Bird Study (2014), 1–5
http://dx.doi.org/10.1080/00063657.2014.897303

SHORT REPORT

Seasonal and environmental influences on the calling behaviour of Eurasian Scops Owls

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Capsule Spontaneous calls and replies to playback of Scops Owls were significantly more frequent during the breeding period, when paired birds defend territories. The probability of spontaneous calls varied with moon phase, with a peak occurring during nights with a full moon. In some cases, during the winter, Scops Owls responded to playback calls of Little Owls, thus suggesting possible intra-guild competition between these species.

Auditory surveys play an important role in understanding the distribution of owls, because of the elusiveness and nocturnal habits of these birds (Fuller & Mosher 1981, Haug & Didiuk 1993). Playback of a recorded song or call is widely used to census nocturnal raptors (Lane *et al.* 2001, Martìnez & Zuberogoitia 2004, Penteriani *et al.* 2010), because it induces birds to call in response, so increasing the probability of being detected (Martìnez *et al.* 2002). Playback has been used to provide insights into space use (Lane *et al.* 2001), behavioural ecology (Galeotti *et al.* 1997, Martìnez & Zuberogoitia 2002) and demographic trends of nocturnal birds (Redpath 1994, Martìnez & Zuberogoitia 2004). Individual response to playback of conspecific calls varies with environmental conditions (e.g. weather and moon phase: Kavanagh & Peake 1993, Navarro *et al.* 2005, Penteriani *et al.* 2010), distance from the source of broadcast sound (Proudfoot *et al.* 2002), sex and individual social status (Appleby & Redpath 1997, Rohner 1997). Playback can also use heterospecific calls to elicit replies, but responses to this auditory technique are poorly known and they are often related to competitive relationships (Herter & Hicks 2000, Crozier *et al.* 2005). For some species, passive auditory surveys provide better results than studies based on playback (Martìnez & Zuberogoitia 2002); for others, elicited calls through playback seem to be more effective (Ritchinson *et al.* 1988, Zuberogoitia & Campos 1998, Navarro *et al.* 2005).

The Eurasian Scops Owl *Otus scops* is a small nocturnal raptor, widely distributed in the Palearctic as breeder (Cramp & Simmons 1980). Most individuals migrate and spend the winter in sub-Saharan Africa, with few resident populations remaining in Eurasia throughout cold months (Cramp & Simmons 1980). In Italy, the winter distribution range of Eurasian Scops Owls includes southern regions (Brichetti & Fracasso 2006), and scattered points of occurrence, in northern (Spina & Volponi 2008) and central Italy (Laurenti 1987, Tellini Florenzano *et al.* 1997, Vannini *et al.* 2013).

During the breeding period, Scops Owls defend a territory (Galeotti *et al.* 1997) with intensive vocal activity consisting in a whistling 'kiuu' (Dragonetti 2007), rhythmically repeated by both sexes (Van Der Weyden 1975, Currie *et al.* 2002). The advertising call is similar in males and in females (Koenig 1973). Alarm calls are louder and more penetrating than the advertising call, and are expressed when nests are disturbed or when predators fly overhead (e.g. Tawny Owls *Strix aluco*; Cramp & Simmons 1980, Koenig 1973). Playback represents an effective census technique for Scops Owls (Currie *et al.* 2002), mainly when their density is high (Zuberogoitia & Campos 1998). Territoriality has never been confirmed during the winter and spontaneous calls have only

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occasionally been recorded (e.g. Crete: Cramp & Simmons 1980, Nigeria: Elgood *et al.* 1966).

The Eurasian Scops Owl is a species of European conservation concern (Mañez 1994, BirdLife International 2004) and its numbers are declining in Italy (Marchesi & Sergio 2005). For example, about 500–1500 pairs are estimated to breed in Tuscany (Tellini Florenzano *et al.* 1997), while no data are available on winter populations. The conservation status of this species (BirdLife International 2004) necessarily requires the design of appropriate monitoring programmes (Elzinga *et al.* 2001) but variables which may influence its calling behaviour are also poorly known.

This study was based on a two-year survey (2011–2013) in Southern Tuscany as part of a study on the abundance and ecology of this species in its Italian winter quarters. We aimed to provide new insights into the distribution and the eco-ethology of wintering Scops Owls by combining two census techniques, direct detections (spontaneous calls) and playback, and to evaluate the effectiveness of these monitoring methods. We hypothesized that the frequency of response to playback stimuli and spontaneous call would change with season and moon phase, to reflect breeding territoriality and perception of predation risk from larger owls, respectively (Lourenço *et al.* 2011).

