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A new method to sex Barn Owls *Tyto alba*

Johan de Jong¹ & Arnold van den Burg²



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Nominate Barn Owls *Tyto a. alba* can be sexed based on flecking patterns of the underwing and underbody, but in the Dutch population consisting of the nominate subspecies and *T. a. guttata*, overlap in flecking exists between the sexes. In this paper we describe a new method to sex Barn Owls based on apical bar widths of the primaries. Data were obtained from 240 dead Barn Owls that were sexed by autopsy. The apical bars of the primaries 10 and 8 were narrower than 7.5 mm in males and wider than 7.5 mm in females. The widths of more basal bars of the primaries and secondaries overlapped between the sexes. The method was validated by providing 20 carcasses to 10 instructed volunteers, who measured the apical bar widths to sex the birds. The measuring error per owl specimen averaged at 2.2% (range 0.8–3.9%), and the proper sex was assigned in all cases.

Key words: sexing, apical bar width of primaries, Barn Owl, *Tyto alba alba*, *guttata*

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Life-history characteristics such as growth, dispersal and survival usually differ between the sexes (Newton 1972, Madison 1980, Holberton 1993, de Jong 1995), and the ability to distinguish males and females is therefore an important aspect of avian studies. Traditionally, it has been difficult to distinguish the sexes in Dutch Barn Owls, partly because both subspecies *Tyto alba alba* and *T. alba guttata* converge, giving rise to intermediate hybrid colour morphs. In *T. alba alba*, females have more underbody and underwing flecking compared to males (Voous 1990, Taylor 1994, de Jong 1995, Roulin 1996). In populations of mixed subspecies, sexing Barn Owls on the basis of colour patterns is possible to some degree, but overlap between the sexes occurs (Taylor 1994, Martinez *et al.* 2002). In this paper we describe a new method to sex Barn Owls, on the basis of apical bar widths of the primaries. The method was validated using carcasses that were sexed in an independent manner by inspecting the reproductive organs upon autopsy.

Methods

Between 2005 and 2009 we collected 240 Barn Owl traffic victims from all over the Netherlands. In all birds, the maximal widths of the solid dark-coloured

part of the bars on primaries P10, P8, and P5 were measured (Figure 1). Similarly, the width of the continuous part of the bars on the secondaries S1, S5, and S8 was determined. Feather numbers were counted from the wrist outward for primaries and inwards for secondaries. Measurements were performed using vernier callipers, the scale of which was accurate to the nearest 0.01 mm. After measuring, the carcasses were sexed by inspecting the reproductive organs. We investigated whether the plumage could be used to separate the sexes by determining the overlap in widths of the bars between males and females.

To further validate sexing Barn Owls on the basis of P10 primary bar width, we instructed 10 volunteers to measure the apical bar of the tenth primary of 20 dead birds and to ascribe the sex of the bird in accordance with their measurements (<7.5 mm for males, >7.5 mm for females).

Results

The widths of the apical bars of primaries 10 and 8 were less than 7.5 mm in males and greater than 7.5 mm in females (Figure 1). The apical bar on primary 5 showed overlap between the sexes (between bar widths of 5.5–7.5 mm), as was also found in the apical bars of

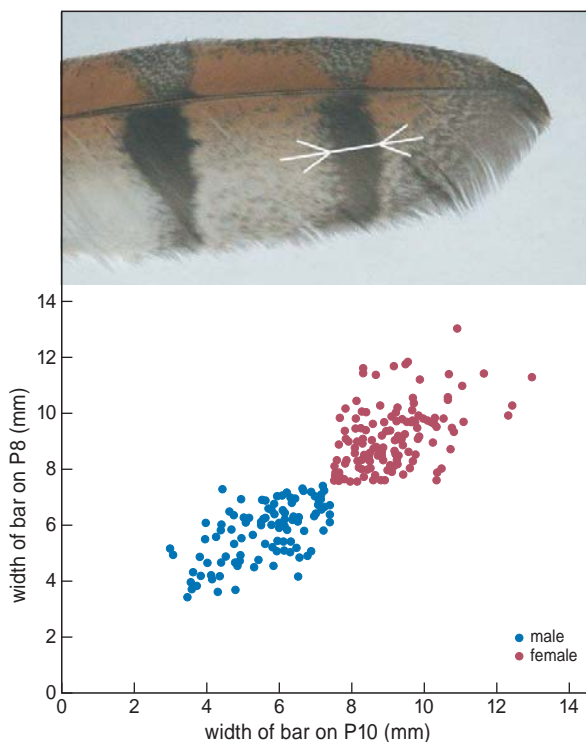


Figure 1. Bar widths of P10 and P8 of females and males. Both bar widths separate males and females. When in doubt, measuring both bars helps to discriminate between the sexes. The apical bar width is taken on the inner vane, where the solid dark coloration of the bar is at its widest (photo).

the secondaries. The width of the more basal bars of the primaries and secondaries also overlapped (Figure 2 for primary 10), showing that only the apical bars can be used to sex the owls.

