

Marian Cieślak

Feathers of European owls

Insights into species ecology and identification



 **ORIOIUS**
FÖRLAG

Table of Contents

Obituary	7
From the publishers	9
Introduction	11
Part A – Description of owl feathers	13
Basic information on feathers.....	13
Types of feather.....	13
Wings	18
The tail	21
Specific features of owl feathers.....	23
Primaries.....	23
Secondaries	25
Rectrices (tail feathers).....	26
Other smaller feathers.....	27
Abnormalities in feather numbers	32
Owl feather dimorphism.....	34
Part B – The ecology of owls and their plumage	39
B1. Analysis of owl silhouettes in flight	39
B2. Wing-loading	44
B3. Feather colouration and pattern.....	48
The optimised distribution of pigment in the plumage of owls	51
The optimised distribution of pigment in feathers.....	52
The species-related variability in colouration pattern.....	53
Aberrations in the colouring of owl plumage	58
Albinism and leucism.....	58
Melanism.....	61
B4. The silent flight mechanisms in owls	62
The diversity of silent flight mechanisms in European owl species	70
The auditory abilities of owls.....	70
Daily activity and type of diet.....	73
Audiles, generalists and visualisers	74
The silent flight mechanisms in different hunting strategies	77
Silent flight and owls' aviation capabilities	81
Ecological isolation between owl species.....	83
B5. Moulting strategies	87
The effect of moulting on owls' flying abilities.....	89

The sequence of moulting	90
The frequency of replacement of individual feathers	92
Moult phenology in relation to breeding and migration	93
How long does moulting a generation of feathers take?.....	95
Feather grow rates.....	96
B6. Why owls have developed a diastataxic wing type?.....	98
B7. Stress bars	104
B8. The bioindication of environmental pollution using owl feathers.....	110
Part C – Species review.....	113
Western Barn Owl <i>Tyto alba</i>	113
Eurasian Scops Owl <i>Otus scops</i>	116
Eurasian Eagle-Owl <i>Bubo bubo</i>	117
Snowy Owl <i>Bubo scandiacus</i>	119
Northern Hawk-Owl <i>Surnia ulula</i>	121
Eurasian Pygmy Owl <i>Glaucidium passerinum</i>	124
Little Owl <i>Athene noctua</i>	125
Great Grey Owl <i>Strix nebulosa</i>	127
Ural Owl <i>Strix uralensis</i>	131
Tawny Owl <i>Strix aluco</i>	133
Long-eared Owl <i>Asio otus</i>	135
Short-eared owl <i>Asio flammeus</i>	137
Marsh Owl <i>Asio capensis</i>	139
Boreal Owl (Tengmalm’s Owl) <i>Aegolius funereus</i>	141
Part D – Identification of feathers from among the European species of owl	143
Variety in owl feathers	144
A feather identification procedure	144
Reasons for the presence of feathers	145
Assigning species to groups	145
Large owls.....	146
Medium-sized owls	155
Small owls.....	165
Ending	171
Acknowledgments.....	171
References	173
Appendices	183

the sample of the feathers of each species there were 2 cases of an unusual number of primaries or rectrices, or asymmetry in the tail. This means that approximately 2% of the population of these owl species manifest an unusual number of primaries or rectrices.

It should be stressed that this percentage could be slightly higher, were it possible to take account of all cases with a smaller-than-normal number of feathers, which could not be said with certainty for many sets of loose feathers. A frequent skipping of the innermost secondaries by feather collectors, makes it simply impossible to register a non-standard number in this feather category. In the majority of cases of unusual numbers of feathers in owls, the locations were similar to those found by Clark and others (1998), in diurnal birds of prey.