Habitats in the study site (province of Grosseto, Central Italy: 474–1045 m a.s.l.) included mixed deciduous woodlands (69%), fallow fields (13%), cultivated fields (5%), pinewoods (3%), human settlements (2%) and scrub (8%). A river (Merse), some rivulets and several ponds fed by rainwater were present (Cantini *et al.* 2013). The climate is sub-montane: during this survey, temperature ranged from −2.7°C to 26.6°C (median = 13.9°C, Q_1–Q_3 = 7.9–19.0°C; meteorological station: Campiano. www.idropisa.it). Agriculture (cereals and vegetable gardens), sheep and cattle raising and wood cutting were limited to the downstream portion of the study area and to the immediate surroundings of the villages. In this area, the Eurasian Scops Owl is a common breeding species, with some overwintering individuals (Vannini *et al.* 2013).

The survey was performed within the framework of a regional Atlas project on wintering and breeding bird species (http://www.centrornitologicotoscano.org; Accessed on 20 November 2013). We performed a playback experiment, using a tape recording of conspecific and Little Owl *Athene noctua* calls. We used two recordings for each species (advertising and alarm calls, which were broadcast one after the other in the same bout), to reduce results being influenced by the specific features of a single recording. Our study was carried out between March 2011 and February 2013: a 52 km long route was driven by car, one night per week, every month. Thirty stations, separated from one another by *c.* 1.5 km, were visited on this route after dusk, by 1–2 observers, regardless of weather. The same 30 stations were surveyed throughout the study. We adapted protocols already used for the species (Samwald & Samwald 1992, Takats *et al.* 2001, Krofel 2008) as following. We stayed for 2 minutes in silence at each station, to record spontaneous calls of the target species (bout S). Then, a playback of Scops Owl vocalizations was broadcast for 2 minutes and we listened for a reaction for a further 3 minutes (bout P1: Krofel 2008). A vocalization of a Little Owl was then broadcast for 2 minutes, and we waited a further 3 minutes for a reaction (bout P2).

Broadcast volume was adjusted every time and at every station to ensure clear vocal rendition (74 dB – which fell within the range of vocal output levels of a variety of small owl species: cf. Cramp 1985, Gerhardt 1991, Parejo *et al.* 2012 – at stations located within fields; 93 dB in wooded areas, where trees may limit sound diffusion, or on windy nights). For each sampling bout, we recorded whether a call of either Scops Owls or non-target species occurred. We recorded weather conditions, moon phase, temperature and wind speed at the time of surveys. Weather conditions were classified according to the percentage of sky coverage (0–25%, 26–50%, 51–75% and 76–100%), and to the presence/absence of precipitation. Wind speed was estimated according to the Beaufort scale (0, calm; 1, light air; 2, slight breeze; 3, gentle breeze; 4, moderate breeze; Takats *et al.* 2001). Moon phases were classified as it follows: phase (1) from new moon to ¼; (n = 32 nights); phase (2) from ¼ to ½ (n = 23 nights); phase (3) from ½ to ¾ (n = 24 nights) and phase (4) over ¾ and full moon (n = 24 nights).

We used generalized linear models with Poisson errors (Crawley 2007) to assess the effects of playback calls on spontaneous call/reply to playback, by Scops Owls. In a first model, the number of stations with spontaneous call/night was fitted as response variable. In a second model, the number of stations where we detected a reply to a playback call by conspecific was fitted as response variable. In all models, breeding period, weather conditions, wind speed and moon phase were the predictors. For all the analyses, all variables were entered in global models (Crawley 2007). Minimum

adequate models were estimated by removing the least significant term at each step, until the elimination of terms caused a significant increase in the residual deviance (Crawley 2007). The significance of changes in residual deviance was assessed through *F* like deletion tests (Crawley 2007). Circular statistics (Rayleigh test) were used to assess if the calling behaviour of Scops Owls was related to moon phase (cf. Di Bitetti *et al.* 2006).

