areas where woodpigeons were previously intensely persecuted. BANNERMAN & BANNERMAN (1966) and LE GRAND (1993) also reported densities varying across islands. LE GRAND (1993) indicates that the species is extremely rare in Santa Maria and Graciosa. Our results also indicate small numbers for Santa Maria but not for Graciosa, which had the second highest encounter rate. LE GRAND (1993) also refers to high numbers in Pico and São Miguel, which in the case of Pico seems to be in accordance with our results, but might indicate that there has been a population decline on São Miguel. BANNERMAN & BANNERMAN (1966) did not observe any woodpigeons on Flores, while the present study found that they did occur on that island, albeit in very low numbers. The comparison of habitats on each island in our study highlights that strong differences in land use may be the driving force behind inter-island differences in woodpigeon numbers. Additionally, woodpigeon densities may be decreased through predation by Common Buzzards, *Buteo buteo*, who can eat mainly birds, including woodpigeon, when mammal prey are less available (CRAMP 1985). Buzzards are the only diurnal bird of prey breeding in the archipelago and appear to be much less common on the island of Terceira than on the other Azorean islands (Paulo Faria pers. comm.). It is possible that a "rat killing campaign" undertaken in the late 1970's caused the accidental poisoning of Buzzards on Terceira, reducing their abundance on that island. Woodpigeon densities may be higher on the island of Terceira due to a combination of large amounts of suitable habitat and lower levels of persecution (at present and in the past).

