



## Spotless starlings rely on public information while visiting conspecific nests: an experiment

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Animals may acquire information on potential breeding sites by prospecting, which allows future optimal selection of breeding territories. The reproductive success of conspecifics, as public information (PI), has been proposed as one of the cues that prospectors could gather and then use for future reproductive decisions. We experimentally decreased brood size in spotless starling nests to investigate whether this species gathers PI while visiting conspecific nests. We expected visiting frequency to decline with the experimental decrease in brood size because visitors are expected to prefer sites with high reproductive success and to spend more time at those sites to gain familiarity. Furthermore, the effect of the experimental manipulation was recorded at three different stages of the nestling period to establish the importance of the reliability of PI. Brood size decreased in direct relation to the manipulation and, consequently, parental feeding rates decreased too. Visiting frequency of starlings to conspecific nests was affected by the interaction between the experimental manipulation and the stage in the nestling period: visiting frequency increased from decreased to control nests at the end of the nestling period, not so strongly in the middle of that period and it was not affected by the manipulation at the beginning of it. This variation in visiting frequency seemed to be better explained by brood size than by parental provisioning rate. These results may be interpreted as spotless starlings visiting conspecific nests to gather PI, which seems to increase its informative value when its reliability does.

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Information derived from the performance of conspecifics, which is known as public information (PI hereafter; Valone & Templeton 2002), has recently received increased interest because gathering information from others to assess resource (e.g. mates, habitat) quality may have important implications in ecological and evolutionary theories (see review in Danchin et al. 2004). In a context of breeding-habitat selection, variables related to fitness should, at least partially, reflect habitat quality. These variables offer reliable information because individuals are selected to maximize reproductive success and then they cannot be falsified by breeders but can be observed by other individuals. Moreover, personal (sensu

Danchin et al. 2004) inspection of habitat characteristics that potentially affect breeding success would, in general, be more costly than gathering information related to fitness from PI. Therefore, the use of traits related to performance of conspecifics for reproductive decisions should be widespread in nature.

The process by which animals acquire information on potential breeding patches or sites is called prospecting (Reed et al. 1999). This behaviour could affect not only selection of potential patches for future reproduction (Pärt & Doligez 2003), but also future reproductive success (e.g. Schjorring et al. 1999; Cam et al. 2002) and population dynamics of the prospector species (Reed & Dobson 1993). Prospecting, although most frequently described in birds, is widespread among different animal taxa, such as marine invertebrates, fish, birds, and mammals (Reed et al. 1999). This behaviour may be linked to the gathering of PI when prospectors get information on the reproductive success of conspecifics, not only in terms of number of nestlings or fledglings, but also in terms of variables related to

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offspring performance, which provides reliable estimates of environment suitability and quality for breeding (Danchin et al. 1998). Complementary or alternatively to PI, any information reliably predicting future local reproductive success is likely to be attractive to prospectors. Informative cues may include physical characteristics of the breeding-habitat (Orians & Wittenberger 1991), food availability (Brown & Brown 1996), presence of parasites (Boulinier et al. 2001) and predators (Pöysä 1999; Pöysä 2003) or, simply, presence of conspecifics (Stamps 1988; Müller et al. 1997) or heterospecifics (Monkkönen et al. 1990). Therefore, although evidence of individuals visiting nests of others is abundant in the literature, visiting could have motives other than gathering PI.

