

A new species of *Strix* owl from Oman

Magnus S Robb, Arnoud B van den Berg & Mark Constantine

For the past decade, the authors have been recording owls for a new book by The Sound Approach about Western Palearctic (WP) owls. In the process, they have become well informed about variations in sounds of owl taxa in the WP, including those in the Arabian Peninsula (for 'new' WP boundaries, see, Martins & Hirschfeld 1994, 1998, Roselaar 2006, Gantlett 2008). As a consequence, they were quickly aware of the significance of unknown owl sounds registered in northern Oman in 2013, which appeared to concern an undescribed taxon in the genus *Strix*.

Course of events

March 2013

In late March 2013, Magnus Robb, together with René Pop, spent seven nights studying Pallid Scops Owls *Otus brucei* at Al Jabal Al Akhdar, the central part of the Al Hajar mountains, northern Oman.

They heard the first pair of Pallid Scops in a flat-bottomed wadi containing a few scattered trees, situated among high cliffs and steep mountain slopes from c 500 m above sea level, and this was where they concentrated all subsequent efforts. Most nights, at least one set of sound recording equipment was in continuous use, usually positioned up a tree where the pair had previously been active. MR would leave it for up to 6 h at a time. It took until 24 March before MR came anything close to a 'direct hit', with two male Pallid Scops hooting from different trees on either side of the tree containing the microphones. After they fell quiet, he decided to move in. Putting on the headphones, he became aware of a different owl-like sound at much greater distance. Its four notes had the rhythm of the start of Richard Wagner's famous wedding march *Treulich geführt* (*Here comes the bride*) from the opera *Lohengrin*. MR started recording the mystery sound immediately. This

372 Study area visited in March-July 2013 by teams of The Sound Approach, Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman, 24 July 2013 (*Cecilia A W Bosman/The Sound Approach*). Overlooking wadi from base of cliffs; road was under construction in early 2013 and ready to be used by late July.



hooting sounded very much like an owl but not like any that MR had heard before. The mystery owl in fact sounded like nothing that was already known to breed in the Arabian Peninsula or the WP. The compound structure of its hooting suggested a *Strix* owl but one with a voice even deeper than Ural Owl *S uralensis*. As MR continued to listen, he became aware of a second individual hooting in a similar compound rhythm much further away, on the other side of the stereo image. Soon, two other kinds of vocalisations could be heard: rhythmic bursts of almost identical lower-pitched hoots from one side of the wadi and a single upward-inflected, nasal-sounding call from the other. The former strongly recalled a similar vocalisation of male Ural, while the latter recalled the typical 'contact' or 'begging calls' of various *Strix* owls. The next night, nothing more was heard from the mystery owl and so RP and MR then followed their plan of spending a night in another area. However, they returned to spend the first part of their last night again in the wadi. MR left one set of equipment recording in the same tree as before and took another set with him to an area 750 m to the north. Every now and then, he imitated the 'compound hooting' heard previously, in the hope of a response. RP stayed and listened from the car,

not far from the first set of equipment. Just when MR was returning, he heard the 'pulsed hooting' again, at closer range than before. He started recording at the base of the cliff where the sound was coming from. Over the next half hour, MR made good recordings of compound hooting, pulsed hooting and a series of upward-inflected contact calls, all just like a *Strix* owl but not any species he knew. By now, RP was also hearing it from the car c 100 m away. Despite using both of their powerful torches, it proved impossible to see any bird on the cliff. Eventually they had to go to the airport in the early hours of the morning, with the owl still hooting on the cliff.

April 2013

Seeing and photographing the mystery owl now became a Sound Approach priority. A month later, on 23-30 April 2013, MR was back, this time with Arnoud van den Berg. For several nights, they listened and recorded at the original location and up to 1 km to the north. No *Strix* owl called in this part of the wadi during the entire April visit. On the fifth night, 28/29 April, AvdB and MR decided to try playback at new locations heading south. Just 2 km down the road, there came a reply. AvdB, who was listening and recording through headphones,

373 Study area visited in March-July 2013 by teams of The Sound Approach, Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman, 23 May 2013 (*Cecilia A W Bosman/The Sound Approach*). Looking up towards steep cliffs.



heard it immediately but not MR, who was listening with the unaided ear. After some frantic hand signals from AvdB, MR heard it too and realised that the faint hooting was coming from the top of a peak c 250 m to the south-east. The bird was giving both compound and pulsed hooting but in a deeper and gruffer voice than before, suggesting that it was a different individual, possibly of the opposite sex. They drove slightly closer and, after further playback, it descended to a spot c 40 m above the road. By torchlight, they could see a plain-looking owl perched on a large rock. It had the shape of a *Strix* owl, lacking ear-tufts and appearing slightly smaller-headed than a Tawny Owl *S. aluco*. As it was facing them, only its face and underparts could be seen, which looked rather featureless except for the presence of a dark breast band, and AvdB noted obvious longitudinal stripes. It was only two nights later, on 30 April/1 May, that the new individual was located again. On this occasion, it called less than 500 m south of where it had been seen and heard on 28 April. Once again, it gave both types of hooting in a deeper, gruffer voice than MR had heard at the original March site. This night, the owl proved impossible to see on the cliff face.

May 2013

From 17 to 31 May 2013, AvdB and Cecilia Bosman went for a fortnight to the *Strix* wadi to obtain photographic documentation and more sound-recordings. Expectations were low, as there had already been a reduction in vocal activity from March to April, and temperatures had risen sharply, ranging from 30°C up to even 44°C at night. Remarkably though, Pallid Scops Owls were more vocal than they had been in March-April, hooting in many corners of the wadi and even up the slopes for hours each night. In this context, it was less of a surprise to find that the *Strix* owls were vocal as well. At the site discovered on 26/28 April, hooting could be heard on many nights from the evening of 19 May onwards, with two individuals hooting simultaneously during the early hours of 21 May. Efforts to hear *Strix* owls again at the site of the original discovery in March were unsuccessful until the evening of 21 May, when one responded to playback. Later that night, at a third location with a steep cliff, halfway between the two known sites 2.2 km apart measured along the wadi road, another individual responded to playback, while the birds at the April site were vocal shortly afterwards as well. This meant that there were at least three territories, each 1.1 km apart. It should be noted that the birds always remained high up the cliffs,

so far that their vocalisations were hardly ever audible to the naked ear, only with the aid of microphones and headphones. By 23 May, all efforts to lure the *Strix* owls down from the very steep cliffs, involving both playback and human imitations, had remained unsuccessful. So, there was no other option but to clamber up to the base of the cliffs. High on the slope below the cliffs of the original March site, under bright moonlight in the early hours of 24 May, a bit of playback of the April song did the trick. Eye-shine revealed one bird perched up on the cliff. Later, this or another bird descended low enough to perch on a dead tree stump where AvdB captured the first photograph. During the rest of that night, several close encounters took place along the base of the cliff but torchlight seemed to startle the owl and it never stayed long enough at one spot for more photographs. Two nights later, on 25/26 May, AvdB and CB heard for the first time loud alarm calls in overhead flight. When one bird landed in low vegetation between rocks at 15 m distance and then jumped up onto a rock to perch for a few minutes, it became apparent that torchlight was no longer a reason to fly off, and many 10s of photographs could be obtained, also of the bird in flight. During the entire night of 27/28 May, long sequences of hooting and various calls of two individuals were recorded at the same spot. Playback no longer had the same effect and no bird came close. This month's last recording concerned a bird alarm calling in flight during the early hours of 30 May.

July 2013

During Ramadan in 2013, AvdB and CB visited the *Strix* area twice, on 10-12 July and 22-25 July. Temperatures were high, most birds had fallen silent and not a single Pallid Scops Owl could be heard. During the night of 11/12 July, after many fruitless attempts to hear the *Strix* owls at the known sites, the ones at the March site finally called and hooted an hour before dawn. During the night of 22/23 July, a playback response came from the April site only, albeit from a huge distance, with hooting barely audible even by use of microphones and headphones. During the night of 23/24 July, one bird was seen twice in bright moonlight high up at the March site, first just before and then after midnight, when it came close enough on the cliffs for more photographs and sound-recordings to be obtained. Based on sound and plumage, this concerned the same individual as the one photographed two months earlier; its plumage looked more tattered though, possibly being in moult.

Material and methods

Photographs

AvdB used a Nikon 500 mm/5.6 lens, D800 camera and SB-800 flash to photograph the owls. All photographs were taken and stored in Nikon's raw image format, Nikon Electronic Format (NEF), which offers the highest possible image quality with minimally processed data. The purpose of raw image formats is to save, with a minimum loss of information, data obtained from the camera sensor, and the conditions surrounding the capturing of the image. By definition, a raw file (ie, a digital negative) is not directly usable as an image but it has all of the information needed to create an image in a viewable format through a process of converting it into, eg, JPEG or TIFF formats. By storing images as raw (NEF) files, the unaltered information of the captured image is preserved, original colours can be retrieved, and manipulation is made even harder than it would be with analog photographs (cf McKay 2013).

In 'Results', we present a detailed description of the *Strix* owl holotype, based on all available photographs. In 'Diagnosis: morphology', we discuss the morphological comparison with owl genera other than *Strix*, the separation from other *Strix* owls and, more specifically, the morphological differences from Hume's Owl *S butleri*.

Sounds

The *Strix* owl of the Al Hajar mountains has a repertoire of rather understated, low-pitched sounds, and might have remained undiscovered for much longer were it not for the use of high quality sound recording equipment. On several occasions, even when expecting a response after the use of playback, we could not hear it at a distance of 300 m, unless we listened to an amplified signal through headphones. For this, we used pairs of omni-directional Sennheiser MKH-20 condenser microphones in a Crown SASS (Stereo Ambient Sampling System) casing. This gives a binaural listening experience, as if the listener's head were positioned exactly where the microphones are, with the difference that the signal can be amplified at will. On the night of the second encounter in March, a Telinga ProV stereo parabolic microphone had to be used, because the SASS with Sennheisers was not at hand. The recorder on all occasions was a Sound Devices 722, and the headphones were semi-open Beyerdynamic DT-990.

We used Raven Pro 1.5 to analyse our recordings and to make sonagrams for publication. When analysing sonagrams, it is necessary to take meas-

urements from the centre of the sonagram trace rather than its outer limits, since the thickness of the line varies with the settings used. On zoomed-in sonagrams, we measured frequency by putting the selection tool in the vertical centre of the trace at the desired point in time. Similarly, we measured duration between the horizontal centres of two traces, which were typically the faint, near-vertical 'limbs' with which a vocalisation starts and ends. In the onomatopoeic descriptions of sounds, capital letters are used to indicate accented or louder syllables, where marked contrasts in accent are present.

We made a total of 137 sound recordings of the *Strix* owl: 15 in March 2013 (MR); 10 in April 2013 (AvdB and MR); 91 in May 2013 (AvdB); and 21 in July 2013 (AvdB). These were recorded within 5 km of one another and most relate to five individuals in three territories. Two owls from a fourth territory are very faintly audible in recordings from the very first night but their hooting is insufficiently clear in sonagrams, so only a contact call of one of them, ie, a sixth individual, has been included in the analysis.

The vocal analysis is divided as follows. In 'Results', we describe the four vocalisations. In 'Diagnosis: vocalisations', we present sections devoted to individual and presumed sexual variation as well as phenology and compare the vocalisations with the only other *Strix* owl of the Arabian Peninsula, Hume's Owl, which we believe to be the closest relative of the new owl. Then, we compare with other *Strix* owls up to 3500 km distant. We demonstrate not only the distinctiveness of the sounds of the new owl but also the existence of clear vocal homologies between members of the genus *Strix*. Finally, we discuss provisional vocal sexing based on comparison with other *Strix* species.

Results

Proposed new species

Vocalisations and plumage characteristics demonstrate that the owls sound-recorded and photographed in the Al Hajar mountains represent a new species, which we propose to name:

Strix omanensis sp nov
Omani Owl

Holotype

The holotype concerns the individual shown in plate 374, which is a presumed adult male, photographed by Arnoud B van den Berg at Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman



374 Holotype of Omani Owl / Omaanse Uil *Strix omanensis*, Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman, 24 May 2013 (Arnoud B van den Berg/The Sound Approach)

(type locality 23°18'N, 57°41'E; see plate 372-273), on 24 May 2013. The same individual was photographed two days later at the same locality (plate 375-380) and again two months later (plate 381). Sonagrams of its vocalisations are shown in figure 1. Besides a minimum of 35 recordings from the holotype, another 52 made at the same location showed characters of the same individual by pitch, timbre and length of compound hooting as well as the rate of delivery of the notes of pulsed hooting.

The original raw image format (NEF) photographs and the original sound recordings from which the sonagrams were made have been deposited at the Macaulay Library, Cornell Laboratory of Ornithology, Ithaca, New York, USA (sound recordings with accession number ML163395-163399). Mp3 versions of the corresponding recordings can be listened to at www.dutchbirding.nl and/or www.soundapproach.co.uk.

The holotype was last observed on 23 July 2013, and is presumed to be still alive at the time of writing. Based on comparison of recordings, we believe that it concerns the first individual to be noticed when the species was discovered on 24 March 2013.

Search for a museum specimen

We did a search for specimens of Omani Owl in zoological museums. On 14 July 2013, AvdB and CB were allowed to check the collection and freezers of the National History Museum at Muscat, Oman, where no *Strix* specimens appeared to be present. No specimen was present at the Natural History Museum, Tring, England, or to the best of our knowledge anywhere else (Weick 2006, cf Ornis database www.ornisnet.org). We considered the possibility that there could be museum specimens of Hume's Owl that were in fact Omani. However, Goodman & Sabry (1984) checked virtually all museum specimens of Hume's for their paper on the first record for Egypt and the African continent. They did not mention the features of Omani in any of the specimens of Hume's they studied and described, although they noted in the specimens of Hume's that 'the ground colour of the body feathers shows considerable variation, from chocolate-brown [in central Saudi Arabia] to rufous-red in the type specimen'. Importantly, it appears that the museum specimens originate from areas where the occurrence of Hume's has been confirmed by photographs and sound-recordings. The only exception con-

A new species of *Strix* owl from Oman



375-377 Omani Owl / Omaanse Uil *Strix omanensis*, Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman, 26 May 2013 (Arnoud B van den Berg/The Sound Approach). Same individual as holotype in plate 374.





378-379 Omani Owl / Omaanse Uil *Strix omanensis*, Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman, 26 May 2013 (*Arnoud B van den Berg/The Sound Approach*). Same individual as holotype in plate 374.





380 Omani Owl / Omaanse Uil *Strix omanensis*, Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman, 26 May 2013 (Arnaud B van den Berg/The Sound Approach). Same individual as holotype in plate 374.



381 Omani Owl / Omaanse Uil *Strix omanensis*, Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman, 24 July 2013 (Arnaud B van den Berg/The Sound Approach). Same individual as holotype in plate 374.

cerns the type specimen at the Natural History Museum, Tring (see below).

Hume's Owl type specimen

According to Hume (1878), the type specimen of Hume's Owl was given to him by E A Butler, who 'procured it for me through one of his friends, Mr. Nash, I believe from Omara [sic], on the Mekran Coast.' Ormara, the correct spelling, is in southwestern Pakistan (often referred to as southern Iran). This eastern location raises the question whether it in fact could have concerned an Omani Owl. If it did, the scientific name now used for Hume's would become the scientific name of Omani while another scientific name would have to be chosen for Hume's.

Therefore, in June 2013, AvdB and CB examined and photographed the three specimens of Hume's Owl in the Natural History Museum at Tring, which include the 'rufous-red' holotype. The other two are a female from Wadi Qelt, Judaeen desert, 'Palestine', on 28 March 1938, and a male from Mahd Dhahab, 400 km north-north-east of Jeddah, Saudi Arabia, on 16 August

1950. The latter was collected by Mr Adams (Meinertzhagen 1954, cf Garfield 2007). The state of the specimens does not allow much study of feather details of the head (see plate 382-384). However, all three show horizontal bars on the underparts, a feature not shown in Omani Owl, and just a few short longitudinal lines. The three specimens of Hume's in Tring differ from each other in colour (the one from 'Palestine' being palest and the one from Jeddah darkest) and markings (the type specimen showing a few short longitudinal dark lines on the underparts). The differences in ground colour of the body feathers between the three specimens illustrate the considerable variation in Hume's described by Goodman & Sabry (1984).

