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Onset of Common Woodpigeon *Columba palumbus* breeding season in Flanders as based on gonadal development

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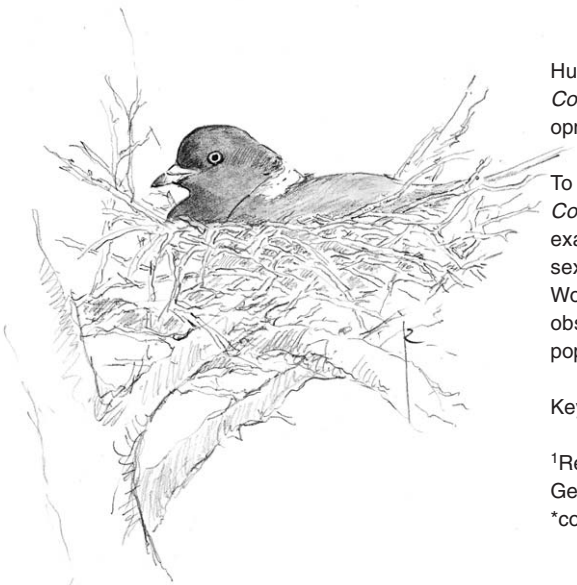

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To determine the start of the breeding season of Common Woodpigeon *Columba palumbus* in Flanders, the gonads of 185 adult Woodpigeons were examined. Analysis of testis size showed that male Woodpigeons became sexually active in March. Follicle size analysis indicated that the first female Woodpigeons became sexually active from the end of February onwards. The observations however indicated an overall start of the breeding season on a population level by late March/early April.

Key words: Gonadal development, breeding season, bird reproduction

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To date, in Flanders, the Common Woodpigeon breeding season is assumed to last from March to September. Recent preliminary surveys, however, indicate a later onset (Huysentruyt & Casaer 2009). To determine the start of the Woodpigeon breeding season in Flanders, we collected adult woodpigeons that were shot by hunters around the alleged start of the breeding season and examined their reproductive systems for indications of breeding activity.

Methods

Timing of breeding in Woodpigeons depends on light cycle, food availability, spring temperature and nest availability (Murton & Westwood 1977), on average starting much later in rural than in urban environments (Cramp 1985). We limited our scope to rural Flanders, where two distinct geographic regions were chosen for sampling (representing extremes on the axis from open farmland to a more closed region with woodland) to anticipate possible differences in start of the breeding season throughout Flanders (Figure 1) due to habitat differences.

To determine the onset of breeding, we examined the gonadal development of pigeons. Since Woodpigeons under the age of one year are not yet reproducing, only data from adult woodpigeons were analysed (Cramp 1985). We collected pigeons shot by 20 hunters in six weeks between 14 February and 1 May 2011 (14–20/2, 28/2–6/3, 14–20/3, 28/3–3/4, 11–17/4 and 25/4–1/5/2011). We aimed to collect 20 pigeons per region per week. Hunters were asked to label each pigeon with shooting date and location. We determined age class (2nd calendar year or adult) based on primary moult pattern and sex.

Determination of the breeding season by gonadal development is well documented for pigeons (Murton *et al.* 1963, Lofts *et al.* 1966, Guttiérrez *et al.* 1975, Frith *et al.* 1976, Murton & Westwood 1977). In male pigeons, Lofts *et al.* (1966) used testis volume as a metric variable, calculated as $v = 4/3\pi \times (\text{length}/2) \times (\text{width}/2)^2$. In this study, testes length and width were measured to the nearest 0.01 mm using Mitutoyo CD-20DC digital callipers. A linear regression between testis volume and testis weight showed that weight was a good proxy for testis size ($P < 0.001$; $R^2 = 0.88$, $n = 103$). To reduce measurement errors we used weight as the metric variable and only weight of the largest testis was used. Testes were weighed to the nearest 0.01 g using a Sartorius TE612 digital scale. In females, the diameter of the largest follicle was measured to the nearest 0.01 mm (Guttiérrez *et al.* 1975). When eggs were present in the oviduct the follicle diameter was classified as 20 mm, i.e. approximately the maximal follicle size. All Woodpigeons with ovaries larger than 5.5 mm were classified as sexually active (Lofts *et al.* 1966, Guttiérez *et al.* 1975). For each of the sample