The survey was carried out for a total of 103 nights ($n = 51$ during the breeding period; $n = 52$ outside the breeding period), with Scops Owls detected ($n = 294$ total detections) on 67 nights (65%): about 97% of 101 spontaneous calls and 96% of responses to playback calls of conspecific ($n = 146$) were recorded in summer. The number of stations with spontaneous calls of Scops Owls was significantly greater during the breeding period than in winter and in nights with moon phases 3–4 (>½ moon) than in other nights (Table 1). The number of stations with replies to playback calls by conspecifics was significantly higher in the breeding period and on nights with a light breeze (Table 1). In the non-breeding (winter) season, most of the vocalizations heard (70%) were emitted spontaneously. During the winter, Scops Owls responded to broadcast calls of Little Owl in 16.4% of cases (Fig. 1). The probability of a spontaneous call was also significantly higher on nights with moon phase 3 than during night with other moon phases (circular Rayleigh test: $Z = 146.7$; $P < 0.001$; $r = 0.24$; Di Bitetti *et al.* 2006).

Monitoring of Scops Owl populations throughout the year was affected by a significant seasonal variation in response to playback. Peaks in detection occurred during the breeding period because it coincided with the arrival of the migratory contingent of the population and so likely territorial disputes with resident and establishing pairs (cf. Currie *et al.* 2002, Krofel 2008, Zuberogoitia *et al.* 2011). Zuberogoitia *et al.* (2011) showed that the detection rate of Scops Owls was below 10% in March, increased to 90–100% in April-to-mid-May, declining to 70% in late May–July, and to 30% in August–September.

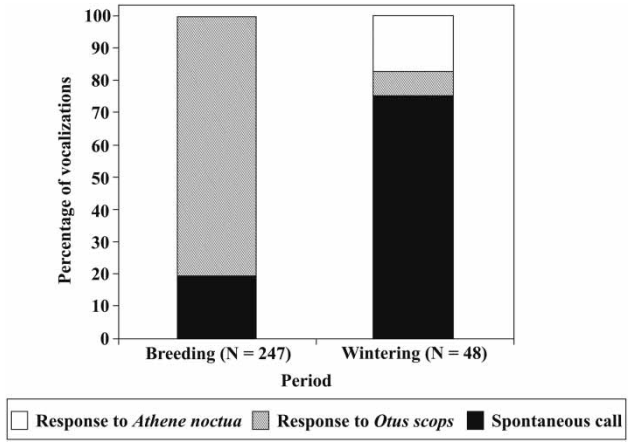

Figure 1. Percentages of spontaneous and induced calls by Scops Owls during the breeding ($n = 247$ vocalizations) and the wintering periods ($n = 48$ vocalizations). Responses to Little Owl calls occurred only during the winter.

During the winter, the use of broadcast conspecific calls seemed not to enhance the detectability of Eurasian Scops Owls. In 16.4% of cases, wintering Scops Owls responded to broadcast calls of Little Owl. This behaviour has been observed also in Southern Italy (Martina Franca, Apulia: G. Chiatante, pers. comm.),

Table 1. Variables influencing spontaneous calls and responses to playback call by conspecifics, in Scops Owls, estimated through generalized linear mixed models, with Poisson errors (response variables: *n* stations with spontaneous call per night or responses to playback calls by conspecific per night).

Model	Variable	*B*	se	*P*
Spontaneous call	Moon phase (2)	0.44	0.27	0.11
	Moon phase (3)	0.67	0.29	0.020
	Moon phase (4)	0.74	0.28	0.007
	Breeding period (no)	−0.49	0.59	<0.001
	Intercept	3.8	0.6	<0.001
Response to conspecific playback	Breeding period (no)	−3.1	0.4	<0.001
	Wind (1)	0.38	0.19	0.041
	Wind (3)	−0.19	0.26	0.46
	Wind (4)	−0.99	0.52	0.058
	Intercept	4.1	0.5	<0.001

Note: Minimum adequate models are shown. Global models included the effects of wind and weather (spontaneous calls), moon phase and weather (response to playback calls).

where the Scops Owl is also a regular wintering species. During the winter, Eurasian Scops Owls are hard to detect because of their low density, which may result in a decrease in territoriality, and so their response to broadcast calls. Parejo *et al.* (2012) suggested a preference by Scops Owls to breed where Little Owls are also present. Little Owls prefer to settle in territories where conspecific have already settled, because alarm calls may give information on the presence of predators, thus perhaps reducing predation risk (Parejo *et al.* 2012). Scops Owls also have been reported to take advantage of this behaviour to breed in potentially safer territories, as indicated by Little Owls' calls, but Zuberogoitia *et al.* (2005) and Parejo *et al.* (2012) considered this behaviour only in the breeding season.