Goodman & Sabry (1984) highlighted the vagueness of Allan Octavian Hume's type locality. This, combined with the lack of later records, led them to believe that the assumed locality was incorrect, and that the type specimen was collected elsewhere. This idea is corroborated by the lack of records in recent years; Scott & Adhami (2006) and Roselaar & Aliabadian (2009) do not mention



382-383 Hume's Owls / Palestijnse Bosuilen *Strix butleri*, Natural History Museum, Tring, England, 20 June 2013 (Arnoud B van den Berg/*The Sound Approach*; © Natural History Museum, Tring). Left to right: female collected at Wadi Qelt, Judaeen desert, 'Palestine', on 28 March 1938; male collected at Mahd ahd Dhahab, Al Madina, Hejaz region, 400 km north-north-east of Jeddah, Saudi Arabia, on 16 August 1950; type specimen, collected at Ormara, Makran, Balochistan, Pakistan (locality uncertain) on unspecified date.





384 Hume's Owls / Palestijnse Bosuilen *Strix butleri*, Natural History Museum, Tring, England, 20 June 2013 (*Arnoud B van den Berg/The Sound Approach*; © Natural History Museum, Tring). Upper to lower: female collected at Wadi Qelt, Judaeen desert, 'Palestine', on 28 March 1938; male collected at Mahd ahd Dhahab, Al Madina, Hejaz region, 400 km north-north-east of Jeddah, Saudi Arabia, on 16 August 1950; type specimen, collected at Ormara, Makran, Balochistan, Pakistan (locality uncertain) on unspecified date.

any record for Iran, and Rasmussen & Anderton (2005) do not for Pakistan (contra, eg, the map in Hüe & Etchécopar 1970).

Description of holotype: morphology

The description is based on photographs made by AvdB on 24 and 26 May and 22-23 July 2013.

STRUCTURE Medium-sized owl with rounded head lacking ear-tufts, with facial disc and obvious rim, and large eye. Leg long. Tail short. Wing projecting slightly beyond tail.

HEAD Facial disc grey, darkest grey above eye, forming distinct dusky 'brows', paler between eyes, around bill and on chin. Rim shaped like outline of apple sliced vertically through core, blackish on inside and whitish on outside, with dark streak broadly edged white coming down on forehead almost until between eyes. Crown, nape, collar and throat buff-brown with small blackish spade-shaped bars on back of head and blackish streaks on throat.

UPPERPARTS Mantle, scapulars, back, rump and upper-tail-coverts dark grey-brown with buff and whitish spots.

UNDERPARTS Breast buffish white with short longitudinal stripes. Whitish belly not demarcated from breast but

paler with longer thin blackish longitudinal (vertical) stripes. Flank pale as belly with few slightly thicker and longer longitudinal blackish stripes. Abdomen, under-tail-coverts and thigh greyish white.

WING Remiges greyish brown with pale bars. On upperside, remiges mostly dark brown, with broad dark brown bars and narrow pale brown bars and top. Alula dark brown-grey. Greater coverts brown, three outer ones with large white spot near top. Median coverts brown, two outer ones with white spot near top. Lesser and marginal coverts brown. Greater, median and lesser primary coverts dark blackish-brown. On underside, remiges whitish at base and greyish at top, from inside to outside of wing dark bars becoming wider, rendering outer primaries largely dark; inner primaries white at base with dark bars becoming broader towards top and broad dark top, and secondaries white with narrow dark bars and broad dark top. Greater, median, lesser and marginal underwing-coverts greyish white. Greater under primary coverts blackish brown, median under primary coverts white, and lesser under primary coverts greyish white.

TAIL Rectrices whitish with white base on underside and with two broad blackish bars caudally, equal in width to white in between and on top, and two vague narrow dark bars distally.

BARE PARTS Pupil black, iris orange-yellow surrounded by black; eyelid black. Bill pale green-grey. Tibia, tarsus and toes feathered whitish, somewhat greyish on front of tibia, possibly because of wear. Claws pale greyish.

Description of holotype: vocalisations

We identified four types of vocalisations. These include two 'song types' that we describe as *compound hooting* and *pulsed hooting*, as well as an *alarm call* and a *contact call*. Compound hooting has a fixed rhythm of notes and spaces between them. Pulsed hooting consists of bursts of virtually identical notes. Various authors have studied vocalisations of *Strix* owls before but most studies have been of a single species, and the names chosen for the various vocalisations are often appropriate only for that species, due to peculiarities of the sounds or associated behaviours. We have attempted to choose more neutral names that work for a variety of species, if not all. To facili-

tate comparisons, table 1 indicates names used by other authors.

The following description is based on 35 recordings of the holotype, which AvdB obtained while taking photographs on the nights of 23/24 May, 25/26 May and 22/23 July.

Compound hooting

This is the louder of the two types of hooting (see figure 1A), and can be written as *HU.....HWA....ha-HA*. It can be heard in three parts, and there are usually just four notes. The first two parts consist of a single note each while the third part consists of two notes, the last one being the longer of the two. The first, second and fourth notes are approximately equidistant from one another while the third forms an 'upbeat' to the fourth. The first note is lower, the second rises slightly in pitch and the final two stay at or close to this higher pitch.

TABLE 1 Relationship between names used for vocalisations of *Strix* owls in this paper and in existing literature. Names only included here where accompanying descriptions and/or sonagrams leave no doubt about homology.

Species	Authors	Compound hooting	Pulsed hooting	Alarm call	Contact call
<i>S aluco</i>					
	Cramp 1985	advertising call	bubbling call	alarm call	contact call
	Glutz von Blotzheim & Bauer 1980	Reviergesang	Roller	Warnruf	Kontaktruf
	Scherzinger 1980	Reviergesang	Kollern/Nestlocken	Warnlaut	Kontaktlaut/ Weibchenbetteln
	Svensson et al 2009	song	'xylophone trill'		<i>kewick</i>
<i>S butleri</i>					
	Cramp 1985	advertising call	<i>hu-hu-hu-hu-hu- hu-hu-hu-hu</i>		
	König et al 2008	song	booming <i>bu</i> notes		
	Svensson et al 2009	song	defensive call		female begging
<i>S occidentalis</i>					
	Forsman et al 1984, Van Gelder 2003	four-note location call	series location call		contact call
<i>S varia</i>					
	Odom & Mennill 2010	one-phrased hoot (usually doubled: two-phrased hoot)	ascending hoot		female begging
<i>S uralensis</i>					
	Cramp 1985	advertising call	contact-alarm call	alarm call	soliciting call
	Glutz von Blotzheim & Bauer 1980	Reviergesang (male), Revierruf (female)	Nestlocken		Weibchenruf
	Lundberg 1980	territorial call	alarm call		contact call
	Scherzinger 1980	Reviergesang	Nestlocken	Warnlaut	Kontaktlaut/ Weibchenbetteln
	Svensson et al 2009	song	alternative song	alarm	

A new species of Strix owl from Oman

TABLE 2 Omani Owl *Strix omanensis* and Hume's Owl *S butleri* compound hooting (which consists of three parts): univariate summary statistics (mean \pm standard deviation, range). N means number of strophes analysed; Mod freq means modular frequency, Max freq means maximum frequency. Note that for clear-sounding individual in territory 1 (ie, the holotype), only strophes that could be conclusively linked with photographed individual are included. All individuals from recordings in Sound Approach collection, except for those from Ein Gedi, Israel (Mild 1990), and Riyadh, Saudi Arabia (Macaulay Library ML2100).

Individual	N	Notes/ strophe	Duration (sec)	Mod freq part 1 (Hz)	Max freq parts 2 & 3 (Hz)
Omani Owl					
Clear terr 1 (holotype)	25	4.4 \pm 0.7 (4-6)	3.11 \pm 0.11 (2.88-3.31)	331 \pm 13 (311-360)	370 \pm 8 (348-384)
Clear terr 2	29	4 \pm 0	3.00 \pm 0.06 (2.87-3.1)	327 \pm 6 (315-337)	356 \pm 5 (344-368)
Clear terr 3	12	4 \pm 0	3.10 \pm 0.06 (3.03-3.27)	353 \pm 4 (344-360)	377 \pm 6 (366-387)
Hoarse terr 1	4	4.3 \pm 0.5 (4-5)	2.94 \pm 0.11 (2.83-3.09)	323 \pm 8 (313-333)	345 \pm 13 (336-364)
Hoarse terr 2	91	4.3 \pm 0.6 (4-7)	3.07 \pm 0.14 (2.54-3.59)	323 \pm 11 (284-344)	336 \pm 11 (286-358)
Hume's Owl					
Riyadh 1, Saudi Arabia	20	5 \pm 0	1.48 \pm 0.01 (1.45-1.51)	579 \pm 9 (561-599)	581 \pm 9 (561-594)
Petra 1, Jordan	20	5 \pm 0	1.57 \pm 0.02 (1.52-1.60)	573 \pm 15 (558-620)	560 \pm 15 (543-591)
Ein Gedi 1, Israel	12	5 \pm 0	1.53 \pm 0.01 (1.51-1.54)	859 \pm 11 (842-868)	847 \pm 9 (833-859)
Al Mughsayl 1, Oman	20	5 \pm 0	1.63 \pm 0.04 (1.50-1.67)	634 \pm 35 (546-681)	625 \pm 15 (582-649)
Al Mughsayl 2, Oman	23	5 \pm 0	1.48 \pm 0.07 (1.33-1.61)	607 \pm 72 (488-767)	615 \pm 35 (558-668)
Al Mughsayl 3, Oman	15	5 \pm 0	1.58 \pm 0.03 (1.54-1.62)	1035 \pm 22 (991-1087)	981 \pm 26 (951-1036)
Al Mughsayl 4, Oman	7	5 \pm 0	1.61 \pm 0.03 (1.56-1.64)	957 \pm 7 (951-971)	932 \pm 16 (907-956)
Al Mughsayl 5, Oman	7	5.3 \pm 0.5 (5-6)	1.77 \pm 0.1 (1.62-1.85)	1001 \pm 24 (962-1029)	942 \pm 28 (922-984)

The entire vocalisation stays below 400 Hz. A common variant (eg, figure 2) has an additional, short and slightly lower-pitched note or occasionally two, after the last accented one, giving *HU.....HWA....ha-HA-ha(ha)*. More rarely, there may be a short and barely audible low note just after the first one, giving *HU-hu.....HWA....ha-HA*. Measurements of compound hooting in the holotype and four other individuals can be consulted in table 2. The holotype gave compound hooting during all three encounters when it was photographed.

Pulsed hooting

This type of hooting shows a subtle rise and fall in

both frequency and intensity along the duration of the strophe, which approximates to: *hu-hu-hu-hu-hu-hu-hu-hu-hu-hu-hu-hu* (see figure 1B). Occasionally, the first note is extended a little and comes to resemble the first note of compound hooting. Within each burst or strophe, the spacing of the notes is regular. The intensity and pitch are both slightly lower than in compound hooting. Measurements of pulsed hooting in the holotype and three other individuals are shown in table 3. The holotype gave pulsed hooting during all three encounters when it was photographed.

On several occasions, the holotype and other individuals gave variants intermediate between compound and pulsed hooting. Such 'intermedi-

TABLE 3 Omani Owl *Strix omanensis* and Hume's Owl *S butleri* pulsed hooting: univariate summary statistics (mean \pm standard deviation, range). N means number of strophes analysed; Min freq means minimum frequency, Max freq means maximum frequency. Note that for clear-sounding individual in territory 1 (ie, the holotype), only strophes that could definitely be linked with the photographed individual are included. All individuals from recordings in Sound Approach collection.

	N	Notes/strophe	Notes/sec	Min freq (Hz)	Max freq (Hz)
Omani Owl					
Clear terr 1 (holotype)	39	13.3 \pm 1.6 (10-17)	3.45 \pm 0.08 (3.27-3.58)	282 \pm 19 (237-327)	346 \pm 10 (311-366)
Clear terr 2	8	11.6 \pm 2.3 (9-15)	3.45 \pm 0.05 (3.42-3.51)	312 \pm 22 (280-337)	345 \pm 6 (341-354)
Clear terr 3	7	10.4 \pm 1.1 (9-12)	3.46 \pm 0.12 (3.32-3.68)	316 \pm 10 (307-331)	350 \pm 5 (343-358)
Hoarse terr 2	11	15 \pm 4 (7-24)	3.65 \pm 0.07 (3.53-3.79)	272 \pm 12 (252-296)	316 \pm 9 (296-331)
Hume's Owl					
Al Mughsayl 2, Oman	5	10.6 \pm 7.9 (3-20)	4.38 \pm 0.26 (3.96-4.69)	350 \pm 35 (329-412)	473 \pm 44 (430-528)

ate' strophes occurred occasionally in bouts of pulsed hooting and did not follow a set pattern. Certain features hinted at compound hooting, such as the introduction of some longer gaps, reduction of the number of notes and suggestion of a similar three-part structure. However, there were some important differences. In 'intermediate' hooting, the first part became a short series of pulsed notes, the second part often included a short note after the main one, and the third part lacked an upbeat. Such a strophe could be written *Hu-hu-hu-hu-hu.....HWA-ha... HA-ha*. There were many other variants, too many to list here.

Alarm call

This is a rapid series of fairly nasal-sounding barks, each with predominantly rising intonation (see figure 1C). The rate of delivery of the barks is slightly slower, the delivery is less regular and the pitch is higher than in pulsed hooting. The nasal timbre is produced by the higher harmonics, which are more prominent than in pulsed hooting: *nyek-nyek-nyek-nyek-nyek...* The holotype gave alarm calls during photographic encounters on 26 May and 23 July 2013.

Contact call

This is usually a nasal, rising sound (see figure 1D), sounding like *NYEP*. Occasionally the call sounds slightly disyllabic, ending with a brief descent: *NYEPu* or *NYEPU*. The holotype gave contact calls during a photographic encounter on 23 July 2013.

Diagnosis: morphology

Comparison with all owl genera except *Strix*

The structure of the bird excludes all owls except *Strix* (cf König et al 2008). One of the features not found in barn owls Tytonidae is the yellow-orange iris. Hawk owls *Ninox* and related genera (*Uroglaux*, *Sceloglaux*) have very indistinct facial discs and many have a much longer tail. Northern Hawk-Owl *Surnia ulula* also has a much longer tail. The many pygmy owls *Glaucidium*, little owls and related genera (*Xenoglaux*, *Micrathene*, *Athene* and *Heteroglaux*) and saw-whet owls (*Aegolius*) are much smaller. All scops *Otus* and screech *Megascops* owls are much smaller and nearly all have ear-tufts (*Psilosops* is small with ear-tufts as well, *Mimizuku* and *Ptilopsis* are large with ear-tufts, *Pyrroglaux* and *Margarobyas* have unfeathered legs). Eared owls *Asio* (and *Pseudoscops*) have ear-tufts and the few without obvious ear-tufts (including *Nesasio*) have a distinct black mask surrounding the eyes. Owls of the Neotropical *Pulsatrix* have a conspicuous white-spectacled face. All *Bubo* owls are larger and most (also *Jubula*, *Lophostrix* and *Ketupa*) have obvious ear-tufts with the exception of Snowy Owl *B scandiacus* and *Scotopelia*, which have no obvious ear-tufts and no obvious facial disc either. Five species of (Neotropical) *Ciccaba* have yellow bills and are included in *Strix* by König et al (2008) (see below).