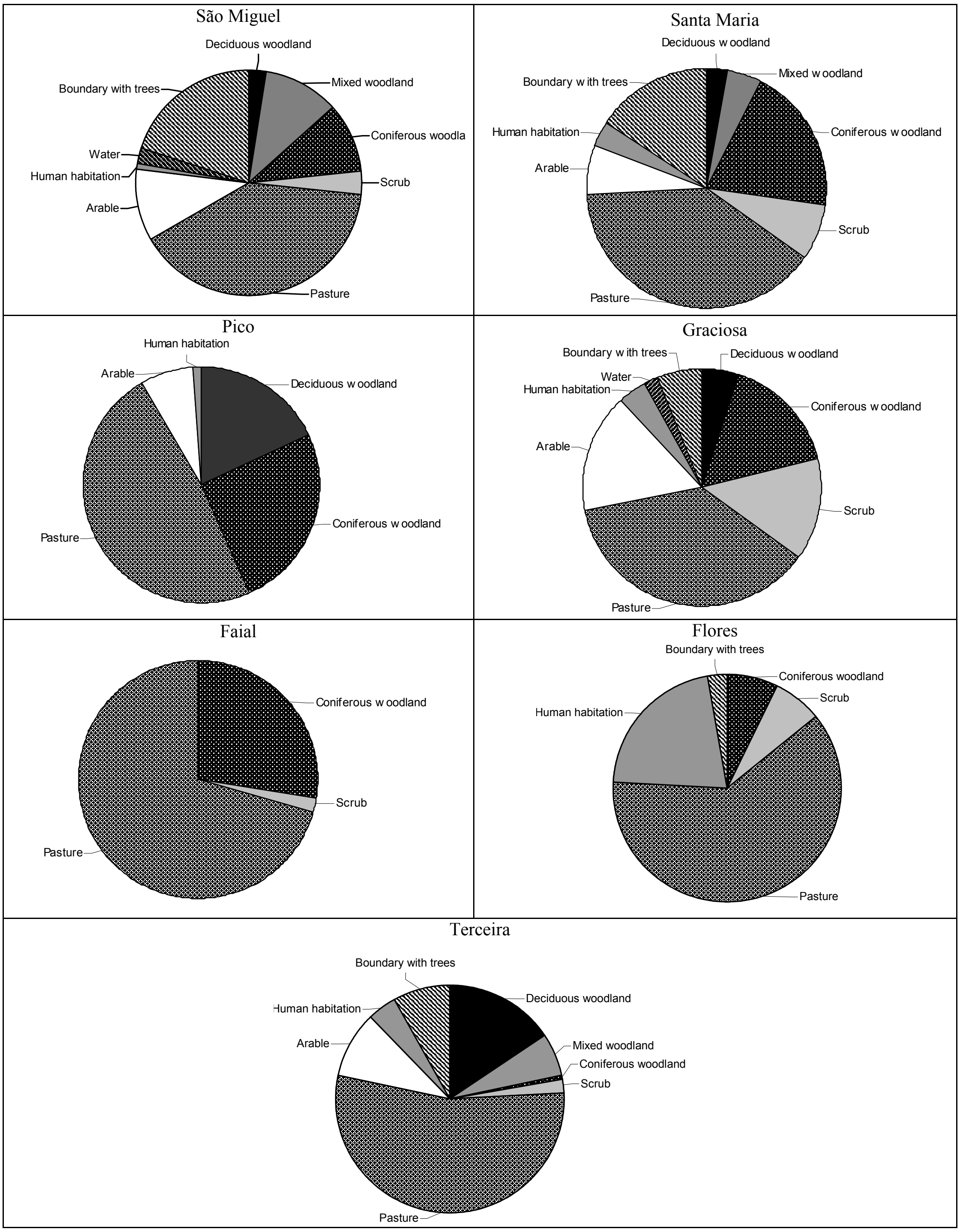


Fig. 4. The proportion of major habitat types composing transects on each island.

The results suggest a larger population size for the Azores Woodpigeon than its status as reported by BANNERMAN & BANNERMAN (1966) suggests. This may indicate either that the population was previously underestimated, or that the population has increased in the period between 1966 and the present survey. Given that the observations in BANNERMAN & BANNERMAN (1966) were not part of a detailed survey and did not include many of the islands, it is quite possible that their conclusion of a very small breeding population was erroneous. However, the landscape of the Azores has been undergoing major changes during the last 40 years, mainly with agriculture moving from arable to milk production and with the spread of coniferous plantations coupled with the loss of deciduous woodlands. These changes may have favoured the woodpigeon, although it is not obvious why. Long-term increases in the woodpigeon population of Britain have been associated with increases in the intensity of arable farming and this is thought to be largely due to the species reliance on arable crops in winter when other food sources are unavailable (INGLIS et al. 1990, MURTON 1965). The recent decrease in arable production in the Azores would be expected to have caused an increase in overwinter mortality rather than an increase in the breeding population. Another possible explanation, which would tie in with the observations of BANNERMAN & BANNERMAN (1966), is that at the time of their survey the woodpigeon was under persecution as a pest species (and being used for human consumption). This practise then declined with declining arable production and increasing human wealth (in the early 1980's). In Britain, woodpigeons have been viewed as a pest due to their consumption of crop plants and populations have been controlled by shooting (MURTON 1965). This practise also occurred in the Azores, but hunting woodpigeon in the archipelago became illegal in 1992 through a regional law (D.L.R. n.º 26/92/A). In comparison, landscape changes alone may have not had such a dramatic impact on woodpigeon populations on the islands. Woodpigeon have the capacity to breed outside of deciduous woodland, for instance in young conifer plantations (YAPP 1962) and to use weeds on pasture as a winter food supply (MURTON 1965).