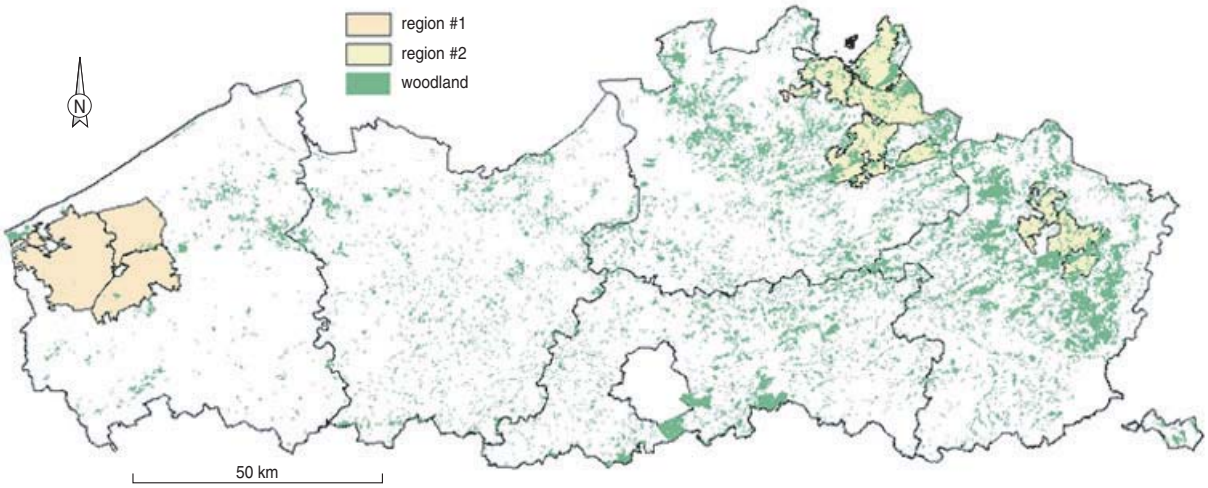

Figure 1. Location of both study regions in Flanders with woodland indicated. Region #1 is located mainly in farmland, region #2 is located in woodland. Black lines indicate province boundaries.

weeks we described the ratio of sexually active versus non-active female Woodpigeons. For the analysis of the metrical variables, we used generalized linear models (GLM) with Poisson distribution in both sexes (McCullagh & Nelder 1989). In these models we tested the hypothesis that regional differences played no role in the start of the breeding season of Woodpigeon in Flanders. To do this, for both sexes a model which included region, sample week and their interaction term was compared to a model without the interaction term and a model which included only week. Models were compared using a likelihood ratio test.

Results

A total of 272 woodpigeons were collected out of which 185 were adults (104 males, 81 females). Forty-nine were collected from farmland, 136 were shot in woodland. The gonads of one male Woodpigeon from woodland could not be analysed. For region 1 in week 1 no pigeons were shot and in week 4 no female pigeons were collected. This way, the interaction term in the model for male pigeons only compared five weeks in both regions (df = 4) and in the model for female pigeons, the interaction term only compared four weeks (df = 3).

For testis weight, the best model comprised both week and region as independent factors (the interaction term was not retained in the final model, Table 1). Testis size started to increase from the first week of March onwards (Figure 2). Woodpigeons in farmland had a slight advance compared to those in the more wooded parts of Flanders. In both regions, average testis sizes were maximal in late April.

The best model for follicle size in adult female Woodpigeons was the model containing only week as factor (Table 1). Before late March/early April only four

Table 1. Comparison of generalized linear models to test effects of region, week and interactions on testis weight and follicle size.

Model	Terms	Residual df	Residual deviance	Df	Deviance	*F*	*P*
Testes (n = 104)							
1	Region×Week	92	9.84				
2	Region+Week	96	10.28	–4	–0.43	1.09	0.36
3	Week	97	10.83	–1	–0.55	5.53	0.02
Follicles (n = 81)							
1	Region×Week	71	196.58				
2	Region+Week	74	206.48	–3	–9.89	1.06	0.37
3	Week	75	208.89	–1	–2.41	0.77	0.38

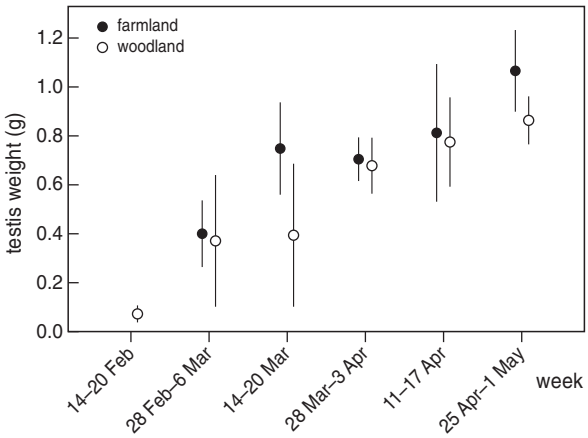

Figure 2. Mean maximal testis weight (g) in male adult woodpigeons in farmland and woodland (+/– SE).