The phase of the moon also played a key role in the emission of spontaneous calls and this may be due to intra-guild predation risk on the small body sized and so particularly vulnerable Scops Owl. Differences in body size may lead to strong interspecific dominance hierarchies, resulting in larger members of the guild dominating the smaller ones (Koenig 1973, Lourenço *et al.* 2011), thus developing a sort of temporal partitioning to reduce dangerous encounters with intra-guild predators (cf. Sih 1987, Penteriani *et al.* 2013). Large nocturnal raptors are reported to call more in conditions of bright light availability (Kotler *et al.* 1991, Longland & Price 1991, Penteriani *et al.* 2010, but see also Martín 1990), with small species possibly relegated to calling on darker nights. However, the probability of a spontaneous call by Scops Owls was significantly higher on brighter nights with moon in phases 3–4. Intra-guild competition with Tawny Owls, reported as a potential predator of Scops Owls (Cramp & Simmons 1980), may not therefore affect the activity rhythms of the smaller species.

The conservation status of European Scops Owls necessarily requires the application of suitable monitoring programmes. This species is nocturnal and criptically coloured, which makes its observation difficult, particularly during the night. During daylight, its detection in roosting areas is rare as well. Therefore, auditory surveys play a pivotal role in assessing the presence and distribution of this nocturnal raptor. During the breeding season, the recording of spontaneous calls and replies to playback of conspecific calls represent effective techniques to detect the presence of Scops Owls. Conversely, during the cold months, when the density of Scops Owls is lower (Vannini *et al.* 2013) and individuals do not show territorial behaviour (Elgood *et al.* 1966), playback of conspecific is not effective (cf. Zuberogoitia & Campos 1998). Outside the breeding period, the best method to detect Scops Owls seems to be the recording of spontaneous calls, mainly during bright nights, possibly with the stimulus of a broadcast call of Little Owls.

ACKNOWLEDGEMENTS

We would like to thank Luca Puglisi, and the volunteers who helped us during the survey. Gianpasquale Chiatante provided us with useful unpublished data about wintering Scops Owls in Apulia (Southern Italy). Gary Ritchinson improved our manuscript with suitable recommendations. We are grateful to Vincenzo Penteriani, to the Editor and to two anonymous reviewers, for improving earlier drafts of our MS.

REFERENCES

Appleby, B.M. & Redpath, S.M. 1997. Indicators of male quality in the hoots of Tawny Owls (*Strix aluco*). *J. Raptor Res.* **31**: 65–70.

BirdLife International. (ed.) 2004. *Birds in the European Union: A Status Assessment*. BirdLife International Press, Wageningen.

Brichetti, P. & Fracasso, G. (eds) 2006. *Ornitologia Italiana*, Vol. 3. Stercorariidae-Caprimulgidae. Alberto Perdisa Eds., Bologna.

Cantini, M., Menchetti, M., Vannini, A., Bruni, G., Borri, B. & Mori, E. 2013. Checklist of amphibians and reptiles in a hilly area of Southern Tuscany (Central Italy): an update. *Herp. Notes* **6**: 223–228.

Cramp, S. (ed.) 1985. *The Birds of the Western Palearctic*, Vol. 4. Oxford University Press, Oxford.

Cramp, S. & Simmons, K.E.L. (ed.) 1980. *The Birds of the Western Palearctic*, Vol. 2. Oxford University Press, Oxford.

Crawley, M. (ed.) 2007. *The R Book*. Wiley Editors, Chichester.

Crozier, M.L., Seamans, M.E. & Gutierrez, R.J. 2005. The effect of broadcasting Great Horned Owl vocalizations on spotted owl vocal responsiveness. *J. Raptor Res.* **39**: 111–118.

Currie, D., Millett, J., Hill, M. & Shah, N.J. 2002. Factors affecting the response of Seychelles Scops-Owl *Otus insularis* to playback of conspecific calls: consequences for monitoring and management. *Bird. Cons. Int.* **12**: 353–364.

Di Bitetti, M.S., Paviolo, A. & De Angelo, C. 2006. Density, habitat use and activity patterns of Ocelots (*Leopardus pardalis*) in the Atlantic Forest of Misiones, Argentina. *J. Zool. Lond.* **270**: 153–163.