Owl feather dimorphism

Generally, owls as a group of species show very weak sexual and age-related dimorphism expressed in the terms of plumage

dimorphism in the colouration of feathers in *A. otus* and *A. flammeus*, though the determining criterion in fact shows linear variation, making it difficult to determine the sexes of individuals with intermediate plumage characteristics (Cieślak and Dul 2009). Sex identification in these species should therefore be based on other criteria. The differences in plumage between the two sexes of *T. alba* concern dotting on small body feathers (Taylor 1993), and are not marked in flight feathers.

It should be emphasised that the vast majority of the material collected for this study (in the form of old stuffed birds, victims of road traffic collisions) was not sexed anatomically as a matter of course. It is difficult to determine whether a better degree of sex determination within the collected material would allow anything additional to the sexual dimorphism expressed in plumage to be established. However, it can be assumed that the owls, as species mostly active in the darkness, have not developed a clear system of visual signalling between the sexes (unlike some raptors, such

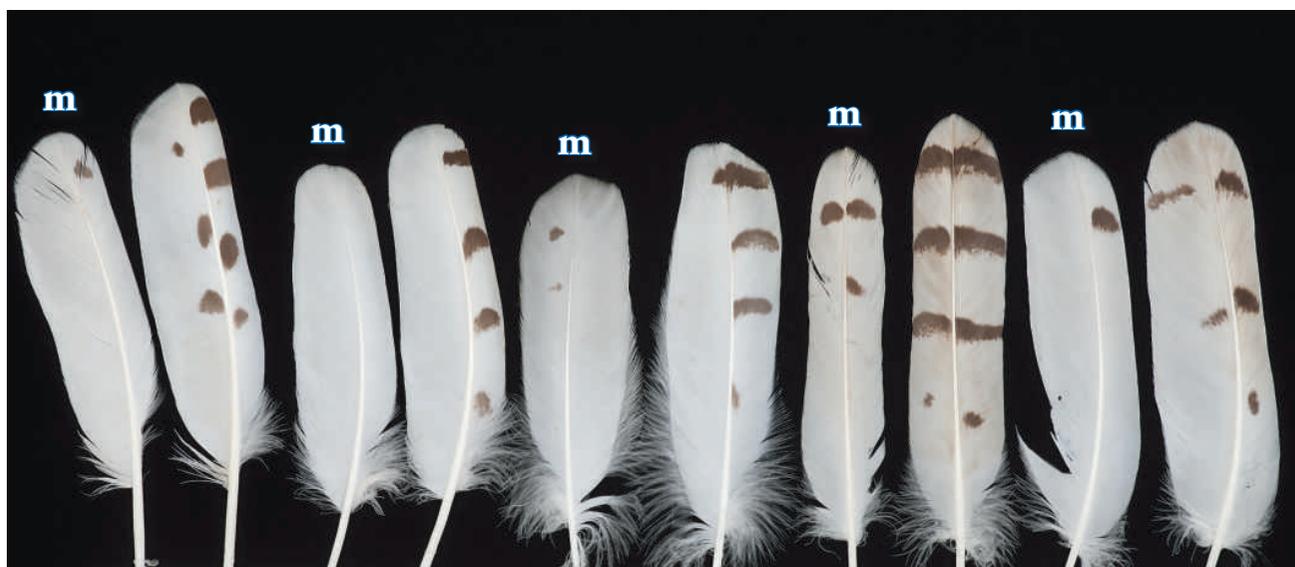


Plate A48. Comparison of selected feathers from males (m – in pairs from the left) and females of *Bubo scandiacus*.

and size. On the other hand, the Strigiformes stand out from other orders of bird in the higher proportion of polymorphic species whose plumage variation is phenotypic and not related to sex or maturity (Fowle and Krüger 2003, Galeotti et al. 2003). In the European avifauna polymorphism is present in *S. aluco* and *O. scops*, and the wealth of plumage variety present in these species is increased greatly.