The present survey is of the post-breeding population. Post-breeding, woodpigeon behaviour is generally described as more skulking and they are considered harder to observe during this period (CRAMP 1985). This may suggest that the population estimate derived from the present study will underestimate the actual numbers present. Conversely, post-breeding population size will be greater than the breeding population due to overwinter mortality. Overwinter mortality is a widely recognised regulator of breeding populations of birds in general and there is no reason to suggest that this would not be a strong predictor of the size of the breeding population of woodpigeons in the Azores. INGLIS et al. (1990) show that prior to the cultivation of cereal crops over the winter period in the South East of England, woodpigeon breeding population size was not significantly correlated with post-breeding population size. The population at this time was limited by the amount of food over the winter. With agricultural changes resulting in extra food over the winter, the breeding population size became correlated with the previous year's productivity. The population dynamics in the Azores would be expected to be more similar to those in East Anglia prior to over-winter cultivation, with the breeding population size affected most by food supply and severity of the winter than by the size of the previous year's post-breeding population. If this is the case, the present survey may not provide a true reflection of the breeding population of woodpigeons in the Azores. Over-winter mortality of woodpigeons has been reported as 74% for juveniles and 36% for adults in Britain (MURTON 1965) and around 50% for adults and juveniles in other parts of Northern Europe (DOUDE VAN TROOSTWIJK 1964, GLUTZ VON BLOTZHEIM & BAUER 1980). Assuming 50% over-winter mortality, breeding densities of the Azores woodpigeon may be as low as 7.26 birds per $km^2$ on Terceira and 2.57 birds per $km^2$ on the other islands surveyed, although this would still indicate population sizes exceeding those predicted by the report of BANNERMAN & BANNERMAN (1966). In comparison to woodpigeon densities in Northern

Europe, the estimates presented here are dramatically lower. INGLIS (1990) estimated mean woodpigeon densities in a study area of East Anglia to be 110 birds per $km^2$. Post-breeding population estimates from Southeast England ranged from 250 to 423 birds per $km^2$ in a study by MURTON et al. (1964).

In conclusion, the present study has estimated woodpigeon densities that, while being considerably lower than those reported on arable areas of England, are much higher than predicted by the observations of BANNERMAN & BANNERMAN (1966). The woodpigeon in the Azores is likely to have recently gone through a period of growth, due to a change in the level of persecution by humans. Populations in the Azores may now be limited by the availability of breeding habitat and over-winter food supply.

## Future work

Two islands were omitted due to time constraints. Any future studies should attempt to include these islands. Reports from BANNERMAN & BANNERMAN (1966) indicate that woodpigeon densities may differ on the two omitted islands: they suggest that woodpigeons are common on São Jorge and absent from Corvo. LE GRAND (1993) also indicate that the birds are common in São Jorge, referring to populations of more than 100 individuals in certain valleys. Woodpigeons have recently been sighted on Corvo but in low numbers; probably equating to less than 7 pairs (Pedro Domingos pers. comm.). This observer, native from Corvo, has records from 1999, previous to this woodpigeons were not seen on the island. His records include at least two juvenile birds (in 2000 and 2005) and sightings of adults during the breeding season, indicating that woodpigeons now breed on Corvo (probably at Ribeira da Fonte).

The present study strongly suggests future research on the Azores woodpigeon being directed into two areas: (1) An intensive survey of islands which are predicted to have low population densities to enable the estimation of densities on those islands, (2) On islands predicted to be strongholds, rates of habitat loss should be closely monitored. In addition, future conservation work in the archipelago should promote management plans that include recommendations for retaining and creating suitable habitat for breeding woodpigeons.

## ACKNOWLEDGEMENTS

This study greatly benefited from the advice of Dr. Len Thomas, Bob Furness and Sónia Mendes. We would like to thank an anonymous referee for helpful comments on the manuscript. We also thank the following members of the Glasgow University Azores 2003 Expedition who helped to collect the data: Geraldine Flanagan, Dr. Ana de León, Andrea Mason, Claire Mcdonald, Julie Mclaughlin, Kirsty Melrose, Dr. Eduardo Minguéz, Ana Pranto & Juan Simón. We are indebted to the following organisations for providing vital financial and logistical support for the expedition: The Carnegie Trust for the Universities of Scotland, The Royal Geographical Society, The Seabird Group, The Glasgow Natural History Society, The Glasgow University Court and Câmara Municipal de Santa Cruz da Graciosa (CMSCG). Duarte Silva from CMSCG kindly provided transport in Graciosa during part of the expedition. Finally we thank Pedro Domingos and Paulo Faria, two local naturalists, for generously providing valuable data from their personal observations.

## REFERENCES

BANNERMAN, D.A. & W.M. BANNERMAN 1966. *Birds of the Atlantic Islands 3: a history of the birds of the Azores*. Oliver & Boyd. Edinburgh. 277pp.