Dragonetti, M. 2007. Individuality in Scops Owl *Otus scops* vocalizations. *Bioacustics* **16**: 147–172.

Elgood, J.H., Sharland, R.E. & Bauer, K.M. 1966. Palearctic migrants in Nigeria. *Ibis* **108**: 84–116.

Elzinga, C.L., Salzer, D.W., Willoughby, J.W. & Gibbs, D.P. 2001. *Monitoring Plant and Animal Populations*. Blackwell Scientific Publications Eds., Abingdon.

Fuller, M.R. & Mosher, J.A. 1981. Methods of detecting and counting raptors. *Stud. Avian Biol.* **6**: 235–246.

Galeotti, P., Sacchi, R. & Perani, E. 1997. Cooperative defense and intrasexual aggression in scops owls (*Otus scops*): responses to playback of male and female calls. *J. Raptor Res.* **31**: 353–357.

Gerhardt, R.P. 1991. Response of mottled owls to broadcast of conspecific call. *J. Field Ornith.* **62**: 239–244.

Haug, E. & Didiuk, A. 1993. Use of recorded calls to detect burrowing owls. *J. Field Ornithol.* **64**: 188–194.

Herter, D.R. & Hicks, L.L. 2000. Barred Owl and Spotted Owl populations and habitat in the central Cascade Range of Washington. *J. Raptor Res*. **34**: 279–286.

Kavanagh, R.P. & Peake, P. 1993. Survey procedures for nocturnal forest birds: an evaluation of variability in census due to temporal factors, weather and technique. In Olsen, P. (ed.) *Australian Raptor Studies*, 86–100. Australasian Raptor Association. RAOU, Melbourne.

Koenig, L. 1973. Das Aktionssystem der Zwergohreule Otus scops scops (Linnè 1758). Fortschritte der Verhaltensforschung Verlag Paul Parey, Berlin and Hamburg, Germany. *Adv. Ethol*. **13**: 1–124.

Kotler, B.P., Brown, J.S. & Hasson, O. 1991. Factors affecting gerbil foraging behavior and rates of owl predation. *Ecology* **72**: 2249–2260.

Krofel, M. 2008. Survey of scops owl, *Otus scops* on the high karst grasslands of Sneznik plateau (Southern Slovenia). *Acrocephalus* **29**: 33–37.

Lane, W.H., Andersen, D.E. & Nicholls, T.H. 2001. Distribution, abundance and habitat use of singing male Boreal owls in Northeast Minnesota. *J. Raptor Res*. **35**: 130–140.

Laurenti, S. 1987. Nota su alcune notevoli presenze avifaunistiche nell'Italia centrale. *Uccelli d'Italia* **12**: 72–75.

Longland, W.S. & Price, M.V. 1991. Direct observations of owls and heteromyid rodents—can predation risk explain microhabitat use? *Ecology* **72**: 2261–2273.

Lourenço, R., Penteriani, V., Delgado, M.M., Marchi-Bartolozzi, M. & Rabaça, E. 2011. Kill before being killed: an experimental approach supports the predator-removal hypothesis as a determinant of intraguild predation in top predators. *Behav. Ecol. Sociobiol*. **65**: 1709–1714.

Mañez, M. 1994. Scops Owl *Otus scops*. In Tucker, G.M. & Heath, M.F. (eds) *Birds in Europe; Their Conservation Status*, 325–326. BirdLife Conservation Series 3, Cambridge.

Marchesi, L. & Sergio, F. 2005. Distribution, density, diet and productivity of the Scops Owl *Otus scops* in the Italian Alps. *Ibis* **147**: 176–187.

Martín, G. 1990. *Birds by Night*. T & AD Poyser. London.

Martìnez, J.A. & Zuberogoitia, I. 2002. Factors affecting the vocal behaviour of Eagle Owls (*Bubo bubo*): effects of sex and territorial status. *Ardeola* **49**: 1–10.

Martìnez, J.A. & Zuberogoitia, I. 2004. Effects of habitat loss on perceived and actual abundance of the Little Owl (*Athene noctua*) in eastern Spain. *Ardeola* **51**: 215–219.

Martìnez, J.A., Zuberogoitia, I., Colàs, J. & Macìa, J. 2002. Use of recorder calls for detecting Long-eared owls *Asio otus*. *Ardeola* **49**: 97–101.