The most remarkable **sexual dimorphism** in plumage is confined to *B. scandiacus*, in which the female is more striped, while the male has uniformly white feathers, or else very weak barring or dots (Plate A48, Josephson 1980). This may be related to the camouflaged plumage of females incubating eggs on the ground. However, Bortolotti and Stoffel (2012) also emphasise the possibility of finding individuals whose sex is difficult to determine by reference to plumage. Climent et al. (2002) also describe sexual

as harriers or certain small falcons), probably compensating for this by using more advanced acoustic signals. It remains an open issue as to whether our (human) perception of the dimorphism characterising the plumage of the two sexes in owls is actually real, given that the eyes of owls may be able to see more than ours.

On the basis of human vision and assessment we basically do not discern differences between the plumage of the two sexes in the vast majority of owl species. This is true of light wavelengths of 400–700 nm visible to the human eye. In contrast, birds can see more than we can, in bands of light that invisible to the human eye, given the fact that they come above the range of wavelengths. A few decades ago, certain studies, including studies of owls, were focused on birds' sight abilities at longer wavelengths of light, i.e. in the infrared part of the spectrum. This topic seemed

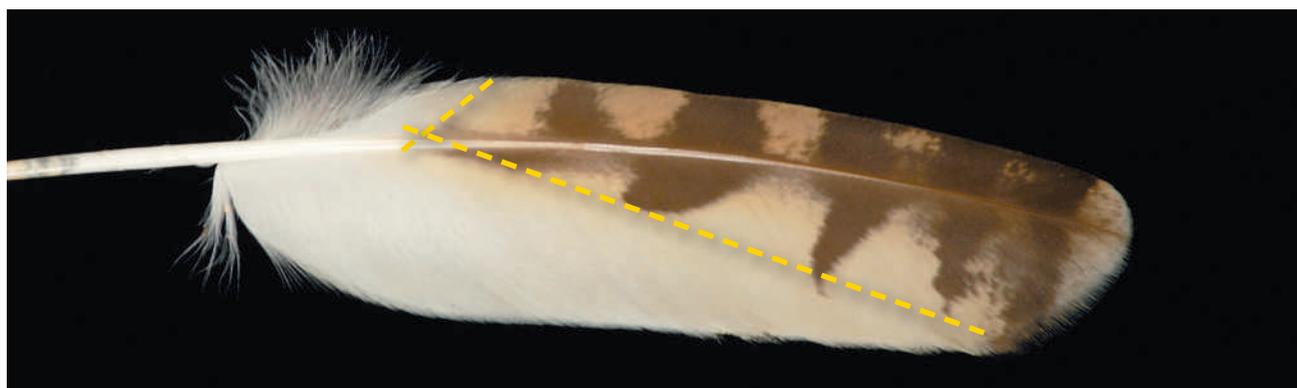


Plate B15. Distribution of the dark-tinged parts of vanes of a primary in *Asio flammeus*. The dashed line indicates the approximate range of upper coverts and a neighbouring primary.

differences in colouration of backgrounds and the distribution of bars are to be noted on the vanes of the rectrices in most owl species.

The species-related variability in colouration pattern

There are two dominating patterns to the colouration of owl remiges: barring and spotting. In the case of the barring type, transverse dark bars or transversely elongated mottling on a light background are present on both webs. In the case of the spotted pattern the situation is the opposite – light spots or semi-ovals (reaching the edge of the vanes) are present against dark-background webs (Plate A24). The colouring of owl rectrices also feature two “designs”: dark barring against a light background, and light bars or transversally elongated light spots against a dark one (Plates B16 and B17). This diversity on central tail feathers is less pro-

nounced (Plate B16), while it is more obvious on the other rectrices (Plate B17).

Both pattern types are present in European and North American owl species, with the ones actually present in any given case apparently being related to the sizes of species (Tables B6 and B7).