Separation from other *Strix* owls

According to König et al (2008), there are 24 spe-

A new species of *Strix* owl from Oman

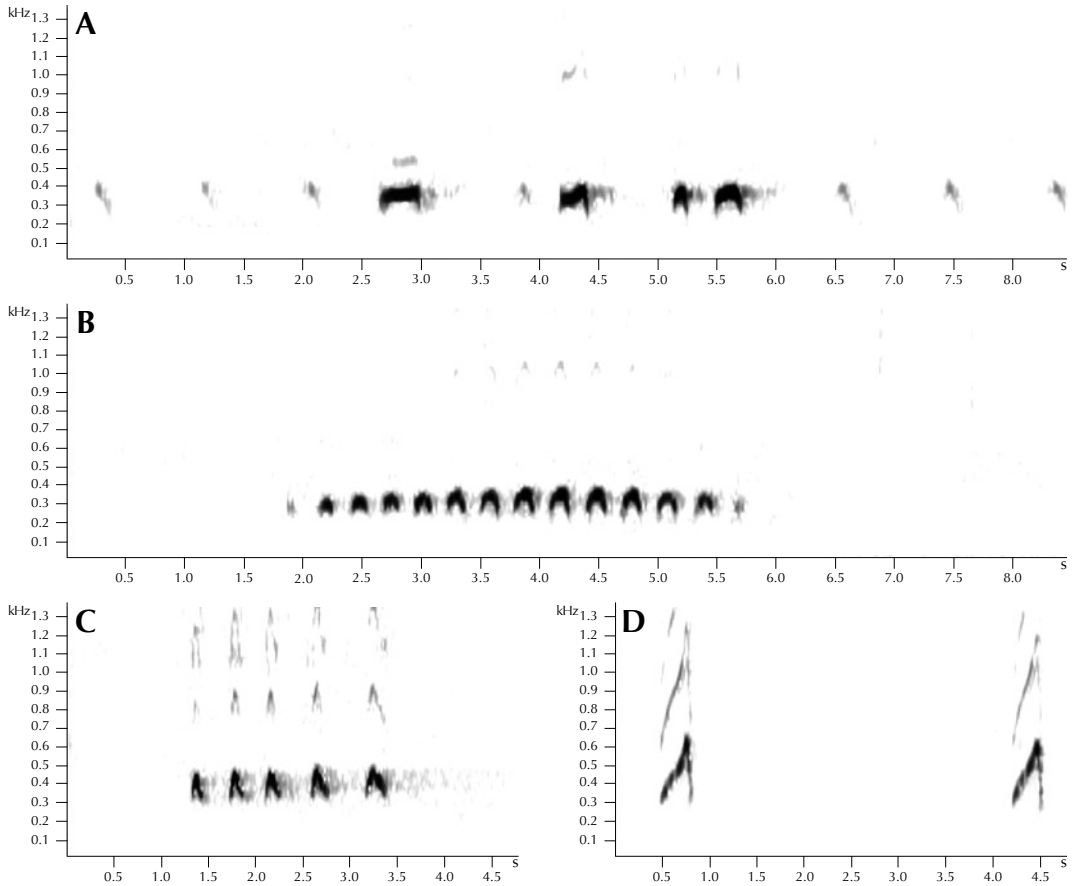


FIGURE 1 Omani Owl / Omaanse Uil *Strix omanensis* (same individual as holotype in plate 374), Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman (Arnoud B van den Berg/The Sound Approach). Catalogue numbers are Sound Approach/Macaulay Library: **A** four-note compound hooting with clear timbre, Pallid Scops Owl *Otus brucei* faintly visible in background, 04:04, 26 May 2013 (130526.AB.040400/ML163398); **B** pulsed hooting with clear timbre, 00:15, 24 May 2013 (130524.AB.001548/ML163396); **C** alarm call, 03:15, 26 May 2013 (130526.AB.031500/ML163397); **D** contact call, 01:55, 23 July 2013 (130723.AB.015536/ML163399)

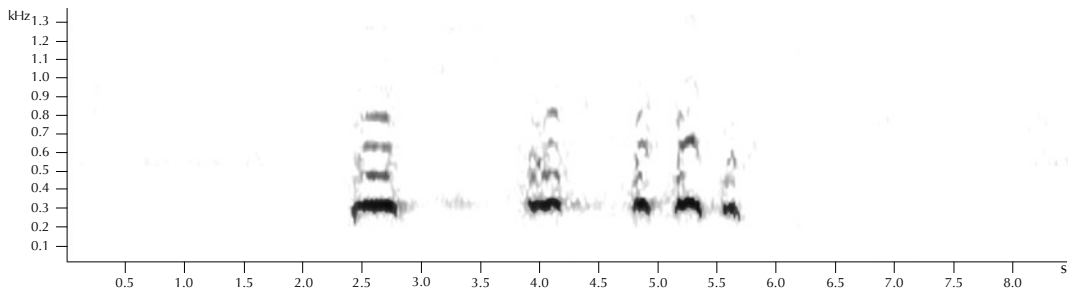


FIGURE 2 Omani Owl / Omaanse Uil *Strix omanensis*, five-note compound hooting with hoarse timbre, Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman, 00:27, 28 April 2013 (Arnoud B van den Berg/The Sound Approach; 130428.AB.002745/Macaulay Library ML163395). Recorded in territory discovered in April 2013. Bands second from bottom and top are subharmonics, contributing to hoarser sound.

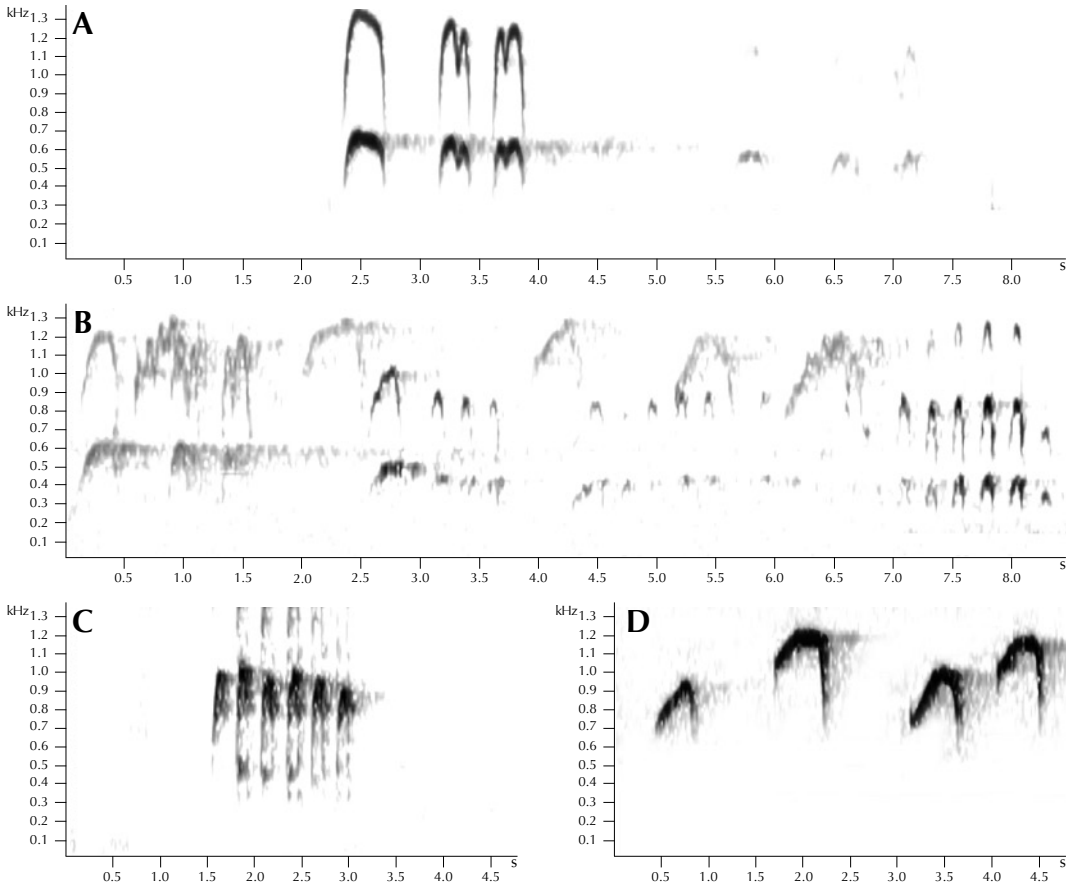


FIGURE 3 Hume's Owl / Palestijnse Bosuil *Strix butleri*, Wadi Al Mughsayl, Dhofar, Oman (*Magnus S Robb/The Sound Approach*): **A** compound hooting of two presumed males, near (left) and far (right), 21:13, 15 April 2010 (100415.MR.211332); **B** pulsed hooting of male (2.5 sec onwards, following compound hoot); two series, first consisting of four notes and second largely obscured. In background, contact calls of female, 21:46, 17 April 2010 (100417.MR.214650); **C** alarm call at nest, 00:16, 18 April 2010 (100418.MR.001602); **D** contact calls of pair. Male gives two higher-pitched calls, 00:16, 18 April 2010 (100418.MR.001602)

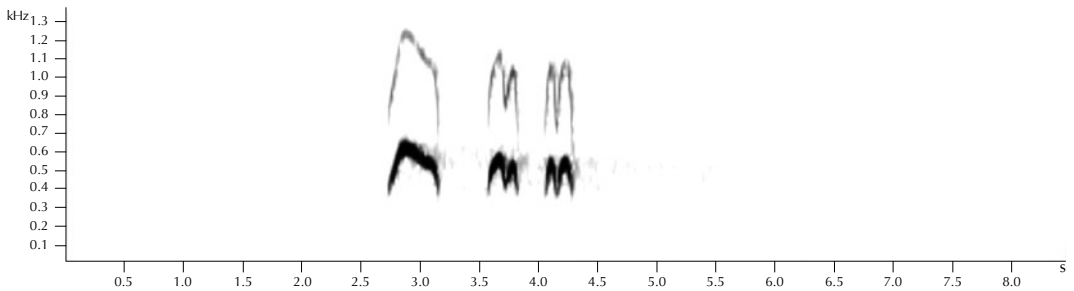


FIGURE 4 Hume's Owl / Palestijnse Bosuil *Strix butleri*, compound hooting, Petra, Jordan, 23:30, 4 May 2004 (*Magnus S Robb/The Sound Approach*; 04.016.MR.12903)



385-386 Hume's Owl / Palestijnse Bosuil *Strix butleri*, Judaeen desert, Israel, 6 February 2013
(Emin Yoğurtçuoğlu). Note plain facial disc and horizontal bars on underparts in plate 385-388.





387 Hume's Owl / Palestijnse Bosuil *Strix butleri*, Wadi Turabi (c 1800 m above sea level), Taïf, Saudi Arabia, 17 March 1994 (*Michel Gunther/Biosphoto*).

388 Hume's Owl / Palestijnse Bosuil *Strix butleri*, Sana'a, Yemen, 26 January 2009 (*János Oláh*).





389 Hume's Owl / Palestijnse Bosuil *Strix butleri*, Judaeen desert, Israel, 23 November 2010
(Barak Granit/birding tours)

390 Hume's Owl / Palestijnse Bosuil *Strix butleri*, Judaeen desert, Israel, 1 December 2010
(Barak Granit/birding tours)



TABLE 4 Morphological differences between Omani Owl *Strix omanensis* (n=2) and Hume's Owl *S butleri* (n= c 20, from Israel/Jordan, central and western Saudi Arabia, northern Yemen and southern Oman)

	Omani Owl	Hume's Owl
Facial disc	bicoloured, with dark grey above and aside eye ('dusky-browed') and pale grey from just above eye downward	plain whitish, buffish or pale grey
Upperside	very dark 'cold' greyish brown; pale spots vaguely bordered	pale greyish, rufous or brown; pale spots well demarcated
Underparts	buffish white, gradually becoming white from lower breast downward; long vertical black lines but no horizontal bars	yellowish to buff; horizontal bar on feathers, sometimes connected to short vertical line
Remiges (wing)	dark bands becoming wider and pale bands dusker from inside to outside, resulting in broad dark trailing edge and wingtips	dark bands slightly narrower than pale ones or equal in width, resulting in rather pale outer wing
Rectrices (tail), underside	outer two dark tail bands broad, inner (two) ones thin and vague, with greyish top of inner rectrices, resulting in dark appearance	outer two bands rather broad and third and fourth band only slightly narrower, resulting in even and rather pale appearance

cies of *Strix* owls and Gill & Donsker (2013) recognize 21 species. Dickinson & Remsen (2013) list (only) 14 *Strix* species as, in contrast with König et al (2008), they do not include four species of *Ciccaba* in *Strix*, while treating a fifth as a subspecies of Mottled Owl (*C virgata squamulata*); moreover, they treat *S (u) davidi* as conspecific with *S uralensis*, *S (a) nivicolium* with *S aluco*, and *S (l) newarensis*, *S (l) niasensis* and *S (l) bartelsi* with *S leptogrammica* (Brown Wood Owl). Most of the 24 *Strix* species recognized by König et al (2008) have dark eyes and the four with orange or yellow eyes include the Neotropical Rufous-banded Owl *C (or S) albitarsis* and Black-banded Owl *C (or S) huhula*, which both have a yellow bill among other differences. In the Palearctic region, only Great Grey Owl *S nebulosa* (which is larger) and Hume's Owl (which is paler) have pale yellow to yellow and yellow-orange to orange eyes, respectively.

Morphological differences from Hume's Owl

Hume's Owl is the only other *Strix* species occurring in the Arabian Peninsula and, based upon its morphology, with a similar structure and orangey eyes, it may also be considered Omani Owl's closest relative. Generally, Omani differs from Hume's by its darker appearance. It should be noted however that there is variation in Hume's with one photographed in Yemen (cf Ertel 2011) being darker with a greyer facial disc than most in the north of their range (cf Aronson 1979, Wrånes 1998). The facial disc of Omani is darker and

bicoloured, with conspicuous dark-grey most prominent above and aside the eyes, on the upper-side of the facial disc ('dusky-browed'), instead of a uniform white or greyish disc as in Hume's. The upperside is dark brown, while in Hume's the upperparts basically vary from pale buffish grey-brown to dark rufous brown. The whitish underparts of Omani show no bars but have conspicuous long black longitudinal (vertical) stripes, while the yellowish to buff underparts of Hume's show faint markings consisting of small dark bars

391 Hume's Owl / Palestijnse Bosuil *Strix butleri*, Wadi Al Mughsayl, Dhofar, Oman, 23 October 2006 (Nick Moran). Note plain facial disc and contrasting dark bands on upperwing.



connected to inconspicuous short dark longitudinal streaks. The remiges show less white on the upperside than in Hume's and less conspicuous blackish bands. On the underside, the rectrices show two broad dark bands in Omani and thin ones distally while the outer two tail bands of Hume's are not so broad with the two more distal ones being only a little thinner. Obviously, any variation in morphology of Omani is unknown as just one individual has been studied extensively with only one or perhaps two other ones briefly seen.

For a summary of the morphological differences between Omani Owl and Hume's Owl, see table 4-5.

Diagnosis: vocalisations

Individual variation in vocalisations

In *compound hooting*, the mean modular frequency (resonating longest and dominating our perception of pitch) of the first part for the five individuals in table 2 was 332 Hz, rising to a mean maximum frequency in the remainder of the call of 357 Hz. The mean duration of all strophes for these five individuals was 3.04 sec (3.03 sec for four-note strophes) and the repetition rate was 3.9 strophes/min (max 5.5/min). A three-note ending was present in 11.7% and a four-note ending in 1.4% of 349 strophes analysed by us. A short and sometimes barely audible low note just after the first one was present in 5.7% of strophes. Seven-note hoots with all three extra notes sounded like *HU-hu.....HWA....ha-HA-ha-ha*. We recorded only three examples of seven-note hoots so far, and those had a mean duration of 3.58 sec.

In *pulsed hooting*, the mean number of notes per strophe for the four individuals in table 3 was 12.6, with the means for four individuals varying between 10.4 and 15. The mean rate of delivery of the notes was highly consistent across individuals at around 3.5/sec. There were six strophes per minute (5.6 to 6.4 per individual). Strophes ascended gradually from means of 296 Hz to 339 Hz (maximum frequency per note) before descending again. The extremes were 237 Hz and 388 Hz, respectively.

Alarm calls were given in series of one to 19 individual barks. The rate of delivery of the barks reached a maximum of 3 barks/sec. The mean range of maximum frequencies per series lay between 406 and 447 Hz (range 303-488 Hz). We recorded alarm calls only in the territory of the holotype, where they could be heard often. In most cases only a single series was given, the owl

then progressing to either kind of hooting. On a few occasions after playback, they were repeated up to a maximum of 10 times in a row, at rates of up to 7.2 series/minute.

Contact calls had mean modular frequency rising from 410 at the start to 565 Hz at the highest point (range 293-723 Hz). Mean duration of the call was 0.3 sec (range 0.2-0.48 sec). Calls were repeated at up to 16/min, and we recorded sequences of up to 22 calls.

A lower-pitched call with rising pitch (mean 234 Hz at start to 361 Hz at highest point) and slightly shorter duration (mean 0.22 sec) was heard on only one occasion, when it was uttered four times in flight. It sounded rather similar to the second note of a compound hoot.

Dimorphism in vocalisations

Dimorphism in hooting was apparent between assumed pair members in two territories (in the third, we heard a single individual). In both territories, two individuals could occasionally be heard hooting from a similar distance and direction. The most easily heard difference between the pair members concerned the timbre of both kinds of hooting. One member of each pair had a clear timbre (see figure 1A-B), while the other had a more muffled, hoarse timbre (see figure 2). The individual in the third territory had a clear timbre. In one pair's territory, we heard almost exclusively the clear-voiced individual; in the other pair's territory, we recorded both birds many times in May, although mostly one at a time.