Navarro, J., Minguez, E., Garcìa, D., Villacorta, C., Botella, F., Sanchèz-Zapata, J.A., Carrete, M. & Gimènez, A. 2005. Differential effectiveness of playbacks for Little owls (*Athene noctua*) surveys before and after sunset. *J. Raptor Res*. **39**: 457–461.

Parejo, D., Avilès, J.M. & Rodrìguez, J. 2012. Alarm calls modulate the spatial structure of a breeding owl community. *Proc. R. Soc. B*. **279**: 2135–2141.

Penteriani, V., Delgado, M.M., Campioni, L. & Lourenço, R. 2010. Moonlight makes owls more chatty. *PLoS One* 5(1): e8696. doi:10.1371/journal.pone.0008696.

Penteriani, V., Kuparinen, A., Delgado, M.M., Palomares, F., Lòpez-Bao, J.V., Fedriani, J.M., Calzada, J., Moreno, S., Villafuerte, R., Campioni, L. & Lourenço, R. 2013. Responses of a top and a meso-predator and their prey to moon phases. *Oecologia*. doi 10.1007/s00442-013-2651-6.

Proudfoot, G.A., Beasom, S.L., Cahvez-Ramirez, F. & Mays, J.L. 2002. Response distance of ferruginous pigmy-owls to broadcasted conspecific calls. *J. Raptor Res*. **39**: 457–461.

Redpath, S.M. 1994. Censusing Tawny Owls (*Strix aluco*) by the use of imitation calls. *Bird Study* **41**: 192–198.

Ritchinson, G., Cavanagh, P.M., Belthoff, J.R. & Sparks, E.J. 1988. The singing behavior of Eastern Screech-Owls: seasonal timing and response to playback of conspecific song. *Condor* **90**: 648–652.

Rohner, C. 1997. Non-territorial floaters in Great-horned owls (*Bubo virginianus*). In Duncan, J.R., Johnson, D.H. & Nicholls, T.H. (eds) *Biology and Conservation of Owls in the Northern Hemisphere*, 347–362. Second International Symposium, Winnipeg.

Samwald, F. & Samwald, O. 1992. Brutverbreitung und Bestandsentwicklung der Zwergohreule (*Otus scops*) in der Steiermark. *Egretta* **35**: 37–48.

Sih, A. 1987. Predators and prey lifestyles: an evolutionary and ecological overview. In Kerfoot, W.C. & Sih, A. (eds) *Predation: Direct and Indirect Impacts on Aquatic Communities*, 203–224. University of New England Press, Lebanon.

Spina, F. & Volponi, S. 2008. *Atlante della Migrazione degli Uccelli in Italia. 1. non-Passeriformi*. Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA). Tipografia CSR-Roma, Italy.

Takats, D.L., Francis, C.M., Holroyd, G.L., Duncan, J.R., Mazur, K. M., Cannings, R.J., Harris, W. & Holt, D. 2001. *Guidelines for Nocturnal Owl Monitoring in North America*. Beaverhill Bird Observatory and Bird Studies Canada, Edmonton.

Tellini Florenzano, G., Arcamone, E., Baccetti, N., Meschini, E. & Sposimo, P. 1997. Atlante degli Uccelli nidificanti e svernanti in Toscana (1982–1992). *Quad. Mus. St. Nat. Livorno* **1**: 173.

Van Der Weyden, W.J. 1975. Scops and screech owls: vocal evidence for a basic subdivision in the genus *Otus* (Strigidae). *Ardea* **63**: 65–77.

Vannini, A., Menchetti, M. & Mori, E. 2013. L'avifauna del SIC 'Poggi di Prata' (Grosseto, Italia Centrale): analisi faunistica, quantitativa e considerazioni sulla gestione ambientale del sito. *Alula* **20**: 101–112.

Zuberogoitia, I. & Campos, L.F. 1998. Censusing owls in large areas: a comparison between methods. *Ardeola* **45**: 47–53.

Zuberogoitia, I., Martìnez, J.A. & Zabala, J. 2005. Interspecific aggression and nest-site competition in a European owl community. *J. Raptor Res*. **39**: 156–159.

Zuberogoitia, I., Martínez, J.A. & Alonso, R. 2011. Censusing owls. Some considerations to achieve better results. In Zuberogoitia, I. & Martínez, J.E. (eds) *Ecology and Conservation of European Forest-Dwelling Raptors*, 137–145. Diputación Foral de Bizkaia, Bilbao.