The comparison of data included in the above-mentioned tables shows that remiges of the 4 genera featuring the largest owl species (*Bubo*, *Strix*, *Asio* and *Tyto*) show the pattern of dark barring against a light background (Plate A24). In contrast, among the smaller species the dominating type of pattern entails pale semi-ovals and spots against a dark background. A similar distribution of design occurs on the rectrices of European species of owls, with a barring pattern present in the large species and spotting in the smaller ones (*S. ulula*, *A. funereus*, *A. noctua*, *O. scops* and *G. passerinum*) (Plates B16, B17).



Plate B16. The colour pattern types of the central rectrices (t1) in European owl species (as in Plate A24 – species descriptions – Appendix 11).



Plate B40. The outer primary (p10) of a fish-hunting owl *Bubo zeylonensis* (top) lacks silent-flight mechanisms, which are visible on the primary of *Strix nebulosa* (comb, fringes, and blurred pattern due to the pennula).

in the dark. According to Dooling (2002), an averaged audiogram for 13 species of owl indicates hearing at about the 20 dB sound pressure level (SPL) that is more sensitive than in a group of 20 species of Passeriformes, which in turn, at approx. 10 dB SPL, out-perform another group of 15 other non-Passeriformes where hearing sensitivity is concerned. These average differences relate to sounds in the frequency range 3–6 kHz. Nevertheless, the hearing abilities of owls are quite varied, as is illustrated by the summary of hearing parameters in several species presented in Table B9.

The data gathered in Table B9, though obtained in different

laboratories and at different stages of development of acoustics and audiology, are generally consistent in showing:

- very sensitive hearing in *B. scandiacus*, *A. otus*, *S. aluco* and *B. bubo*,
- an ability to hear highest frequencies in *T. alba*,
- hearing across a narrow range of frequencies in *B. scandiacus*,
- poor hearing performance in *O. scops*,
- least-refined hearing parameters in the fish-hunting *Bubo zeylonensis*.

Data from Manley (1971) and Konishi (1973) show that, in the frequency range 3–6 kHz *T. alba* has more acute

Table B9. Comparative summary of hearing sensitivity and recorded sound frequencies in certain owl species, by van Dijk (1973) – vD, Dyson et al. (1998) – DKG, and Dooling (2002) – D (the best performance is marked in bold, while the weakest are italicised).

Species	Maximum sensitivity dB SPL (D)	Frequency associated with maximum sensitivity kHz (D)	Hearing frequency range kHz (D)	Hearing frequency range kHz (vD)	Max. hearing sensitivity (dB) / frequency of max. sensitivity kHz (DKG)
<i>T. alba</i>	-16.20	2.83	0.32– 12.00	-	-14.4 / 13.8
<i>A. otus</i>	-25.05	2.83	0.43 – 8.06	0.5 - 8	-21.5 / 11.1
<i>S. aluco</i>	-24.62	2	0.22 – 6.62	0.4 - 7	-17.5 / 10.3
<i>B. bubo</i>	-23.48	2	0.21 – 6.52	0.5 - 7	-20.0 / 8.6
<i>O. scops</i>	-14.29	2	0.34 – 6.65	0.25 - 6	-6.0 / 9.5
<i>B. scandiacus</i>	-25.25	2	0.63 – 5.88	0.25 - 8	-18.0 / 8.5
<i>Bubo zeylonensis</i>	<i>-1.60</i>	<i>1</i>	<i>0.08 – 4.00</i>	<i>0.25 - 4</i>	<i>-9 / -</i>

Ural Owl *Strix uralensis*

This owl is resident in the northern and eastern parts of the continent, and in the mountainous regions of Central and south-east Europe. The contiguous main range in north-east Europe is occupied by the *S. u. liturata* subspecies, while *S. u. macroura* occurs in the south-east.

This is a large-sized owl of body mass 630–1020 g, length 60–62 cm, wingspan 124–134 cm, and wing length 342–382 mm.

Birds nest in forest biotopes, while hunting at the forest edge or in sparse stands. This activity mainly takes place at night and, in addition to rodents, birds like forest grouse and smaller owls are also consumed.