In compound hooting, the three individuals with clear timbre reached higher maximum frequency than those with hoarse timbre (see table 2). There was also a greater difference in pitch between the first note and the remainder of the strophe in the clear-sounding birds; compound hoots of hoarse birds were at a more level pitch. In pulsed hooting also, birds with clear timbre reached a higher average maximum frequency than the only hoarse bird we heard producing this sound (see table 3). Dimorphism is also suggested by the number of notes in pulsed hooting (largest in the hoarse individual), and the speed of their delivery (fastest in the hoarse individual).

No dimorphism has so far been detected in alarm calls or contact calls.

Phenology of vocalisations

During all encounters with Omani Owl, we heard both compound hooting and pulsed hooting. Compound hooting was heard from all five of the well-documented individuals and pulsed hooting

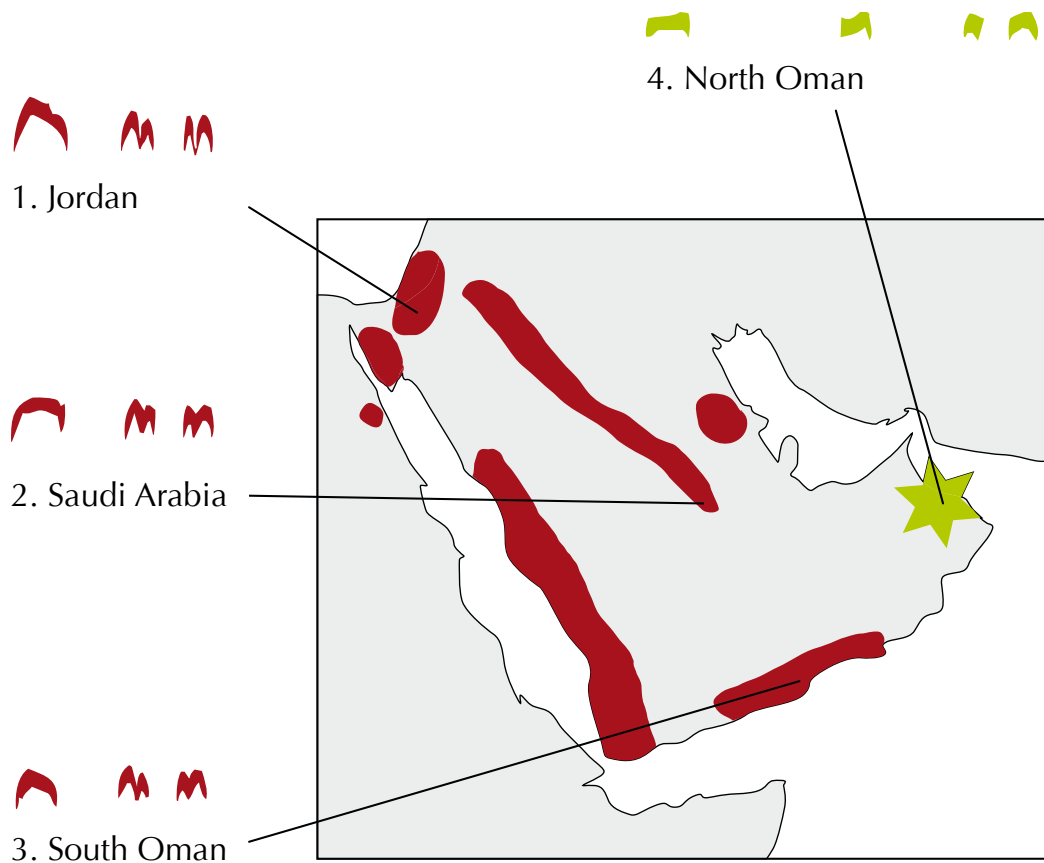


FIGURE 5 Map of compound hooting of *Strix* species in Arabian Peninsula: **1** Hume's Owl / Palestijnse Bosuil *S butleri*, Petra, Jordan, 3 May 2004 (*Magnus S Robb/The Sound Approach*; 04.016.MR.03150); **2** Hume's Owl / Palestijnse Bosuil, 70 km south-west of Riyadh, Saudi Arabia (*Ben King; Macaulay Library ML2100*); **3** Hume's Owl / Palestijnse Bosuil, Wadi Al Mughsayl, Dhofar, Oman, 15 April 2010 (*Magnus S Robb/The Sound Approach*; 100415.MR.211332); **4** Omani Owl / Omaanse Uil *S omanensis*, type locality, Al Jabal Al Akhdar, Al Hajar mountains, Al Batinah, Oman, 26 May 2013 (*Arnoud B van den Berg/The Sound Approach*; 130526.AB.040400)

from all but one. In general, one kind of hooting flowed directly into the other, sometimes by way of one or more 'intermediate' hoots. Both types of hooting were used in all months that we visited the area, although it was only in May that the owls hooted frequently. The use of playback (mostly of compound hooting) in April and May could have influenced the balance of the two types during those months. As far as we could ascertain, neither type was ever given in flight.

We heard alarm calls and contact calls less frequently, and only from one or two individuals. Alarm calls were recorded only in May and July. In most cases, alarm calling was the first reaction to playback, and only a single series was given,

the owl then usually progressing to either kind of hooting. Alarm calls were frequently given in flight, also when no playback was involved. Contact calls were recorded in March, May and July, only in the territory of the holotype and once, on 24 March, from a member of a neighbouring pair that we did not hear subsequently.

Vocal differences from Hume's Owl

RP and MR visited southern Oman in April 2010, spending two nights recording a pair of Hume's Owl with young in the nest, as well as at least four other individuals in the same wadi. On 19 July 2013, AvdB and CB visited the same Hume's site for another night, during which they recorded at

least two individuals. In addition, we analysed recordings by MR for The Sound Approach of a single individual from Petra, Jordan (May 2004), and recordings in publications and sound archives, eg, from Ein Gedi, Israel (Mild 1990); Riyadh, Saudi Arabia (Macaulay Library ML 2100); and Petra, Jordan (Xeno-canto 46066).

Hume's Owl uses the compound type of hooting almost exclusively. It hoots a diagnostic three-part rhythm that is virtually identical in all locations sampled (see figure 5). This starts with a loud first hoot, followed by two groups of two shorter hoots at the same or a slightly lower pitch (see figure 3A and 4). Within each of these groups, the notes are typically joined together (ie, second to third, then fourth to fifth note). The second and fifth notes are usually accented (being slightly longer than the third and fourth), giving something like: *HUUU.....HUhu..huHU*. The mean strophe duration is 1.58 sec and the strophes are repeated at up to 9.6/min but more often at around half that rate. Note that exceptionally, some individuals give an extra, quiet note at the end, giving *HUUU.....HUhu..huHUhu* or *HUUU.....HUhu..HUhuhu*. We only heard an extra note from one, possibly two individuals in Oman.

Compound hooting of Omani Owl differs structurally from Hume's Owl in the number of notes: overwhelmingly four in the former and five in the latter. In the few Omani strophes that have five or more notes, the rhythm, duration and pitch are very different from Hume's. For instance, the three accented notes in Omani are more or less equidistant, whereas in Hume's the distance between the second and final accented notes (second and fifth note of the strophe) is much shorter than that between the first and second. In Omani, the second part of the compound hoot never contains more than one note whereas in Hume's there are always two. The mean total duration is much longer in Omani, almost twice that of Hume's.

In pitch, Omani Owl sounds much lower than Hume's, with no overlap in frequency measurements. This difference in pitch is very striking, with Hume's being in the range of a Eurasian Collared Dove *Streptopelia decaocto* or higher, while Omani hoots at a pitch similar to a male nominate Long-eared Owl *A otus otus* (ie, lower than Common Wood Pigeon *Columba palumbus*). There are no indications of geographical variation in Hume's, with birds from Israel, Jordan and Saudi Arabia falling within the range of variation recorded in southern Oman (see table 2 and figure 5). In the recordings analysed, mean modular frequency of the first part of the compound

hoot was 331 Hz in Omani and 781 Hz in Hume's. Mean maximum frequency for the second and third parts of the compound hoot was 357 Hz in Omani and 760 Hz in Hume's. In fact, the *highest* maximum frequency that we have recorded in Omani compound hooting is 399 Hz, which is 89 Hz below the *lowest* maximum frequency we have recorded in compound hooting of Hume's. Note that the maximum of 399 Hz in Omani was not included in table 2, because, although it came from the individual sounding like the holotype in territory 1, it was not in one of the recordings from a night when photographs were taken.

We did not knowingly record any compound hooting of a female Hume's Owl. According to Yoav Perlman and James Smith (pers comm), the female version is deeper voiced and slightly muffled. In the recordings available to us, the modular frequency of compound hooting in Hume's lay between 488 and 1087 Hz. Even if this only refers to males, it is considerably higher pitched than in either sex of Omani, pairs of which we have recorded hooting together several times.

Published and online recordings of Hume's Owl contain nothing other than compound hooting. However, other calls have been described in the literature. According to Svensson et al (2009), 'A pumping 'do-do-do-do-do-do-du', rising slightly in pitch at the end, appears to serve as a defensive call'. Jennings (1977) was probably referring to the same call when he wrote: 'The only other note I have heard it make is an excited and agitated 'Hu-Hu-Hu-Hu-Hu-Hu-Hu-Hu' (two or three seconds duration) uttered after its call has been imitated or played back from a recorder'. These descriptions suggest pulsed hooting but neither mentions song-like repetition of this sound, as in pulsed hooting of Omani Owl.

We have recorded three brief utterances of pulsed hooting in Hume's Owl, given by the male during food-passes to the female near the nest. In two cases, the first note was higher pitched than the rest and resembled the first note of a compound hoot. With maximum frequency per note in the range of 329 to 528 Hz, the pitch was higher than pulsed hooting in Omani Owl (see table 3). The rate of delivery of the individual hoots was faster at 4.4/sec, while the number of hoots per strophe varied from 3 to 20. Two instances involved multiple strophes but only a short first one followed by a longer strophe, almost without a break (eg, figure 3B). Jonathan Meyrav from Israel, when we asked him about this sound, gave a near-perfect rendition and confirmed that in his experience, it is only ever given in bouts of one or two strophes,

usually directly following a compound hoot. In summary, pulsed hooting of Hume's differs from that of Omani in being higher pitched and faster but mainly in being used only occasionally and in short bouts, whereas in Omani it is used in long bouts, as often as, if not more often than compound hooting. We obtained two recordings of alarm calls of Hume's (see figure 3C), which were similar to those of Omani but higher pitched and delivered more quickly. The modular frequency reached 1 kHz and the rate of delivery reached 3.8/sec. Strophes were of irregular duration (1-6 barks) as were the intervals between them. At least one series was given by a female, after MR made an unexpected movement.

The adult female Hume's Owl in our recordings of a pair gave contact calls more often than any other vocalisation, with the pitch rising by around 200-300 Hz over a duration of just under 0.5 sec. Contact calls of the female typically lay between 800 and 1200 Hz, with lower and upper extremes of 650 and 1340 Hz. The few male contact calls we recorded were towards the upper end of the female's range, at 950-1310 Hz. On two occasions when both sexes called together, the male was higher pitched than the female (see figure 3D). Compared with Omani Owl, contact calls of Hume's were considerably higher pitched as well as being slightly longer and more whistled or less nasal in timbre.

For a summary of vocal differences between Omani Owl and Hume's Owl, see table 5.

Vocalisations of other *Strix* owls up to 3500 km from Oman

In the course of our work on WP owls, we have made over 550 recordings of *Strix* owls, mainly Palearctic species but also, eg, Brown Wood Owl and Northern Barred Owl *S varia*. AvdB also recorded several additional species in the past, including African Wood Owl *S woodfordii*. We have been able to fill gaps in our knowledge by consulting published CDs (Chappuis 2000, Jännes 2002, Gibbon 2003, Chappuis et al 2008) and various online resources, in particular the Macaulay Library (www.macaulaylibrary.org) and Xeno-canto (www.xeno-canto.org). We also referred to recordings from the Borror Library of Bioacoustics (blb.biosci.ohio-state.edu) and the private collection of Hannu Jännes.

In the following comparison of sounds of Omani Owl and other *Strix* owls breeding within c 3500 km of the type locality, we have used the same names for equivalent sounds to simplify comparisons across a range of species. Although we be-

lieve these to be homologous vocal signals conveying related messages, they should not be assumed to correspond to exactly the same behaviours. Signals derived from the same ancestral version may be put to subtly or radically different uses, depending largely on the ecology of the descendent species.

Ural Owl

Some 3500 km separate Omani Owl from the nearest population of Ural Owl in the boreal forests of Russia (del Hoyo et al 1999). In both types of hooting, Omani shows clear similarities with male Ural, which is rather surprising for a smaller-sized owl of Arabian cliffs and treeless mountain slopes. One strong resemblance is the extensive use of both kinds of hooting. As in most other *Strix* owls, compound hooting of Ural is divided into three sections (see figure 6A). The first is usually a single note, although it can sometimes be two. The second follows after a long gap and usually consists of two or three notes linked together as a single modulated sound. The third usually has three notes that are also incompletely separated from one another: an upbeat, an accented note and a quieter, lower-pitched final note. The pitch is low in both species but even lower in Omani. In Ural, the modular frequency is around 350-400 Hz in males and marginally higher in females. Omani differs most strikingly in the much shorter gap between the first and second sections, and the second section having just a single (barely modulated) note. In addition, the overall duration and the gaps between strophes are shorter in Omani.

Pulsed hooting of Ural Owl (see figure 7A) sounds remarkably similar in pitch and rhythm to that of Omani Owl. However, Ural surges more noticeably in volume and pitch towards the middle of the strophe, and also usually has longer gaps between strophes. A more important difference is that there is much greater sexual dimorphism in both types of hooting in Ural, whereas pair members of Omani sound only subtly different from one another. We heard this apparently low level of sexual dimorphism in Omani in pairs from two different territories.

Alarm calls of Ural Owl (see figure 8A) also show a certain similarity to those of Omani Owl. Barks of Ural are given in groups of one to four, mostly two or three, whereas those of Omani can be given in much longer series, in which the delivery becomes faster with duration.