BIBBY, C.J., N.D. BURGESS, D.A. HILL, & S. MUSTOE 1998. *Bird census techniques*. Academic press, Harcourt. London. 257pp.

BUCKLAND, S.T., D.R. ANDERSON, K.P. BURNHAM & J. L. LAAKE 1993. *Distance sampling: Estimating Abundance of Biological Populations*. Chapman & Hall. London. 464pp.

CRAMP, S. (Ed) 1985. *Handbook of the Birds of Europe the Middle East and North Africa, The Birds of the Western Palearctic: the birds of the Western Palearctic: Terns to Woodpeckers.* Volume IV. Oxford University Press. Oxford. 960 pp.

DOUDE VAN TROOSTWIJK, W.J. 1964. Some aspects of the woodpigeon in the Netherlands. *Ardea* 52: 13-29.

GLUTZ VON BLOTZHEIM, U.N. & K.M. BAUER 1980. *Handbuch der Vögel Mitteleuropas 9*. Akademische Verlagsgesellschaft. Wiesbaden.

GREGORY, R.D. & S.R. BAILLIE 1998. Large scale habitat use of some declining British birds. *Journal of Applied Ecology* 35: 785-799.

HARTERT, E. & W.R. OGILVIE-GRANT 1905. On the birds of the Azores. *Novitates Zoologicae*, XII: 80-128.

INGLIS, I.R., A.J. ISAACSON, R.J.P. THEARLE & N.J. WESTWOOD 1990. The effect of changing agricultural practice on Woodpigeon *Columba palumbus* numbers. *Ibis* 132: 262-273.

JACOBS, J. 1974. Quantitative measurement of food selection. *Oecologia* 14: 413-417.

KRESS, S.W. 1998. Applying research for effective management: case studies in seabird restoration. Pp. 141-154 in: MARZLUFF, J.M. & ARNOLD, J.M. (Eds). *Avian conservation: research and management.* Island Press. Washington D.C. 512 pp.

LE GRAND, G.W. 1993. *Recherches sur l'écologie des Vertébrés terrestres de l'archipel des Açores.* Unpublished Ph.D. thesis. École pratique des Hautes Etudes, Montpellier.

MURTON, R.K. 1965. *The Woodpigeon*. Collins. London. 256 pp.

MURTON, R.K., N.J. WESTWOOD & A.J. ISAACSON 1964. A preliminary investigation of the factors regulating population size in the woodpigeon. *Ibis* 196: 482-507.

NEVES, V., M. DICKENS, A. DE LEÓN, E. MINGUEZ, G. FLANAGAN, & J. MCLAUGHLIN 2003. *Glasgow University Azores 2003 expedition: report of an ornithological expedition by Glasgow University Exploratory Society to the Azores archipelago, Northeast Atlantic.* Applied Ornithology Unit, Department of Ecology and Evolutionary Biology, Glasgow University. 62 pp

STATTERSFIELD, A.J., M.J. CROSBY, A.J. LONG & D.C. WEGE 1998. *Endemic Bird Areas of the World: Priorities for Biodiversity Conservation*. BirdLife Conservation Series No. 7. Cambridge. 846 pp.

THOMAS, L., J.L. LAAKE, S. STRINDBERG, F.F.C. MARQUES, S.T. BUCKLAND, D.L. BORCHERS, D.R. ANDERSON, K.P. BURNHAM, S.L. HEDLEY, J.H. POLLARD & J.R.B. BISHOP 2003. Distance 4.1. Release "2". Research Unit for Wildlife Population Assessment, University of St. Andrews, UK.

WILKINSON, N.I., R.H. LANGSTON, R.D. GREGORY, D.W. GIBBONS & M. MARQUISS 2002. Capercaillie *Tetrao urogallus* abundance and habitat use in Scotland, in winter 1998-99. *Bird Study* 49: 177-185.

YAPP, W.B. 1962. *Birds and woods*. Oxford University Press. London. 320 pp.

*Accepted 8 October 2005*