Whenever visitors gather public information to assess patch or site quality for future breeding-habitat choice, they should be attracted to, and spend more time at, successful patches or sites (Doligez et al. 2004). This could not be the result of bird curiosity, for instance, because in this case visitors should be attracted to all patches or sites equally. Thus, empirical studies that have found a positive relationship between visiting frequency and local reproductive success in several bird species provide evidence of prospecting to gather PI (e.g. Schjorring et al. 1999; Ottosson et al. 2001; Doligez et al. 2004; Ward 2005; Piper et al. 2006; Pöysä 2006). However, correlations cannot support the use of PI because cues providing PI such as brood size, feeding rates, etc. are likely to be correlated with other different cues indicating habitat quality (Doligez et al. 2002; Valone & Templeton 2002). Thus, for a distinction between the effects of conspecific PI and some other correlated habitat characteristic, experimental manipulation of traits related to reproductive performance (as PI) is necessary. Up until now, only one study in the collared flycatcher *Ficedula albicollis* has experimentally shown a link between prospecting and a variable that belongs to PI (Pärt & Doligez 2003). Briefly, Pärt & Doligez (2003) showed that prospectors were more common at nests with experimentally increased brood size, probably because brood size and adult feeding visits were positively related and parental feeding rate predicted subsequent fledgling production. More importantly, the year following the experimental manipulation of PI, prospectors bred close to the most frequently prospected site the year before. Hence, a link between probability of prospecting and selection of breeding site for the next breeding season can be established. Consequently, the detection of a relation between experimentally manipulated variables related to breeding success and frequency of visitors at the nest might be considered evidence of the interest of the manipulated variable as a cue to be gathered by animals during prospecting.

The spotless starling *Sturnus unicolor* is a resident medium-sized, long-lived colonial passerine (Moreno et al. 1999; Veiga et al. 2002). Inspections of nest contents of conspecifics have not yet been described in this species. However, for the closely related European starling *Sturnus vulgaris* there is profuse evidence of visiting active nests by conspecifics (Sandell & Diemer 1999; Tobler & Smith 2004). These visits were more common during the nestling than during the incubation period and visitors

seemed to use the gathered information for selection of breeding sites during the following breeding season (Tobler & Smith 2004). We detected a high frequency of visits in nests of spotless starlings and thus we decided to investigate whether the function of this behaviour was to gather PI. To test this hypothesis, we manipulated PI, by decreasing brood size in nests, which removes the natural correlation between reproductive success and habitat characteristics reflecting quality. We chose this manipulation, instead of increasing brood sizes, because during the nestling period, enlarged broods may be constrained by resource availability. Indeed, increased nests with many added chicks would more probably suffer chick mortality under poor environmental conditions than nests with reduced brood sizes, which would render public information less stable throughout the nestling period in increased nests. Furthermore, we measured visiting during three different stages of the nestling period to explore manipulation-effect variation in relation to nestling age. Briefly, we first tested the effectiveness of our manipulations on brood size and parental provisioning rate, variables that provide PI. Afterwards, we tested the following general predictions from the hypothesis of gathering of PI as a function of visiting behaviour: (1) frequency of nest visiting should decrease with the experimental decrease in brood size because familiarity with the area before settlement may affect breeding success (Cadiou et al. 1994; Pärt 1994) and thus visitors are expected to spend more time at the chosen sites; and (2) because reliability of the information provided by brood size or parental feeding rates at a nest increases with nestling age, the expected effect of our experiment should increase over the nestling period.

## METHODS

### Study System

The study was carried out in Guadix (37°18'N, 3°11'W), south-eastern Spain, during the breeding season of 2006, in nestboxes installed either at the beginning of 2005 or 2006 years close or within colonies of spotless starlings already established in old buildings in the area.

The spotless starling is a medium-sized, hole-nesting and facultative polygynous passerine (Veiga et al. 2001). Males choose nest sites and try to attract females to them (Cramp 1998), being thus the females who choose the males. Incubation, which takes around 14 days, is done mainly by the females, whereas parental care is provided by both members of the pair (Cramp 1998; Veiga et al. 2002). The nestling period lasts approximately 21–22 days (Cramp 1998).

Adults were captured before or during nest building in traps placed in nestboxes. Then, they were ringed with an aluminium ring and a unique combination of three colour rings. Sexes were distinguished by morphological traits. Nestboxes were visited regularly from nest building to fledging to determine reproductive parameters. Mean clutch size  $\pm$  SE in the study area was  $4.82 \pm 0.10$  eggs ( $N = 68$  nests). Brood-size manipulation was carried out