The contact call of Ural Owl is given only by females (see figure 9A) and is subject to their very coarse vocal timbre. As such, it sounds very differ-

A new species of Strix owl from Oman

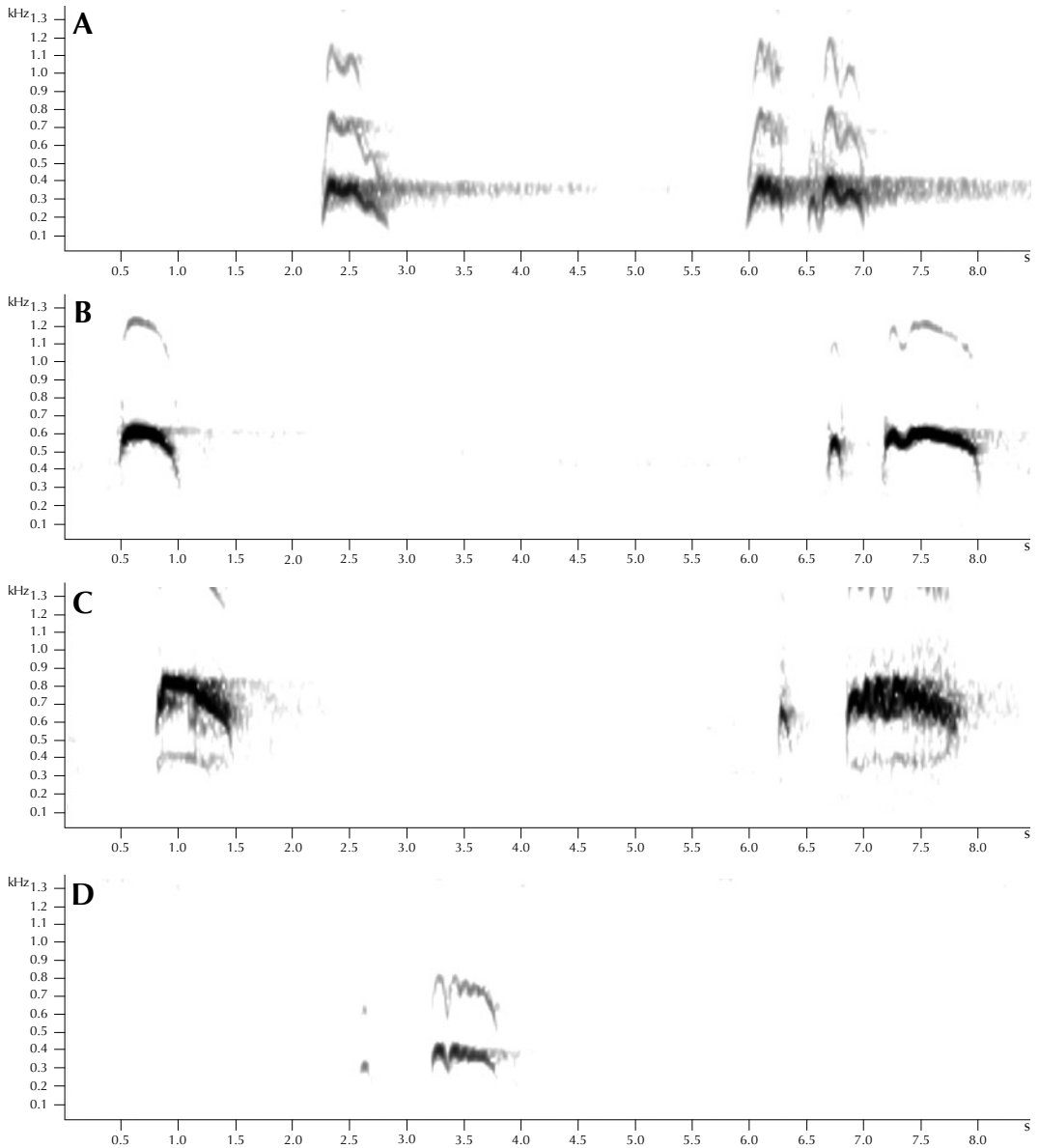


FIGURE 6 Compound hooting of *Strix* owls: **A** Ural Owl / Oeraluil *S uralensis*, compound hooting of male, Vällén, Harg, Uppland, Sweden, 23:00, 1 April 2006 (*Magnus S Robb/The Sound Approach; 06.004.MR.14030*); **B** Tawny Owl / Bosuil *S aluco biddulphi*, compound hooting of male, Dunga Gali, North-West Frontier, Pakistan, 04:00, 27 April 1978 (*Sheldon Severinghaus; Macaulay Library ML179419*); **C** Tawny Owl / Bosuil *S aluco sylvatica*, compound hooting of a male, Rocha da Pena, Algarve, Portugal, 21:40, 19 March 2009 (*Magnus S Robb/The Sound Approach; 090319.MR.214026*); **D** Brown Wood Owl / Bruine Bosuil *S leptogrammica*, compound hooting, Pasoh Forest Reserve, Negeri Sembila, Malaysia, 20 February 1982 (*Ben King; Macaulay Library ML41807*); **E** Himalayan Owl / Kleine Himalayabosuil *S nivicolum*, two-note hoot, 8 km south of Machapuchare, Gandaki, Nepal, 19 May 1982 (*Ben King; Macaulay Library ML41955*); **F** Mottled Wood Owl / Indische Bosuil *Strix ocellata*, compound hooting of pair Bandhavgarh, Madhya Pradesh, India, February 2010 (*Hannu Jännes*). Second of four series belongs to second bird; **G** African Wood Owl / Afrikaanse Bosuil *S woodfordii*, compound hooting of male followed by female, Caprivi Strip, Divundo, Namibia, 02:00, 19 March 1999 (*Arnoud B van den Berg/The Sound Approach; 99.002.AB.11129*)

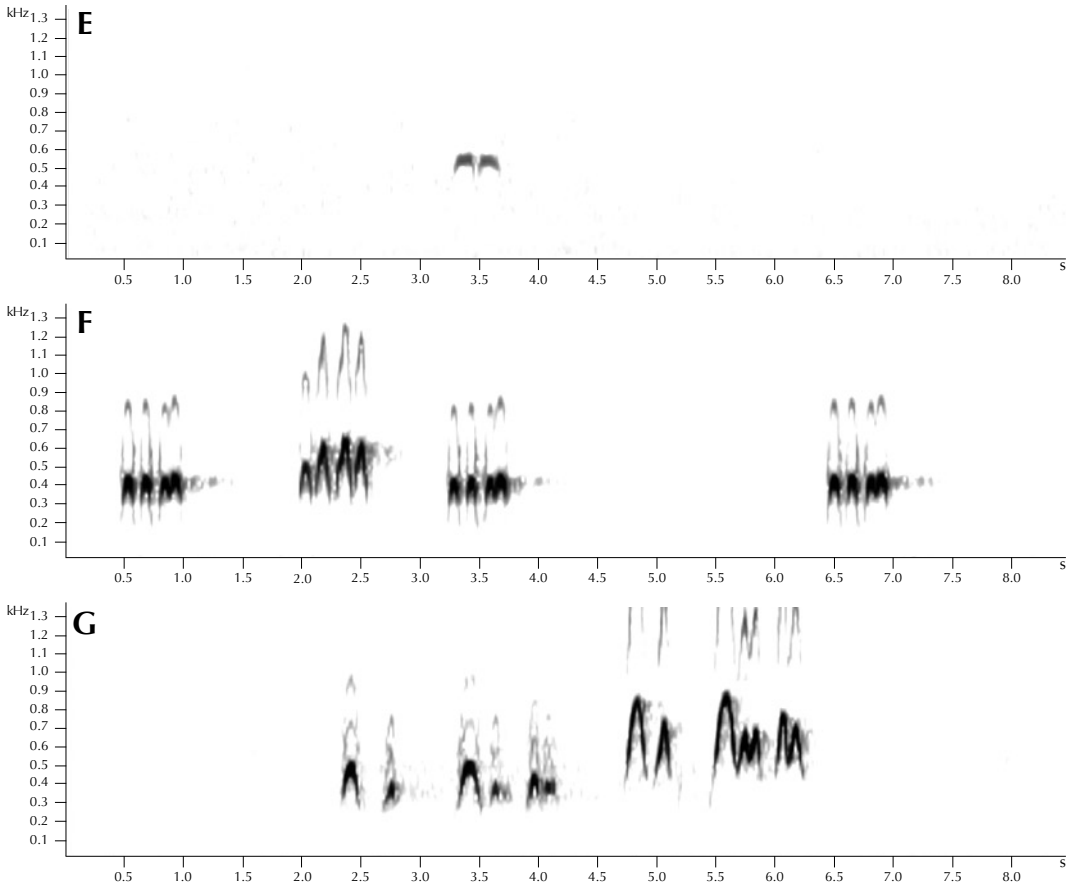


FIGURE 6 (continued)

ent from the contact call of Omani Owl, despite similarities in shape and probably also in behavioural context.

Tawny Owl

While most listeners will hear very little resemblance between Omani Owl and Tawny Owl, comparing their sounds proved to be instructive. The basic form of compound hooting can be found in the easternmost taxon *S a biddulphi* from northern Pakistan (see figure 6B). Its compound hooting lacks any of the florid modulation typical of European and North African birds. Hooting of *biddulphi* consists of four notes: a long first one followed by a long pause, a short second one followed by a short pause and a third that is similar to the second, linked and forming an upbeat to a fourth that is similar to but longer than the first.

Hooting of other subspecies such as *S a sylvatica* (see figure 6C) has the same basic structure but this is partly obscured by modulations, making the number of 'notes' more difficult to count. Compound hooting of Omani is much lower-pitched and, at c 3 sec, it has duration less than half of that of most Tawny (eg, 7.5 sec in the recording from Pakistan). In Omani, the proportions are also very different, with the first, second and fourth notes more or less equidistant, whereas in Tawny the gap between first and second hoots is many times longer than that between the second and fourth. Comparing Omani with the desert form *S a sanctinicolai*, which breeds as close to the type location of Omani as ancient Persepolis, Fars, Iran, a distance of c 875 km (Khaleghizadeh 2011), was not possible as no recordings were available.

A new species of Strix owl from Oman

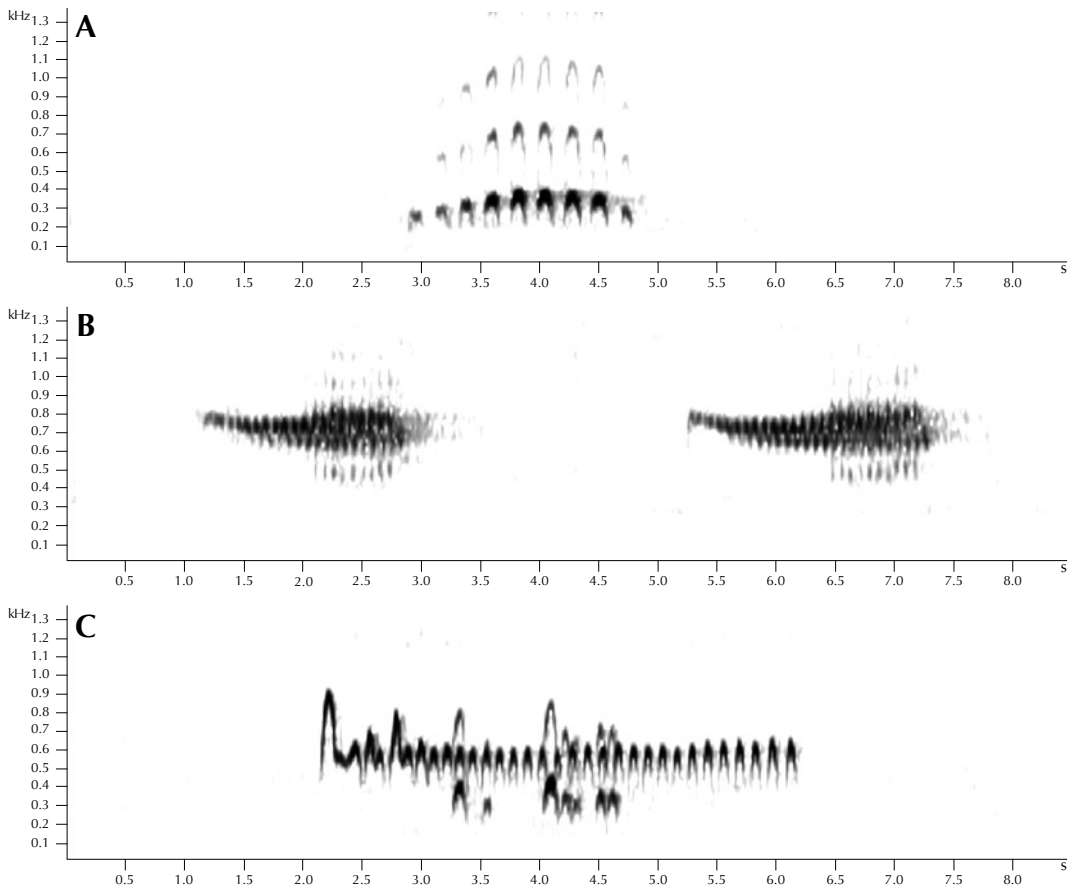


FIGURE 7 Pulsed hooting of *Strix* owls: **A** Ural Owl / Oeraluil *S uralensis liturata*, pulsed hooting of male, near Västerås, Västmanland, Sweden, 21:23, 18 April 2012 (*Magnus S Robb/The Sound Approach; 120418.MR.212328*); **B** Tawny Owl / Bosuil *S aluco aluco*, pulsed hooting of male, De Kennemerduinen, Bloemendaal, Noord-Holland, Netherlands, 01:19, 28 September 2011 (*Arnoud B van den Berg/The Sound Approach; 110928.AB.011910*); **C** African Wood Owl / Afrikaanse Bosuil *S woodfordii*, presumed pulsed hooting of female, superimposed on compound hooting of male, Amani Forest, Tanga, Tanzania, 14 October 1962 (*C Stuart Keith; Macaulay Library ML23487*)

Pulsed hooting of Tawny Owl is the ‘bubbling’ call that occasionally causes confusion with similar-sounding vocalisations of Northern Hawk-Owl and Boreal Owl *A funereus*. We recorded this call type for the subspecies *S a aluco* (see figure 7B), *S a sylvatica* and *S a mauritanica* but know of no recordings of pulsed hooting in eastern subspecies such as *S a sanctinicolai* or *S a biddulphi*. Although much less familiar than compound hooting, this is a frequently used vocalisation, sometimes given in long bouts containing many strophes. Pulsed hooting of Tawny is very different from that of Omani Owl. It is much faster, with many more hoots per strophe and is also much higher pitched.

The alarm call of Tawny Owl (see figure 8B) is usually given in groups of two to four, sometimes more, and is both higher pitched and sharper sounding than that of Omani Owl. The contact call of Tawny is the well-known *kuwitt* with which the female answers the male’s compound hooting. The female uses it as a begging call and both sexes also use it in a range of circumstances (see figure 9B). It is much higher pitched and less nasal sounding than the contact call of Omani and also differs in that it first descends slightly before rising in pitch.

Brown Wood Owl

The nearest population of Brown Wood Owl oc-

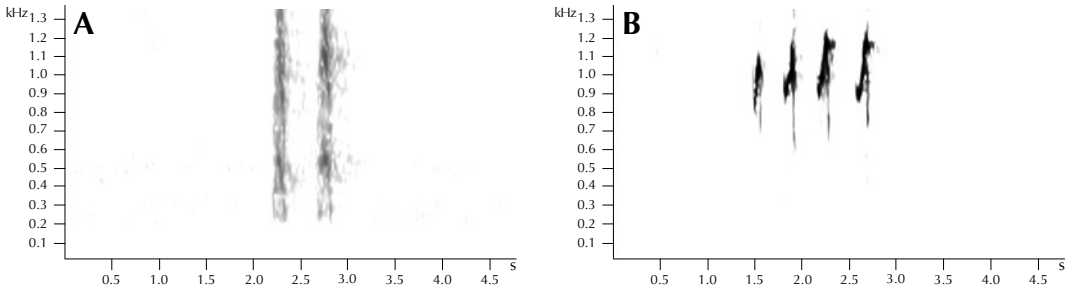


FIGURE 8 Alarm calls of *Strix* owls: **A** Ural Owl / Oeraluil *S uralensis liturata*, alarm call of female, Hauho, Kanta-Häme, Finland, 07:30, 3 May 2009 (*Dick Forsman/The Sound Approach; 090503.DF.073000*); **B** Tawny Owl / Bosuil *S aluco sylvatica*, alarm call of female guarding fledged brood, Pancas, Benavente, Portugal, 22:59, 25 May 2013 (*Magnus S Robb/The Sound Approach; 130525.MR.225912*)

curs c 1900 km away, on the western coast of India (del Hoyo et al 1999). Its main song type can be identified as a form of compound hooting: a brief collection of three to seven short notes, with around four apparently being most typical (Macaulay Library, The Sound Approach, Xenocanto). Often, it starts with a single note followed by a long gap (see figure 6D), the same as in many other *Strix*. However, this note may be omitted altogether. The remaining notes vary geographically in rhythm and number but in all recordings analysed they appear to accelerate towards the end, another typical *Strix* feature. Compound hooting of Brown Wood differs markedly from that of Omani

Owl, most obviously in its very compressed duration (up to 1.54 sec). Male and female often duet, and differ markedly in pitch, but we found no information about which sex had the higher-pitched voice. All but three of the 33 recordings available contained only compound hooting. The other three concerned sounds very different from Omani and other Palearctic *Strix* owls, and we will not consider them further.