Measuring the width of the apical bar of either P10 or P8 is sufficient for proper sexing. However, the probability of assigning sex incorrectly may be reduced by measuring both primaries, in particular when the bar width is close to the cut-off point of 7.5 mm. Among the 240 studied birds, 15% of the individuals had P10 apical bar widths between 7 and 8 mm. However, only 5% of the birds had apical bar widths between 7 and 8 mm on both P10 and P8.

Representative examples of male and female primaries P10 are given in Figure 3. Note the differences in banding pattern, especially the width of the apical bar on the inner vane. Because the bar pattern is repeated in subsequent feathers, complete wings of males are less heavily barred compared to those of females (Figure 3).

All ten volunteers sexed the 20 Barn Owls successfully on the basis of the apical bar width of P10. The

overall measuring error (highest measured value minus lowest measured value) per owl specimen among the volunteers averaged 2.2% (range 0.8–3.9%) of the average measured bar widths.

Discussion

We introduced a new method to reliably determine the sex of Barn Owls from feather characteristics and tested the method in the Dutch Barn Owl population. As the Barn Owl is a cosmopolitan species with considerable variation in plumage among populations (Voous 1990), this method may not be valid across the entire range of Barn Owls. Our results indicate that apical bar widths of primaries 8 and 10 discriminate males from females in a mixed population of *Tyto alba alba* and *Tyto alba guttata*.

As yet, we have no support for any hypotheses on the functionality, if any, of sexual dimorphism in apical bar width. There may be evolutionary forces such as sexual selection that result in males being less barred, or anti-predator selection that results in darker and more heavily barred females.

As we now have a tool to sex Barn Owls, several aspects of their ecology can be further elucidated. These include the sex ratios of chicks, for example in relation to geographical area or first egg-laying date. In adults, sex-specific mortality, dispersal, and behaviour can be further investigated. Furthermore, determination of body condition on the basis of body mass can be adjusted for sex, and thereby will become more accurate. Finally, sexing live birds on the basis of feather patterns avoids time consuming and costly laboratory DNA analyses.

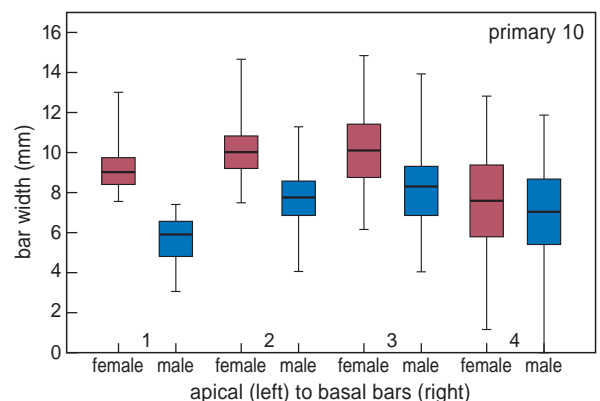


Figure 2. The width of successive bars of the primary 10 of male and female Barn Owls ($n = 240$). The most apical bar is numbered 1. Indicated are median, 25–75% quartiles (boxes), and range of bar widths (whiskers).



Figure 3. Tips of primaries P8 of four males (top left) and four females (bottom left). Because the bar pattern is repeated in subsequent feathers, complete wings of males (top right) are less heavily barred compared to those of females (bottom right).

We are very grateful to the volunteers of the 'Werkgroep Kerkuilen Nederland' and especially Stef Waasdorp, who collected many road victims. The following bird ringers tested the method to sex Barn Owls: Peter Das, Meinte Engelman, Willem Louwsma, Anton Meenink, Ben Nijboer, Luc Smit, Oane Tol, Romke van der Veen, Coen Vogt en Anne van der Wal. We wish to thank Iain Taylor, Ruud Foppen and two anonymous referees for their valuable comments on this manuscript.

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Samenvatting

Bij Kerkuilen *Tyto alba* van de nominaatvorm zouden de geslachten volgens de literatuur kunnen worden onderscheiden op basis van het vlekkenpatroon op de ondervleugel en het onderlichaam. De Nederlandse populatie, waarbinnen zowel vogels van de donkere ondersoort *guttata* als de lichte nominaatvorm voorkomen, laat echter veel overlap in het vlekkenpatroon tussen beide geslachten zien. In dit artikel beschrijven we een nieuwe methode om het geslacht van Kerkuilen te bepalen aan de hand van de breedte van de bandjes nabij de top van de binnenvlag van de handpennen. De methode is ontwikkeld op basis van 240 dode Kerkuilen, waarvan het geslacht door autopsie was vastgesteld. De bandjes nabij de top van de van de handpennen 8 en 10 (telling van binnen naar buiten) waren bij alle mannetjes smaller dan 7,5 mm, bij alle vrouwtjes breder dan 7,5 mm. De breedtes van de andere bandjes op de hand- en armpennen lieten een overlap tussen de geslachten zien. De methode werd gevalideerd bij 20 dode Kerkuilen door 10 geïnstrueerde vrijwilligers (ringers), die allen de bandjes nabij de top van de binnenvlag hebben gemeten om het geslacht te bepalen. De totale meetfout per uil bedroeg 2,2% (spreiding 0,8–3,9%) van de gemiddelde gemeten bandbreedte. Ondanks de meetfout waren alle vrijwilligers in staat het geslacht van de Kerkuil correct vast te stellen.

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