by removing from 1 to 4 nestlings from experimental nests when chicks were 1–2 days old. Thus, we created brood sizes deviating from their original sizes by  $-4$  ( $N = 6$  nests),  $-3$  ( $N = 17$  nests),  $-2$  ( $N = 18$  nests),  $-1$  ( $N = 10$  nests) and  $0$  ( $N = 17$  nests) nestlings. Experimental and control nests were disturbed equally as control nests were also visited at the beginning of the nestling period to monitor chick hatching. Nests were randomly assigned to treatments (decreased or control) throughout the breeding season. Therefore, laying dates did not differ among manipulation categories (one-way ANOVA:  $F_{4,63} = 1.61$ ,  $P = 0.18$ ). Removed nestlings were added to a set of nests allocated to another experiment in which all eggs had been removed and replaced with artificial model eggs to avoid abandonment.

Provisioning behaviour of parents was monitored three times in each nest over the nestling period. This corresponded to nestling ages of approximately 4 (mean  $\pm$  SD:  $4.1 \pm 1.3$  days,  $N = 66$  nests), 9 ( $8.9 \pm 1.8$  days,  $N = 58$  nests), and 15 ( $15.1 \pm 1.4$  days,  $N = 50$  nests) days old. Differences in the number of observations carried out at different nests were due to predation. All observations were carried out during the morning (i.e. 0800–1200 hours). Parental visits were recorded for periods of approximately 1 h ( $59.8 \pm 3.4$  min,  $N = 174$ ) either by direct observation of nests with telescopes (from hideouts or cars), or by video cameras placed several metres away from the targeted nestbox. For each observation, we calculated the parental provisioning rate as the number of parental feeding visits/h. Also, for each observation, we identified conspecifics' visits and the sex of visitors. We considered a bird to be a visitor of a nest when it was an extrapair individual that looked inside or entered the nestbox within the 1-h period of observation. Extrapair individuals were identified either by colour rings, by the simultaneous presence of more than two individuals at the nestbox, or by the detection of nonringed individuals at a nest that do not provide parental care (i.e. feeding or removing faecal sacs).

Experimental procedures were licenced by the 'Consejería de Medio Ambiente, Dirección General de Gestión del Medio Natural de la Junta de Andalucía'. Traps consisted of a net around a flexible wire circumference that we fitted inside the nest hole to retain the bird when it entered the nestbox. Only a maximum of five traps were put simultaneously in neighbouring nestboxes to allow us to record all movements around them and then to remove birds from traps immediately. In no case were birds damaged by the capture. During days with good weather, traps were installed from the sunrise to 3 h before sunset to avoid manipulating birds during the night. We did not capture them on days with bad weather such as rainy or very cold days. Our experiment, as well as the visitation rate of nests, did not cause nest desertion, that is, no single nest either from the manipulated or control group was deserted. For the experiment, nestlings were transported in small boxes having the inside covered with cotton. The transport of nestlings between nests took no more than half an hour and this manipulation seemed not to cause any adverse effect on nestlings because the mortality rate of manipulated and control nests throughout the nestling period did not differ (total nestlings died throughout

the nestling period = 17 (experimental: 10 out of 117 nestlings, control: seven out of 87 nestlings), chi-square with Yates correction = 0.02,  $df = 1$ ,  $P = 0.9061$ ). Moreover, no chick died during transportation. Therefore, our study did not affect starling welfare.

## Statistical Analyses

Analyses were carried out using SAS statistical software (SAS 2001 Institute Inc., Cary, NC, U.S.A.). We first tested the effect of the brood-size manipulation on brood size and parental provisioning rates at different observation times (see above). A one-way ANOVA model (GLM SAS procedure) was performed to test the effect of the brood-size manipulation on brood size at nests. The effect of the manipulation on parental provisioning rate was analysed by using a linear mixed model (LMM, MIXED SAS procedure) in which we introduced the nest as a random factor to account for the fact that different behavioural observations focused on the same nest are not independent.

As response variables of our experimental manipulation, we used the probability of each nest to be visited by visitors as a binary variable (visited = 1 versus non-visited = 0) and the visiting frequency as the number of visits/h.