Himalayan Owl

The nearest population of Himalayan Owl *S nivicolium* occurs c 2000 km away (König et al 2008). Only one vocalisation is well known (see figure

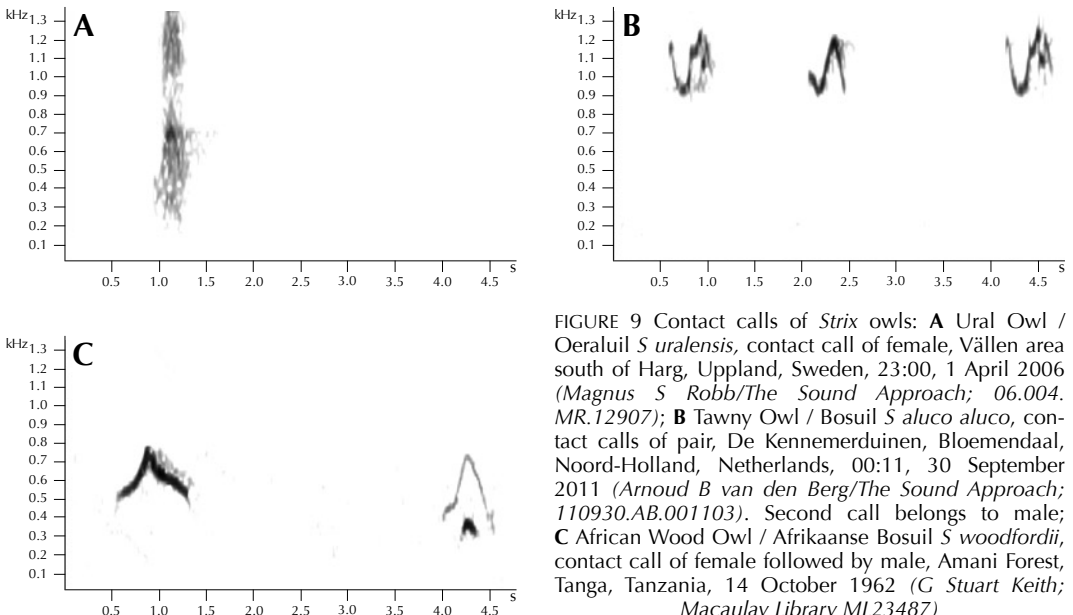


FIGURE 9 Contact calls of *Strix* owls: **A** Ural Owl / Oeraluil *S uralensis*, contact call of female, Vällena area south of Harg, Uppland, Sweden, 23:00, 1 April 2006 (*Magnus S Robb/The Sound Approach; 06.004.MR.12907*); **B** Tawny Owl / Bosuil *S aluco aluco*, contact calls of pair, De Kennemerduinen, Bloemendaal, Noord-Holland, Netherlands, 00:11, 30 September 2011 (*Arnoud B van den Berg/The Sound Approach; 110930.AB.001103*). Second call belongs to male; **C** African Wood Owl / Afrikaanse Bosuil *S woodfordii*, contact call of female followed by male, Amani Forest, Tanga, Tanzania, 14 October 1962 (*C Stuart Keith; Macaulay Library ML23487*)

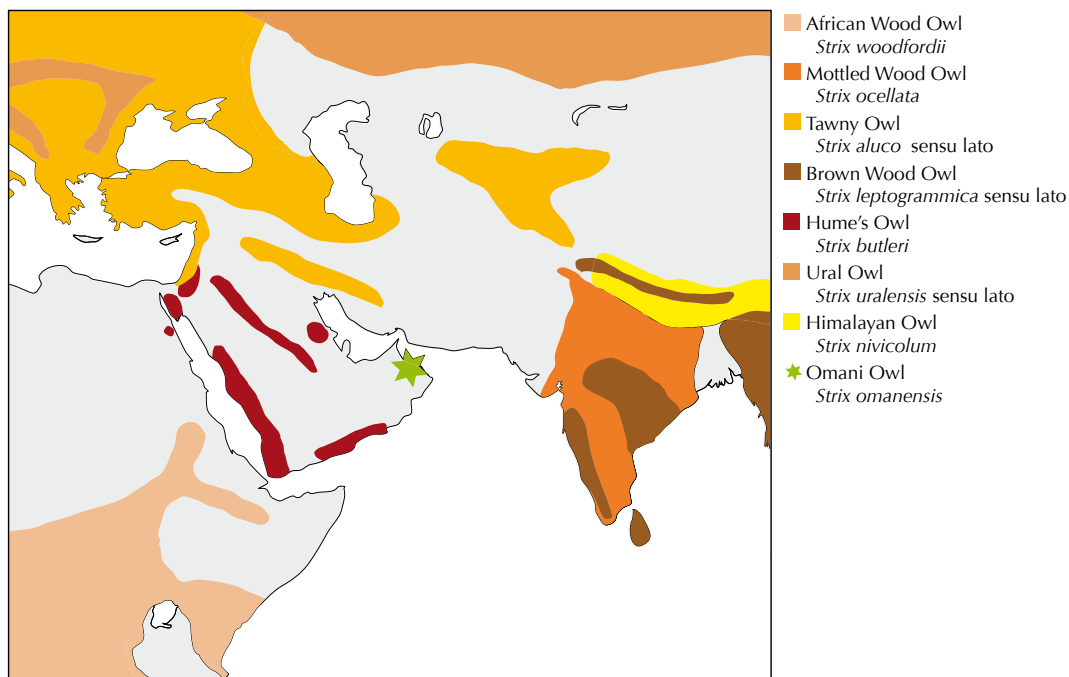


FIGURE 10 Distribution map of *Strix* species within 3500 km from type locality of Omani Owl *S omanensis* in northern Oman: African Wood Owl *S woodfordii*, Mottled Wood Owl *S ocellata*, Tawny Owl *S aluco sensu lato*, Brown Wood Owl *S leptogrammica sensu lato*, Hume's Owl *S butleri*, Ural Owl *S uralensis sensu lato* and Himalayan Owl *S nivicolium*, largely based upon del Hoyo et al (1999), Rasmussen & Anderton (2005), König et al (2008) and Porter & Aspinall (2010)

6E), and it is the main reason why this taxon was recently split from Tawny Owl. According to König et al (2008), the song of the male 'comprises two, sometimes three, clear hoots in rapid succession; at c. 0.05 second intervals...', ie, with a gap of this duration between them. '...Similar in pitch to vocalisations of doves (c.0.55kHz)... Phrase duration up to c.0.3 seconds; phrases are repeated at intervals of several seconds'. Recordings available online (Borror Library of Bioacoustics, Macaulay Library, Xeno-canto), all of which concern two-note hoots, support this description. Whether this is a form of compound hooting or not, Omani Owl differs in having a minimum of four notes when it hoots. A distant recording of Himalayan from Bhutan contains a call that is similar in pitch and nasal quality to contact calls of Omani but has a much shorter duration. It can also be heard in a recording from India where it is repeated at regular intervals in a song-like manner, effectively cancelling any similarity to Omani.

Mottled Wood Owl

The nearest population of Mottled Wood Owl *S ocellata* occurs c 1400 km away, in Gujarat, India (del Hoyo et al 1999). Mottled Wood has two song-types, one of which can be identified as an even more compressed form of compound hooting (see figure 6F). Like that of Brown Wood Owl, it accelerates towards the end but in the four examples available to us (Hannu Jännes unpubl recording; Xeno-canto), it only contains four notes and lasts a mere 0.44-0.72 sec. Clearly, there is no risk of confusion between it and compound hooting of Omani Owl.

The same can be said for the other song type, possibly related to pulsed hooting. This is a rising wail followed without a break by a descending nasal whinny, the whole repeated at a rate of up to 33/min (Hannu Jännes unpubl recording; Macaulay Library). Given regularly on emerging from the daytime roost, it can sometimes be heard in duet with the female's shorter, lower-pitched and less tremulous version (Ali & Ripley 1969, König et al 2008).

TABLE 5 Most important differences in field characters between Omani Owl *Strix omanensis* and Hume's Owl *S butleri*

Character	Omani Owl	Hume's Owl
Compound hooting		
Notes per strophe	usually 4 but sometimes up to 7	usually 5, rarely 6
Notes per 3 parts	usually 1 – 1 – 2 (never 2 in 2nd part)	1 – 2 – 2 (occasionally 3 in 3rd part)
Proportions	1st, 2nd & 4th notes \pm equidistant	1st to 2nd note > 2nd to 4th note
Duration	c 3 sec	c 1.5 sec
Pitch	as male nominate Long-eared Owl <i>Asio otus otus</i> (see table 2)	as Eurasian Collared Dove <i>Streptopelia decaocto</i> or higher (see table 2)
Pulsed hooting		
Prevalence	\pm as often as compound hooting	rarely heard
Duration of bouts	many minutes, many strophes	only 1 or 2 strophes
Rate of delivery	c 3.5/sec (see table 3)	c 4-5/sec (see table 3)
Alarm calls		
Pitch	low: < 500 Hz	high: up to c 1000 Hz
Contact calls		
Pitch and timbre	low and nasal	high 'falsetto' or whistled
Facial disc		
	bicoloured (dark grey and grey)	plain (whitish, buffish or pale grey)
Underparts markings		
	long black (vertical) lines, no horizontal bars	horizontal bar on feather, sometimes connected to short vertical line
Upperside colour		
	very dark, greyish brown, with inconspicuous markings	variable greyish to brown, with conspicuous pale markings

A call type present in three recordings (Macaulay Library, Xeno-canto) is a level hoot lasting c 0.3 sec, with which male and female duet at different pitches. This may be an equivalent to the contact call of Omani Owl although it lacks any inflection. Other calls described in König et al (2008), a 'metallic hoot' and a 'harsh screech similar to that of Common Barn Owl', suggest no similarity to anything we have heard from Omani.

African Wood Owl

The nearest population of African Wood Owl occurs in Ethiopia, just over 2000 km away (del Hoyo et al 1999). AvdB made recordings during a trip to Namibia in March 1999, and many recordings were available to us in publications and online collections (Chapuis 2000, Gibbon 2003; AVoCet Avian Vocalizations Center, Macaulay Library, Xeno-canto; www.plexusowls.com). Compound hooting of most populations of African Wood consists of seven notes (see figure 6G), although there is a population in the Democratic Republic of Congo (DRC) with six-note hoots (Marcot 2007). The structure is again divided into three sections, which have two, three and two notes respectively. The first notes of the first and second parts are

markedly higher pitched and more accented than the other notes. Exceptions to this rule include compound hoots of the DRC population, and those of African Wood from Ghana (Macaulay Library), in which the first note is the lowest and the remainder of the call is at a nearly even, slightly higher pitch, a pitch contour similar to that of Omani Owl. Most sources agree that female African Wood have higher-pitched compound hooting than males (eg, Marcot 2007). Compound hooting of Omani differs from that of African Wood in a number of respects. Most obviously, it is lower pitched than either sex of African Wood, which occupies a frequency range similar to that of Hume's Owl. Strophes of Omani also have a slower delivery and correspondingly longer duration than those of African Wood. Infrequent six- and seven-note strophes of Omani differ in rhythmic pattern from African Wood in that the second section is only a single hoot in Omani, and the final section starts with an upbeat preceding an accented note. African Wood has no upbeats in its compound hooting: each section begins with an accented note.

The recordings of African Wood Owl available to us contained almost exclusively compound

hooting and contact calls. In this species, the contact calls are distinctly arch-shaped as well as being higher pitched, longer and less nasal than in Omani Owl (see figure 9C). They are used extensively by both sexes. Only one recording contained what we assume to be a homologue to pulsed hooting, given by a female (see figure 7C). It is structured similarly to pulsed hooting of Hume's Owl, starting with a note at a pitch similar to the higher notes of a compound hoot and continuing at a pitch similar to the lower ones. However, the individual notes are delivered almost as quickly as in 'bubbling' or pulsed hooting of Tawny Owl. Pulsed hooting of African Wood thus differs from that of Omani in being higher pitched and much faster, and apparently also in being used rather only occasionally.

Provisional sexing of vocalisations

Unfortunately, the vast majority of recordings and all visual observations of Omani Owl concerned single birds. We made no observations or recordings conclusively linking dimorphism in hooting with male and female owls. However, sexual dimorphism seems to be the most likely explanation for dimorphism in hooting of Omani, and a comparison with other *Strix* species allows us to make a provisional attribution.

In *Strix* owls, the usual pattern is for males to have a lower-pitched voice than females. This is known to be the case in, eg, Tawny (Andersen 1961), Spotted *S occidentalis* (Gutiérrez et al 1995), Northern Barred (Kroodsma 2005, Odum & Mennill 2010), Fulvous *S fulvescens* (König et al 2008), Chaco *S chacoensis* (König et al 2008), Rufous-legged *S rufipes* (König et al 2008), Ural (Svensson et al 2009) and African Wood Owl (Marcot 2007) and in three *Ciccaba* species regarded as *Strix* by König et al (2008): Mottled (König et al 2008), Black-and-white *C nigrolineata* (König et al 2008) and Black-banded Owl (König et al 2008) (cf Dickinson & Rensen 2013). In Great Grey Owl, our recordings show no difference in pitch of male and female hooting but Bull & Duncan (1993), writing about nominate *nebulosa*, reported the female to be higher pitched. The only clear exceptions we are aware of concern Hume's Owl, in which males are higher pitched than females in both compound hooting (Yoav Perlman pers comm, James Smith pers comm) and contact calls (own observation), and Mottled Wood Owl, in which females are said to be lower pitched than males in the descending nasal whiny (König et al 2008).

Where there is dimorphism in timbre, male *Strix*

owls have the clearer voice (AvdB pers obs, MR pers obs). This is especially evident in some species (eg, Ural Owl and Great Grey Owl), weaker in others (eg, Tawny Owl) and apparently absent in a few (eg, African Wood Owl). However, we know of no *Strix* species where the female consistently has a clearer voice than the male. Even in Hume's Owl, which forms an exception to the pitch rule, females are more muffled-sounding than males. Given the lack of known exceptions, it seems reasonable to assume that the muffled, hoarse-sounding individuals of Omani Owl are also females, despite having lower pitch than clear-sounding individuals. The lower pitch of females would then be an unusual character shared with Hume's, suggesting either convergence or a sister species relationship between the two Arabian species.

If our provisional sexing of dimorphism in hooting is correct, then the holotype is a male. In support of this, it was nearly always the bird we heard hooting in its territory, where its hoarse-sounding mate only hooted on a couple of occasions.

Biogeography, generic placement and etymology

Biogeography

We have found six or seven individuals, including at least two pairs, in a c 3 km stretch of a single wadi located in the northern foothills of Al Jabal Al Akhdar, the central part of the Al Hajar mountains, northern Oman. As similar habitat exists in other still unsurveyed wadis besides the type location, it seems likely that the species will be found elsewhere in the Al Hajar mountains. Given an apparent requirement for cliffs for singing and nesting, its range may prove to be limited to this massif, of which the highest and largest parts lie within Oman. The nearest neighbouring mountain range in the Arabian Peninsula is the Dhofar range of southern Oman, separated from the Al Hajar range by c 700 km of low-lying and largely barren desert.

Omani Owl is the only bird known to be endemic to the Al Hajar mountains. It is also the only endemic bird for Oman and for the Eastern Arabia region sensu Jennings (2010). It joins at least 11 other bird species endemic to the Arabian Peninsula (cf Jennings 2010). The only other Arabian endemic species known to occur in the same area of northern Oman is Arabian Partridge *Alectoris melanocephala*, which however also breeds in southern Oman, Yemen and mountainous regions of Saudi Arabia. The Al Hajar mountains are home to one endemic mammal, Arabian

Tahr *Arabitragus jayakari*, and several endemic reptiles belonging to *Asaccus*, *Lacerta* and *Pristurus*.

Generic placement

We assign this species to the genus *Strix* because of both morphological and vocal affinities with existing members of that genus. Morphologically, the strongest affinities concern size, facial disc structure and the lack of ear-tufts, and we note an overall resemblance in plumage to Hume's Owl. Vocally, the strongest affinity to other *Strix* owls concerns the structure of the vocal repertoire, with compound and pulsed hooting, as well as alarm calls and contact calls. Within that repertoire we would draw particular attention to the three-part, accelerating rhythm of compound hooting. Outside the genus *Strix*, similar rhythms can be found only in some Oriental Scops Owls *O sunia* and Socotra Scops Owl *O socotrana*, which however have much shorter gaps between strophes, and no equivalent to pulsed hooting in their repertoire.

Etymology

Both the scientific name *Strix omanensis* and the English name, Omani Owl, honour the Sultanate of Oman and the Omani people, in acknowledgement of their efforts to preserve the natural heritage of the country. In the words of His Majesty Sultan Qaboos bin Said al Said, the leader of the Omani people, 'God's gift of nature as a heritage carries with it a responsibility to guard it and to nurture it for the future generations of our people'. The name also refers to the fact that Omani Owl is, on current knowledge, endemic to Oman (see below).

Discussion and conclusions

Description without specimen

In the absence of a specimen we use sonagrams and photographs to document our hypothesis that this represents a previously undescribed species. We believe that presenting high-quality photographs and sonagrams of four different vocalisations of the holotype along with sonagrams of similar vocalisations from several other individuals provides sufficient and verifiable evidence for the uniqueness of this species. In time, we anticipate the collection of moulted feathers for DNA analysis and perhaps even biometrics of captured live individuals to further document its taxonomic status. Comparison of the DNA of the holotype of Hume's Owl (see discussion above) with that of

other Hume's specimens and that of future topotypes of Omani Owl (eg, from birds captured or from lost feathers) may also help to clarify the geographical provenance of the Hume's holotype.