The wide and relatively short wings in this species have the most-rounded tips of any European owls (Table B2) and 16 secondaries. The tail is long and wedge-ended, allowing for rapid and agile flight among the trees. Rectrices are fine, but not as supple or as openwork in structure as are those in *S. nebulosa*. Remiges are fairly strong, comparable with the larger ones in *S. nebulosa*, and more deeply embedded. Values for the wing-loading index are relatively high.

The pennula on the upper surface of the vanes are shorter and less abundant than in *S. nebulosa*, but other well-developed silent flight mechanisms (a comb and a belt of fringes of up to 4 mm) allow hunting to take place largely on the basis of good hearing.

Feather size

Primaries are long and quite wide. The cross sectional diameter of the shafts of primaries at the base of the vanes does not exceed 5 mm. The longest remex is usually p6 (in

approx. 95% of cases), occasionally p5 or both p5 and p6. The longest secondaries are: most often s2 (in 70% of cases), rarely s1 or both s1 and s2. Rectrices are very long – the range of lengths partly overlapping with those of the corresponding rectrices in *S. nebulosa*. The central rectrices are about 34–54 mm longer than the outer ones.

Feather shape

Fingers on the outer primaries are short and wide. Emargination is present on the six outer primaries (in some individuals a trace of inner emargination also occurs on p4) (Fig. C9). Handles of remiges are relatively longer than in *S. nebulosa*, and shorter than in *S. aluco*. Remiges are relatively more deeply embedded in the skin in this species than in *S. nebulosa*, but more shallowly than in *B. scandiacus* and *B. bubo*. A slightly upturned comb of height approx. 3 mm is present on p10, while there is a vestigial one in the lower parts of the fingers of p9 and p8. The flattening ratio of the shafts of the longest

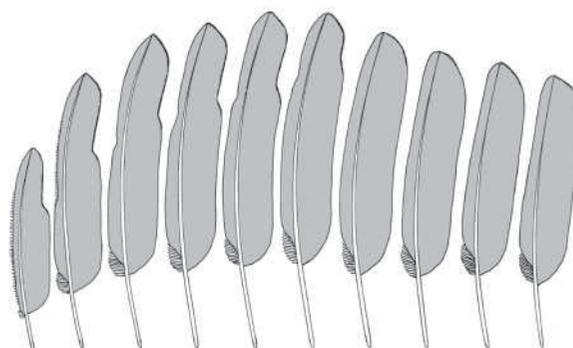


Fig. C9. Silhouettes of primaries in *S. uralensis*.



Plate C25. Selected feathers of *Strix uralensis*.

Plate D23. The central rectrices (♂) of the medium-sized owls, from left: *Strix aluco*, *Asio otus*, *Asio flammeus*, *Tyto alba*, *Surnia ulula* and *Asio capensis* (life size).



Marian Cieślak (1950–2016) became one of the few researchers in Europe to commence with scientific study of bird feathers, and most especially – the feathers of birds of prey and owls. This resulted in the first guide to feathers published in Polish (in 1999). Presented there were baseline details on how to identify the feathers of selected bird species enjoying legal protection (mainly birds of prey and owls). In his publications, Marian Cieślak noted repeatedly how the identification of bird feathers was one of the least-developed areas of applied ornithology – and all the more so when set against, for example, flight identification, or the identification of calls, nests and eggs. This was therefore the inspiration for further research into feathers resulting in the release of another book – *Feathers: Identification for Bird Conservation* (Cieślak and Dul 2006); which was published in both Polish and English. In the years that followed, the research focus homed in on the ecology of owls, and in particular the relationship between biology, plumage and the moulting process.



This book fills many gaps in current knowledge of owl feathers. The Author not only describes the identification of feathers of the European owl species, but also presents relationships between feather morphology and the behaviour and ecology of this group of birds. These findings are largely based on the Author's original research, and his extensive collection of feathers.



ISBN 978-91-978652-2-7



9 789197 865227 >