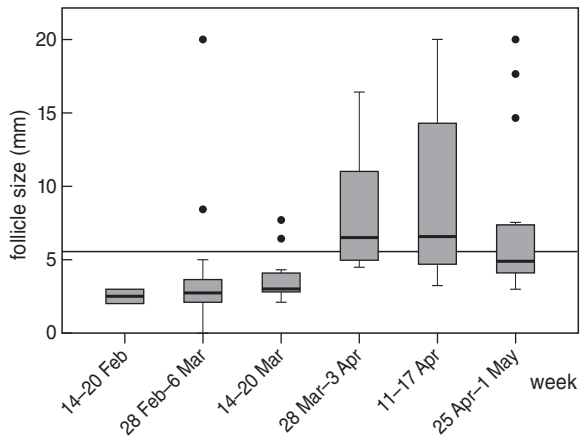

Figure 3. Boxplots of maximal follicle size (mm) in adult female woodpigeons. Horizontal lines represent median, box limits represent the 25th and 75th percentile, the interquartile range (IQR). Whiskers are drawn to the nearest value not beyond 1.5×IQR. Any points beyond this value (outliers) are drawn individually. The reference line at 5.5 mm indicates sexual activity.

female Woodpigeons in which follicle size surpassed 5.5 mm, indicating sexual activity, were found. In the first sample week 0 out of 2 Woodpigeons had reached this state, in week 2 this ratio was 2/15, in week 3 2/17. The boxplots presented in Figure 3 show that these follicle size were outliers within the follicles examined for those weeks. From late March onwards, a drastic increase in the proportion of reproductive female Woodpigeons was observed (7/11 in week 4, 8/15 in week 5 and 8/21 in week 6). From this period on, the boxplots in Figure 3 also show a difference in follicle size between the first and last three weeks of our study.

Discussion

The analysis of follicle sizes shows that the first female Woodpigeons in Flanders become sexually active by late February/early March, followed by the majority of the females a month later. Testis size started to increase earlier, namely in early March. This difference in onset of sexual activity between males and females is well known in Woodpigeons (Lofts *et al.* 1966). In the UK, Lofts *et al.* (1966) observed that active testes were found from March to September but breeding only took place when environmental conditions were favourable and couples spent sufficient time together in their breeding territories. Courtship behaviour is considered to trigger the physical development that allows ovulation (Murton *et al.* 1963, Lofts *et al.* 1966). Our own results indicate that male Woodpigeons in Flanders prepare for breeding from early March on, followed slightly later by females. The first phase of follicle growth from 1 to 5 mm, in Flanders in March, is influenced by gonadotropine, the luteinising hormone LH and the follicle stimulating hormone FSH (Murton & Westwood 1977). A second phase in follicle development starts during pair formation, when courtship and nesting behaviour have a positive feedback on the emission of FSH en LH (Murton & Westwood 1977). Only when the ovaries produce oestrogen and follicles develop further, egg laying is possible (Murton & Westwood 1977).

The start of the breeding season is often studied using nesting observations and the moment egg laying starts. The study of gonads provides a useful addition to these studies since it directly measures the physiological capacity of the species for breeding onset. Various studies from the UK describe that egg laying between 1955–1998 in Woodpigeons in rural and suburban conditions only starts from May/June on and peaks around July/August (Inglis *et al.* 1994, Slater 2001). Additional observations from Denmark and the Netherlands from the late 1970s and late 1980s also describe the first eggs laid early April, with laying numbers culminating for a first time by early May (Bijlsma 1980, Søndergaard 1996). A start of sexual activity by late March/early April, as found in this study, is similar to the timing in southern England in the 1960s (Lofts *et al.* 1967a,b), where woodpigeons started to develop their gonads from late March onwards. Behavioural studies indicate that by late March, pair formation has taken place and breeding territories are occupied, although egg laying has not yet started (Murton & Isaacson 1962, Murton *et al.* 1974, Schnock 1981). Observations from Belgium in the 1980s also describe the first manifestations of sexual