We note that articles 72.5.6 and 73.1.4 of the International Code of Zoological Nomenclature (1999, amended 2012) allow the use of photographs to make a name available for the purpose of zoological nomenclature. Indeed, it is established that new species names can be based on illustrations, and that a live specimen can be a type (Wakeham-Dawson et al 2002, Notton 2011). It means that a photograph in itself cannot be a type but the depicted bird can be. So, it should be stressed that the type is the individual that is photographed, not the photograph itself.

Describing a new taxon without a specimen is exceptional but not unique, as there are previous examples that did not result in confusion about the application of the name (cf Donegan 2008). Probably the best known example of a bird species described without a type specimen in recent decades is Bulo Burti Boubou *Laniarius liberatus*, known from a single bird trapped in Somalia in 1988, and freed after being DNA-sampled in 1990 because of its supposed rarity; the fact that it now appears to be a colour morph of Somali Boubou *L erlangeri*, a species split from Tropical Boubou *L aethiopicus* based on DNA analysis in 2008, has no relationship with the lack of a specimen (Smith et al 1991, Collar 1999, Nguembock et al 2008). A more recent example is Bugun Liocichla *Lio-cichla bugunorum* from Arunachal Pradesh, India, which was described despite the lack of a specimen because of fear for the survival of the species; there were only three known breeding pairs at the type locality (Athreya 2006, van Loon 2007). In addition, the subspecies *sepikensis* of Hooded Mannikin *Lonchura spectabilis* was named on the basis of photographs and has been accepted in subsequent works (Jonkers & Roersma 1990, Dickinson 2003). Likewise, a new African monkey *Lophocebus kipunji* (Jones et al 2005) and, from Galápagos, a new iguana *Conolophus marthae* (Gentile & Snell 2009) have been accepted without a specimen (for comments, see Landry 2005, Timm et al 2005, Donegan 2009, Dubois 2009, Nemésio 2009b).

Although we are fully aware of the value of information-rich specimens for ornithological research and conservation, it was not an option to collect a specimen of Omani Owl. Trapping appeared virtually impossible at the three sites we found so far, as the birds were only active during the night and rarely left their high, steep, inacces-

sible cliffs. We could have asked museum professionals to shoot a specimen (cf Nemésio 2009a). However, there were at least three reasons not to do so: **1** Most importantly, there are only six or seven individuals known from three or four territories, too few to permit collecting a specimen without jeopardising the continued survival of the only known population (cf Collar 2000). For the time being, the population size remains a matter of speculation. Given that the species is only known from the highest of cliffs in a restricted mountain range and may be dependent on such cliffs, it may be very rare or at least hard to census. **2** Killing the most accessible bird(s) in these mountains would make it difficult to study this species in the future. **3** Collecting the only endemic bird of Oman would be disapproved of locally as we have little doubt that for the Omani authorities, conservation and protection of a possibly endangered taxon would come first. For instance, as far as we understand, the Natural History Museum at Muscat, Oman, does not collect birds by deliberately killing them but only encourages people to send specimens accidentally found dead, which further illustrates the local people's respect for wild birds, incompatible with killing them.

We acknowledge that specimens may take away any uncertainty about the validity of a species and, therefore, increase the speed of necessary actions for conservation (Dubois & Nemésio 2007). Peterson & Lanyon (1992) and Banks et al (1993) have put forward that specimens guarantee verifiable taxonomy, verifiability being essential in science. However, we emphasize that the sound recordings and the photographs in raw file format present verifiable phenotypical information. Besides, the population of this species is not extinct, so its presence in Oman can be verified as well.

Lecroy & Vuilleumier (1992) and others stated that a specimen is of such importance that one should wait with describing a species without specimen after fieldwork has shown its population size. However, the fact that this owl has remained hidden for so long in a well-known birding area in one of the more populated regions of Oman shows that it is clearly very difficult to find. As a consequence, it is likely to take considerable time before further research establishes whether the species is really rare. Another reason for us to describe it without further delay is that, without a formal name and description, it will not get a protection status in, eg, the IUCN Red List of Threatened Species. By formally describing this species, we also hope to stimulate other people to look for it and collect information.

Conclusions

Omani Owl is probably most closely related to Hume's Owl. Both species share a number of morphological features which differ from other *Strix* species, including relatively long legs and short tail, bands on wings and tail, orange eyes and pale underparts. Both species also occupy rather similar rocky desert habitat although, so far, Omani has only been found on high cliffs, not in shallow wadis. In this context, it is worthwhile to mention that there are no records of Hume's in northern Oman or the United Arab Emirates (Jennings 2010, Porter & Aspinall 2010). In Oman, Hume's only occurs in the south, in Dhofar (and into Yemen), ie, further than 830 km from Omani's locality (Jennings 2010), rendering the map of Hume's in König et al (2008) erroneous.

While there is variation in ground colour within the population of Hume's Owl, there is no such variation in its vocalisations. We compared sounds of Hume's from its entire range, from Israel and Jordan in the north, Riyadh, Saudi Arabia, in the centre, to southern Oman in the south, and all these birds show the same song and calls, very different from the vocalisations of Omani Owl.

Omani Owl is the first entirely new 'non-cryptic' bird species to be discovered in the WP (sensu Martins & Hirschfeld 1998) for 40 years, the last being Algerian Nuthatch *Sitta ledanti* from Kabylia, Algeria, discovered in 1973 (Vielliard 1976). The most recently described new WP species concerns Monteiro's Storm Petrel *Oceanodroma monteiroi* from the Azores, previously a 'cryptic' population of Madeiran Storm Petrel *O castro* (Bolton et al 2008, Robb et al 2008). In 2009, one of the current authors played a decisive role in the rediscovery of Turkish Brown Fish Owl *B zeylonensis semenowi* in Turkey (van den Berg et al 2010). For us to have been involved in such events twice in five years suggests that there is still much to discover in the WP, especially during the night.

On current knowledge, Omani Owl is the rarest owl in the WP. Priority must now be given to a comprehensive survey of suitable habitat, in order to establish what level of protection it requires. Once this crucial information has been obtained, we look forward to the gradual filling in of details about every aspect of the physical attributes, genetic affinities and behaviour of the species.

Acknowledgements

We would like to thank His Majesty Sultan Qaboos bin Said al Said for answering a query regarding a proposed name for the new species and for his interest in our discovery. We are grateful to Cecilia

Bosman and René Pop for their assistance in the field. We were granted access to look at specimens in the Natural History Museum at Tring and the Natural History Museum at Muscat, and given support by the Macaulay Library, Cornell Laboratory of Ornithology, at Ithaca, New York. Cecilia Bosman made the distribution maps. Edward Dickinson, George Sangster and Manuel Schweizer acted as external referees. GS advised us to await a specimen being collected, an advice which, for reasons given above, we have not followed. In various ways, we were assisted by Per Alström, Sandy Bartle, Keith Betton, Sander Bot, Greg Budney (Macaulay Library), Håkan Delin, Enno Ebels, Rainer Ertel, Dick Forsman, Barak Granit, Hein van Grouw, Hannu Jännes, Mike Jennings, Guy Kirwan, Don Kroodsma, André van Loon, Matt Medler (Macaulay Library), Jonathan Meyrav, Christopher Mills, Nick Moran, Paul Morton, Killian Mullarney, Peter Nuyten, János Oláh, Gert Ottens, Ricardo Palma, Yoav Perlman, René Pop, Forrest Rowland, James Smith, David Stanton, Paul Sweet (American Museum of Natural History), Roland van der Vliet, Mike Watson, Emin Yoğurtçuoğlu and Matthew Young (Macaulay Library). We thank Hanne Eriksen, Jens Eriksen, Mike Jennings and Dave Sargeant for providing information on where to find birds in northern Oman.

Samenvatting

EEN NIEUWE SOORT *STRIX*-UIL IN OMAN Op 24 maart 2013 werd een nieuwe soort *Strix*-uil ontdekt in Al Jabal Al Akhdar, het centrale deel van het Al Hajar-gebergte in het noorden van Oman. Van grote afstand werden toen drie verschillende vocalisaties opgenomen, die alle afweken van bekende soorten op het Arabisch Schiereiland en elders. Drie nachten later werd de uil opnieuw gehoord en toen konden betere opnames worden gemaakt. Vanwege het vermoeden dat het een nieuwe soort betrof, volgden er bezoeken in de laatste week van april, de tweede helft van mei en in juli 2013. Eind april werd geen spontane vocalisatie gehoord maar één uil reageerde uiteindelijk wel op playback, en kon als eerste worden gezien. Dit betrof een nieuw exemplaar op 2 km van de oorspronkelijke locatie. Op 24 mei werd de eerste foto gemaakt op de eerste locatie, en op 26 mei volgde een uitgebreide serie foto's van hetzelfde individu. Het totale aantal opgenomen individuen steeg in mei tot zes of zeven, alle hoog op kliffen boven dezelfde wadi. In juli werden opnieuw foto's gemaakt van hetzelfde exemplaar als op 24-26 mei, dat er inmiddels gehavend uitzag, vermoedelijk vanwege lichaamsrui.

Geluids- en verenkleedkenmerken demonstrenen dat de in mei opgenomen en gefotografeerde uilen een nieuwe soort vertegenwoordigen, waarvoor de auteurs de naam Omaanse Uil *Strix omanensis* voorstellen. Het holotype betreft het naar wordt aangenomen nog levende exemplaar in plaat 374. Er worden ook andere foto's

en vier sonogrammen van hetzelfde exemplaar getoond. De coördinaten van de typelocatie in Al Jabal Al Akhdar, Al Hajar-gebergte, Al Batinah, Oman, zijn 23°18'N, 57°41'E.

Het beschrijven van een nieuwe soort door middel van een illustratie is controversieel maar wel expliciet toegestaan in artikel 72.5.6 en 73.1.4 van de International Code of Zoological Nomenclature, onder de conditie dat niet de illustratie maar het geïllustreerde exemplaar het holotype vormt. Verschillende voorbeelden worden genoemd waarbij het beschrijven van een nieuw taxon zonder balg niet tot taxonomische complicaties heeft geleid. De auteurs hebben geen exemplaar verzameld om drie redenen. **1** Slechts zes of zeven exemplaren waren bekend, te weinig om een exemplaar te verzamelen zonder de populatie in gevaar te brengen. **2** Het doden van de meest toegankelijke individuen zou verdere studie kunnen verhinderen. **3** Het verzamelen van de enige endemische soort van Oman (zie onder) zou tot veel lokaal onbegrip leiden. Het Natuurhistorische Museum van Muscat, Oman, doodt bijvoorbeeld geen dieren ten behoeve van hun collectie en accepteert slechts dieren die dood worden aangetroffen door het publiek. Er is onderzocht of er zich een balg van Omaanse Uil in een museum bevond maar dat leverde niets op, ook niet in de vrieskisten van het museum in Muscat. Wereldwijd zijn er heel weinig *Strix*-uilen van het Arabisch Schiereiland in museumverzamelingen en er is geen exemplaar uit Oman aangetroffen.

De enige andere *Strix*-uil die op het Arabisch Schiereiland voorkomt is Palestijnse Bosuil *S butleri*. Het type-exemplaar van Palestijnse ligt thans in het Natural History Museum, Tring, Engeland. Op de typelocatie (Makrankust, Beloetsjistan, Pakistan) is nimmer een *Strix*-uil aangetroffen en dus ook geen Palestijnse Bosuil. Indien het type-exemplaar van Palestijnse in feite een Omaanse Uil zou blijken te zijn, zou de nieuwe uil de naam *S butleri* moeten krijgen en Palestijnse een andere naam. De typelocatie van Palestijnse is echter altijd twijfelachtig geweest (Hume ontving de balg via tussenpersonen) en het is dus onduidelijk waar het type-exemplaar vandaan komt. Ook elders in Pakistan of Iran is nooit een Palestijnse vastgesteld. Het type-exemplaar vertoont bovendien de kenmerken van Palestijnse zodat geen namenruil verwacht hoeft worden.

Omaanse Uil is een middelgrote uil zonder oorpluimen, met een duidelijk omrande gezichtsschijf, grote geeloranje tot oranje ogen, lange poten en een korte staart. De gezichtsschijf is tweekleurig, met donkergrijs boven en opzij van het oog, en lichtgrijs van net boven het oog naar beneden. De bovendelen zijn koud donkerbruin met vaag begrensd lichte vlekken. De onderdelen zijn bruingeelachtig wit, geleidelijk wit wordend vanaf de borst, met lange lengtestrepen maar geen dwarsstrepen. De vleugel heeft donkere banden die van binnen naar buiten breder en donkerder worden, waardoor een brede donkere achterrand van de vleugel ontstaat. De staart heeft twee brede banden in het buitenste deel en twee smalle, vage banden in het binnenste deel.

Er worden vier typen vocalisaties beschreven die allemaal door het holotype zijn gemaakt en door de au-

teurs opgenomen. *Samengestelde zang* kan worden beschreven als *HOE.....HWA....ha-HA*. Het bestaat uit drie delen waarvan alleen de laatste meerdere noten heeft. De eerste, tweede en vierde noot staan op min of meer gelijke afstand van elkaar, terwijl de derde een opmaat vormt naar de vierde. De eerste noot is iets lager dan de overige. Qua toonhoogte is de samengestelde zang van Omaanse Uil vergelijkbaar of lager dan die van Oeraluil *S uralensis*, met als hoogste tot nu toe gemeten frequentie 400 Hz. Er zijn ook varianten bekend met tot vier noten in het laatste deel en tot twee in het eerste, waardoor de meeste complexe variant dus zeven noten heeft. *Pulserende zang* kan worden beschreven als *hoe-hoe-hoe-hoe-hoe-hoe-hoe-hoe-hoe-hoe-hoe*, en bestaat uit een aantal min of meer gelijke tonen die even laag of lager zijn dan bij de samengestelde zang. Er zijn c 10-15 noten per strofe, en de strofen worden gemiddeld zes keer per minuut herhaald. De frequentie en de intensiteit stijgen iets tot het midden van de strofe, om daarna weer licht af te zakken naar het einde. Soms zijn tussenvormen van de zang te horen, meestal in de loop van series pulserende zang. Deze zijn erg onregelmatig maar neigen naar samengestelde zang, door bijvoorbeeld een suggestie van een driedelige structuur. De *alarmroep* bestaat uit een snelle serie vrij nasale blaffende klanken, elk met een stijgende toonhoogte. De snelheid is iets groter dan bij pulserende zang, en het ritme is minder regelmatig. Bovendien is de alarmroep hoger en met sterkere boventonen: *njek-njek-njek-njek-njek...* De *contactroep* is een stijgende, nasaal klinkende roep die kan worden beschreven als *NJEP* of, wanneer er een lichte daling aan het eind komt, *NJEPoe*.

Omaanse Uil hoort duidelijk tot het genus *Strix*. De sterkste morfologische overeenkomsten met andere leden van dit genus zijn grootte, structuur van de gezichtsschijf en het ontbreken van oorpluimen. Binnen *Strix* verschilt Omaanse van de meeste soorten door de oranjegele ogen. In het Palearctische gebied hebben alleen de lichtere Palestijnse Bosuil en de veel grotere Laplanduil *S nebulosa* respectievelijk geeloranje en lichtgele ogen.

Palestijnse Bosuil is waarschijnlijk de soort die het meest verwant is aan Omaanse Uil. Omaanse verschilt van Palestijnse door zijn donkerdere verenkleed. De gezichtsschijf van Omaanse is contrastrijker, met opvallend donkergrijs boven en opzij van de ogen (bij Palestijnse veel egaler witachtig tot grijsachtig). De bovendelen zijn donkerbruin (bij Palestijnse variërend van licht zandkleurig grijsbruin tot roodbruin). De witachtige onderdelen van Omaanse hebben geen dwarsstrepen maar wel lange en opvallende lengtestrepen (bij Palestijnse zijn de onderdelen meer bruingeel getint en onopvallend gemarkeerd met dwarsstrepen en veel kortere lengtestrepen). De slagpennen van Omaanse tonen minder wit op de bovenzijde dan bij Palestijnse, en minder opvallende zwartachtige banden. De staartveren van Omaanse tonen op de onderzijde twee brede donkere buitenste banden en twee smallere binnenste, terwijl de staartbanden van Palestijnse iets minder breed en meer gelijk van breedte zijn.