activity to be often observed starting late March/early April (Schnock 1981). The lag of time between the onset of sexual activity and egg laying is probably a response to inadequate feeding conditions earlier in the season (Murton & Isaacson 1962, Murton *et al.* 1974). All observations confirm the importance of photoperiodicity in gonadal development in Woodpigeon (Lofts *et al.* 1967a). The gonads of Woodpigeons are stimulated into breeding condition at a daily photoperiod-equivalent to that of late March in southern England (Lofts *et al.* 1967a,b, Murton *et al.* 1974). Although feeding conditions between Flanders and southern England may vary significantly, daylength does not. Therefore, our expectation is that, independent of feeding conditions, onset of sexual activity will not vary much between years and will start throughout Flanders on average in late March/early April. Subsequently, a delay in egg laying can be the result of the local inadequate feeding conditions.

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References

Bijlsma R.G. 1980. De invloed van predatie op de broedresultaten van de Houtduif *Columba palumbus* op de Zuidwest-Veluwe. Limosa 53: 11–19.

Cramp S. 1985. Birds of the Western Palearctic, Vol. 4. Oxford University, Oxford.

Frith H.J., Carpenter S.M. & Braithwaite L.W. 1976. Sexual cycles of pigeons in arid and semiarid Australia. Aust. J. Zool. 24: 331–351.

Guttiérrez R.J., Braun C.E. & Zapatka T.P. 1975. Reproductive biology of the Band-Tailed Pigeon in Colorado and New Mexico. Auk 92: 665–677.

Huysentruyt F. & Casaer J. 2009. Duiven in een West-Vlaamse context : Deel 2: veldonderzoek. INBO.R.2009.13. Instituut voor Natuur- en Bosonderzoek, Brussel.

Inglis I.R., Isaacson A.J. & Thearle R.J.P. 1994. Long term changes in the breeding biology of the woodpigeon *Columba palumbus* in eastern England. Ecography 17: 182–188.

Lofts B., Murton R.K. & Westwood N.J. 1966. Gonadal cycles and the evolution of breeding seasons in British Columbidae. J. Zool. 150: 249–272.

Lofts B., Murton R.K. & Westwood N.J. 1967a. Interspecific differences in photosensitivity between three closely related species of pigeons. J. Zool. 151: 17–25.

Lofts B., Murton R.K. & Westwood N.J. 1967b. Photoresponses of the Woodpigeon *Columba palumbus* in relation to the breeding season. Ibis 109: 338–351.

McCullagh P. & Nelder J.A. 1989. Generalized Linear Models, 2nd ed. Chapman and Hall, London.

Murton R.K. & Isaacson A.J. 1962. The functional basis of some behaviour in the woodpigeon. Ibis 104: 503–521.

Murton R.K. & Westwood N.J. 1977. Avian breeding cycles. Clarendon Press, Oxford.

Murton R.K., Isaacson A.J. & Westwood N.J. 1963. The food and growth of nestling woodpigeon in relation to breeding season. Proc. Zool. Soc. Lond. 141: 747–782.

Murton R.K., Westwood N.J. & Isaacson A.J. 1974. Factors affecting egg-weight and moult of the woodpigeon *Columba palumbus*. Ibis 116: 52–73.

Schnock G. 1981. Fluctuations annuelles du poids des ramiers (*Columba palumbus*) et facteurs responsables. Le Gerfaut 71: 235–248.

Slater P. 2001. Breeding ecology of a suburban population of Woodpigeons *Columba palumbus* in northwest England. Bird Study 48: 361–366.

Søndergaard K. 1996. Om danske Ringduers *Columba palumbus* ynglebiologi. Dansk. Orn. Foren. Tidsskr. 90: 109–114.

Samenvatting

Om vast te stellen wanneer het broedseizoen van de Houtduif *Columba palumbus* in Vlaanderen begint werden de gonaden van 185 volwassen duiven onderzocht. De ontwikkeling van de mannelijke geslachtsorganen liet zien dat de mannetjes in maart seksueel actief werden. De eerste vrouwtjes werden vanaf eind februari seksueel actief, maar voor de meeste vrouwtjes gold dat de follikels een maand later tot rijping kwamen, namelijk eind maart/begin april.

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