Verschillen in geluid tussen Omaanse Uil en Palestijnse Bosuil zijn groot. De samengestelde zang van Omaanse bestaat meestal uit vier noten, terwijl er bij

Palestijnse vrijwel altijd vijf zijn en nooit vier. Bovendien is het ritme anders bij Palestijnse, met twee noten in het tweede deel, terwijl er bij Omaanse nooit twee zijn. De frequentie is veel hoger bij Palestijnse, vergelijkbaar met of hoger dan Turkse Tortel *Streptopelia decaocto*, terwijl de toonhoogte van Omaanse kan worden vergeleken met een mannetje nominaat Ransuil *Asio otus otus* (dus lager dan Houtduif *Columba palumbus*). De lengte van de samengestelde zang is c 3 sec bij Omaanse en 1.5 sec bij Palestijnse. Bij Omaanse worden samengestelde en pulserende zang ongeveer even vaak gebruikt en voor lange perioden, terwijl bij Palestijnse pulserende zang veel minder vaak en slechts gedurende enkele seconden wordt gebruikt. Bovendien is pulserende zang van Omaanse lager en wordt deze iets trager voortgebracht. De alarmroep van Omaanse is vergelijkbaar met die van Palestijnse maar iets lager en langzamer, en wordt minder snel voortgebracht. De contactroep van Omaanse is veel lager dan de meer fluitende van Palestijnse, en heeft een veel sterkere nasale toon.

Dezelfde vier vocalisaties worden vergeleken met alle *Strix*-uilen die binnen een straal van 3500 km van de typelocatie van Omaanse Uil voorkomen. Hierdoor wordt duidelijk dat er veel homologieën bestaan tussen de geluiden van de verschillende soorten. Oeraluil is misschien de soort die wat geluid betreft het meeste op Omaanse lijkt, vooral wat betreft de pulserende zang. Bij Bosuil *S aluco* is de pulserende zang veel sneller, zodat het eerder bibberend klinkt. De bekende samengestelde zang van Bosuil is veel langer, hoger en heeft andere proporties, hoewel de basisstructuur nog wel wat overeenkomsten met Omaanse toont. Drie *Strix*-uilen uit Azië hebben veel kortere samengestelde zang dan Omaanse: Bruine Bosuil *S leptogrammica*, Indische Bosuil *S ocellata* en Kleine Himalayabosuil *S nivicolum*. Van die soorten is nog niet duidelijk of ze ook pulserende zang hebben. Afrikaanse Bosuil *S woodfordii* heeft een samengestelde zang die even hoog is als die van Palestijnse Bosuil maar met zeven noten in plaats van vijf. De pulserende zang van Afrikaanse wordt zelden opgenomen. Uit één opname blijkt echter dat deze vergelijkbaar is met die van Palestijnse, met vooral een hogere snelheid.

Op verschillende momenten kon worden vastgesteld dat twee Omaanse Uilen dicht bij elkaar zaten te roepen. In twee verschillende territoria kon worden gehoord dat één van de twee een iets hogere en meer heldere stem had dan de andere. Dit suggereert seksueel dimorfisme, wat bij de meeste uilen goed te horen is. Er zijn echter nog geen waarnemingen gedaan waardoor het duidelijk werd welk geslacht bij welke toonhoogte hoort. Bij vrijwel alle *Strix*-uilen heeft het vrouwtje de hogere stem. De enige bekende uitzonderingen zijn Palestijnse Bosuil en, voor minstens één type vocalisatie, Indische Bosuil. Bij alle soorten waarvoor informatie beschikbaar was is er of geen verschil in timbre/klankkleur, of het vrouwtje heeft de minder heldere stem. Er zijn nog geen *Strix*-soorten bekend waarbij het vrouwtje een helderdere stem heeft dan het mannetje. Daarom is het ook waarschijnlijk dat bij Omaanse Uil de vogel met de lagere, minder heldere stem het vrouwtje betreft. De lagere stem zou dan een uitzondering zijn die Omaanse met Palestijnse deelt.

Momenteel zijn er slechts zes of zeven individuen bekend van Omaanse Uil maar de beschikbaarheid van vergelijkbare habitat op andere locaties in het Al Hajar-gebergte maakt het aannemelijk dat er meer exemplaren zijn. Dit gebergte is sterk geïsoleerd en Omaanse Uil is daarom hoogstwaarschijnlijk endemisch binnen het Al Hajar-gebergte, waarvan het hoogste en grootste deel binnen Oman ligt. Palestijnse Bosuil is overigens nog nooit in het noorden van Oman of in de Verenigde Arabische Emiraten vastgesteld maar komt wel op meer dan 830 km afstand in Dhofar in zuidelijk Oman voor. Het Al Hajar-gebergte heeft één endemisch zoogdier en verschillende endemische reptielen. Omaanse Uil is de enige endemische vogelsoort van het gebergte en van heel Oman. Voor het Arabisch Schiereiland zijn ten minste 11 endemische vogelsoorten bekend, waarvan de meeste in Jemen en het zuidwesten van het Arabisch Schiereiland voorkomen.

De laatste soort die werd ontdekt in het West-Palearctische gebied (WP; inclusief het Arabisch Schiereiland en Iran) is het in 2009 beschreven Monteiro's Stormvogeltje *Oceanodroma monteiroi*, voorheen een 'cryptische' populatie van Madeirastormvogeltje *O castro*. Omaanse Uil is echter de eerste 'niet-cryptische' nieuwe vogelsoort voor de WP in 40 jaar. De vorige was Algerijnse Boomklever *Sitta ledanti* in 1973. Op basis van huidige kennis is Omaanse Uil de zeldzaamste uil in de WP. Het is belangrijk dat er eerst een grondige inventarisatie wordt uitgevoerd om te bepalen welk niveau van bescherming vereist is. Daarna kan door verder onderzoek de kennis over deze soort stapsgewijs worden uitgebreid.

References

- Ali, S & Ripley, S D 1969. Handbook of the birds of India and Pakistan 3. Oxford.
- Andersen, T 1961. En nordjsjaellandsk Natugle-bestand (*Strix aluco* L.) i yngletiden. Dansk Ornithol Foren Tidsskr 55: 1-55.
- Aronson, L 1979. Hume's Tawny Owl *Strix butleri* in Israel. Dutch Birding 1: 18-19.
- Athreya, R 2006. A new species of *Liocichla* (Aves: Timaliidae) from Eaglenest Wildlife Sanctuary, Arunachal Pradesh, India. Indian Birds 2: 82-94.
- Banks, R C, Goodman, S M, Lanyon, S M & Schulenberg, T S 1993. Type specimens and basic principles of avian taxonomy. Auk 110: 413-414.
- van den Berg, A B, Bekir, S, de Knijff, P & The Sound Approach 2010. Rediscovery, biology, vocalisations and taxonomy of fish owls in Turkey. Dutch Birding 32: 287-298.
- Bolton, M, Smith, A L, Gómez-Díaz, E, Friesen, V L, Medeiros, R, Bried, J, Roscales, J L & Furness, R W 2008. Monteiro's Storm-petrel *Oceanodroma monteiroi*: a new species from the Azores. Ibis 150: 717-727.
- Bull, E L & Duncan, J R 1993. Great Grey Owl *Strix nebulosa*. In: Poole, A (editor), The birds of North America online, issue 041. Website: <http://bna.birds.cornell.edu/bna/species/041/articles/introduction>.
- Chappuis, C 2000. African bird sounds. Birds of North, West and Central Africa. 15 CDs and booklet. Paris.
- Chappuis, C, Deroussen, F & Warakagoda, D 2008. Indian bird sounds. The Indian peninsula. 5 CDs and booklet. Hyderabad.
- Collar, N J 1999. New species, high standards and the case of *Laniarius liberatus*. Ibis 141: 358-367.
- Collar, N J 2000. Opinion. Collecting and conservation: cause and effect. Bird Conserv Int 10: 1-15.
- Cramp, S (editor) 1985. The birds of the Western Palearctic 4. Oxford.
- Dickinson, E C (editor) 2003. The Howard and Moore complete checklist of the birds of the world. Third edition. London.
- Dickinson, E C & Remsen, J V Jr (editors) 2013. The Howard and Moore complete checklist of the birds of the world. Fourth edition, vol 1: Non-passerines. London.
- Donegan, T M 2008. New species and subspecies descriptions do not and should not always require a dead type specimen. Zootaxa 1761: 37-48.
- Donegan, T M 2009. Type specimens, samples of live individuals and the Galapagos Pink Land Iguana. Zootaxa 2201: 12-20.
- Dubois, A & Nemésio, A 2007. Does the nomenclatural availability of nomina of new species or subspecies require the deposition of voucher specimens? Zootaxa 1409: 1-22.
- Dubois, A 2009. Endangered species and endangered knowledge. Zootaxa 2201: 26-29.
- Ertel, R C 2011. Birds in Africa. An introduction and survey to the birdlife of Africa. Nottuln.
- Forsman, E D, Meslow, E C & Wight, H M 1984. Distribution and biology of the Spotted Owl in Oregon. Wildl Monogr 87: 3-64.
- Gantlett, S 2008. The Handbook of Western Palearctic Birds – and a request for photographs. Birding World 21: 109-113.
- Garfield, B 2007. The Meinertzhagen mystery: the life and legend of a colossal fraud. Lincoln.
- Gentile, G & Snell, H 2009. *Conolophus marthae* sp. nov. (Squamata, Iguanidae), a new species of land iguana from the Galápagos archipelago. Zootaxa 2201: 1-10.
- Gibbon, G 2003. Southern African bird sounds. 6 CDs and booklet. Westville.
- Gill, F & Donsker, D (editors) 2013. IOC World Bird List (version 3.3). Website: www.worldbirdnames.org. [Accessed 10 August 2013.]
- Glutz von Blotzheim, U N & Bauer, K M (editors) 1980. Handbuch der Vögel Mitteleuropas 9. Wiesbaden.
- Goodman, S M & Sabry, H 1984. A specimen record of Hume's Tawny Owl *Strix butleri* from Egypt. Bull Br Ornithol Club 104: 79-84.
- Gutiérrez, R J, Franklin, A B & Lahaye, W S 1995. Spotted Owl *Strix occidentalis*. In: Poole, A (editor), The birds of North America online, issue 179. Website: <http://bna.birds.cornell.edu/bna/species/179/articles/introduction>.
- del Hoyo, J, Elliott, A & Sargatal, J (editors) 1999. Handbook of the birds of the world 5. Barcelona.
- Hüe, F & Etchécopar, R D 1970. Les oiseaux du proche et du moyen orient. Paris.

A new species of Strix owl from Oman

- Hume, A 1878. *Asio butleri*, sp. nov.? *Stray Feathers* 7: 316-318.
- Jännes, H 2002. Bird sounds of Goa & South India. CD and booklet. Helsinki.
- Jennings, M 1977. More about 'Desert Liliths': Hume's Tawny Owl. *Israel Land Nature* 2: 168-169.
- Jennings, M C 2010. Atlas of the breeding birds of Arabia. *Fauna of Arabia* 25: 1-772.
- Jones, T, Ehardt, C L, Butynski, T M, Davenport, T R B, Mpunga, N E, Machaga, S J & De Luca, D W 2005. The highland Mangabey *Lophocebus kipunji*: a new species of African monkey. *Science* 308: 1161-1164.
- Jonkers, B & Roersma, H 1990. New subspecies of *Lonchura spectabilis* from East Sepik Province, Papua New Guinea. *Dutch Birding* 12: 22-25.
- Khaleghizadeh, A 2011. About diet of Tawny Owl in Fars, southern Iran. *Raptor Conserv* 23: 199-200.
- König, C, Weick, F & Becking, J-H 2008. Owls of the world. Second edition. London.
- Kroodsma, D 2005. The singing life of birds. New York.
- Landry, S O 2005. What constitutes a proper description? *Science* 309: 2164.
- LeCroy, M & Vuilleumier, F 1992. Guidelines for the description of new species in ornithology. *Bull Br Ornithol Club* 112A: 191-198.
- van Loon, A J 2007. DB Actueel: New species of Iio-cichla. *Dutch Birding* 29: 72-73.
- Lundberg, A 1980. Vocalizations and courtship feeding of the Ural Owl *Strix uralensis*. *Ornis Scand* 11: 65-70.
- Marcot, B G 2007. Unique songs of African Wood-Owls (*Strix woodfordii*) in the Democratic Republic of Congo. *Gabar* 18: 16-24.
- Martins, R P & Hirschfeld, E 1994. Where are the limits of the Western Palearctic? *Bull Br Ornithol Club* 114: 207-208.
- Martins, R P & Hirschfeld, E 1998. Comments on the limits of the Western Palearctic in Iran and the Arabian Peninsula. *Sandgrouse* 20: 108-134.
- McKay, B D 2013. The use of digital photography in systematics. *Biol J Linn Soc* 109: 1-13.
- Meinertzhagen, R 1954. Birds of Arabia. Edinburgh.
- Mild, K 1990. Bird songs of Israel and the Middle East (two sound cassettes and booklet). Stockholm.
- Nemésio, A 2009a. Nomenclatural availability of nomina of new species should always require the deposition of preserved specimens in collections: a rebuttal to Donegan (2008). *Zootaxa* 2045: 1-14.
- Nemésio, A 2009b. On the live holotype of the Galapagos pink land Iguana, *Conolophus marthae* Gentile & Snell, 2009 (Squamata: Iguanidae): is it an acceptable exception? *Zootaxa* 2201: 21-25.
- Nguembock, B, Fjeldså, J, Couloux, A, Pasquet, E 2008. Phylogeny of *Laniarius*: molecular data reveal *L. liberatus* synonymous with *L. erlangeri* and 'plumage coloration' as unreliable morphological characters for defining species and species groups. *Mol Phyl Evol* 48: 396-407.
- Notton, D G 2011. The availability and validity of the name *Forpus flavicollis* Bertagnolio & Racheli, 2010, for a parrotlet from Colombia. *Bull Brit Ornithol Club* 131: 221-224.
- Odom, K J & Mennill, D J 2010. A quantitative description of the vocalizations and vocal activity of the Barred Owl. *Condor* 112: 549-560.
- Peterson, A T & Lanyon, S M 1992. New bird species, DNA studies and type specimens. *Trends Ecol Evol* 7: 167-168.
- Porter, R & Aspinall, S 2010. Birds of the Middle East. Second edition. London.
- Rasmussen, P C & Anderton, J C 2005. Birds of South Asia: the Ripley guide 1 & 2. Barcelona.
- Robb, M, Mullarney, K & The Sound Approach 2008. Petrels night and day: a Sound Approach guide. Poole.
- Roselaar, C S 2006. The boundaries of the Palearctic region. *Br Birds* 99: 602-618.
- Roselaar, C S & Aliabadian, M 2009. Review of rare birds in Iran, 1860s-1960s. *Podoces* 4: 1-27.
- Sargeant, D E, Eriksen, H & Eriksen, J 2008. Birdwatching guide to Oman. Second edition. Muscat.
- Scott, D A & Adhami, A 2006. An updated checklist of the birds of Iran. *Podoces* 1: 1-16.
- Scherzinger, W 1980. Zur Ethologie der Fortpflanzung und Jugendentwicklung des Habichtskauzes (*Strix uralensis*) mit Vergleichen zum Waldkauz (*Strix aluco*). *Bonn Zool Monogr* 15: 5-66.
- Smith, E F G, Arctander, P, Fjeldså, J & Amir, O G 1991. A new species of shrike (Laniidae: *Laniarius*) from Somalia, verified by DNA sequence data from the only known individual. *Ibis* 133: 227-235.
- Svensson, L, Grant, P J, Mullarney, K & Zetterström, D 2009. Collins bird guide. Second edition. London.
- Timm, R M, Ramey II, R R & The Nomenclature Committee of the American Society of Mammalogists 2005. What constitutes a proper description? *Science* 309: 2163.
- Van Gelder, J J 2003. Variation in four-note location calls of male Spotted Owls (*Strix occidentalis*). Doctoral dissertation, Humboldt State University, California, USA.
- Vielliard, J 1978. Le djebel babor et sa sittelle *Sitta ledanti* Vielliard, 1976. *Alauda* 46: 1-42.
- Wakeham-Dawson, A, Morris, S & Tubbs, P 2002. Type specimens: dead or alive? *Bull Zool Nomencl* 59: 282-284.
- Weick, F 2006. Owls Strigiformes. Annotated and illustrated checklist. Berlin.
- Wrånes, R E 1998. Photo spot: Hume's Tawny Owl. *Sandgrouse* 20: 105-107.

Magnus S Robb, Rua Dr Pedro de Almeida Lima 6, 2710-122 Sintra, Portugal (magnus.robb@me.com)

Arnoud B van den Berg, Duinlustparkweg 98, 2082 EG Santpoort-Zuid, Netherlands (arnoud.b.vandenberg@gmail.com)

Mark Constantine, 24 Constitution Hill Road, Poole, Dorset BH14 0QD, England