The effects of the nesting stage and the brood-size manipulation on probability of visiting were studied by performing a generalized linear mixed model with logistic link function and binomial distribution (GLMM, SAS Macro program GLIMMIX). Moreover, we used a linear mixed model (LMM, MIXED SAS procedure) to test the effect of experimental manipulation on frequency of visiting. In the two analyses, the nest was introduced as a random factor to account for the fact that behavioural observations focused on the same nest are not independent. Even when we have ordered expectations for both the nesting stage and the brood-size manipulation, we used nondirectional tests and thus fitted these two variables as categorical because this structure provided us with lower AIC than the alternative (with these two variables as continuous effects).

We also used a LMM (MIXED SAS procedure) to test the effects of the nesting stage and the brood size, on the one hand, and of the nesting stage and the parental provisioning rate, on the other hand, on visiting frequency after statistically controlling for the random effect of the nest. Possible models with these three independent variables explaining visiting frequency were compared by using their Akaike information criteria (AIC) values.

We tested if the probability of a nestbox to be occupied in year  $t$  was affected by the year in which the nestbox was installed (year  $t$  versus year  $t - 1$ ) by means of a logistic regression model (GENMOD SAS procedure). This aimed to assess whether starlings inspect and/or locate nest sites during a season to use them the next one.

Model selection was carried out by removing, one by one, the effects that were furthest from statistical significance, starting with the highest-order interactions down to the main effects.

## RESULTS

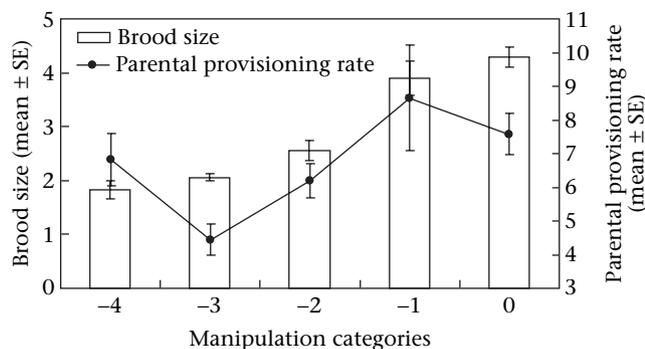
## Effectiveness of Nest–Brood-Size Manipulations

Brood-size manipulation significantly affected the brood size of nests at the time of observations (ANOVA:  $F_{4,63} = 32.56$ ,  $P < 0.0001$ ): brood size decreased gradually from the 0 control to the -4 category (Fig. 1). Consequently, the frequency of parental feeding visits significantly decreased with the manipulation (LMM:  $F_{4,106} = 2.43$ ,  $P = 0.05$ ; Fig. 1) once we controlled for the random effect of the nest ( $Z = 3.91$ ,  $P < 0.0001$ ). Thus, our experiment was effective in reducing not only brood size, but also the parental provisioning rate to nests.

## Effect of the Manipulation on Visiting

We detected 96 visits during observations at 68 nests; 79.2% of visitors were males. Most individuals providing parental care at the nests (70.43% of 115 breeders: 53 males and 62 females) and juveniles born in the area during the 2005 breeding season were colour-ringed, however, most visitors were unmarked, suggesting that they may be nonbreeding individuals or birds breeding in places other than nestboxes in the study area. We identified two visitors that were known (ringed) as breeders. Both were females and, while one was detected after failing its own reproduction, the other visited a conspecific nest during the raising of her own chicks.

The probability of each nestbox to be visited was independent of the experimental manipulation (LMM:  $F_{4,104} = 0.63$ ,  $P = 0.64$ ) once controlled for the random effect of the nest ( $Z = 1.61$ ,  $P = 0.05$ ). This probability was affected only by the nesting stage ( $F_{2,104} = 16.20$ ,  $P < 0.0001$ ), in such a way that the probability of observing a visitor in a nest increased with the age of the chicks being raised in the nest. Finally, the interaction between the nesting stage and the manipulation did not affect the probability of visiting either ( $F_{8,96} = 0.64$ ,  $P = 0.74$ ). This lack of effect of the brood-size manipulation could indicate that visitors may first visit conspecific nests at random and, afterwards, they may repeat the visit at the most successful nests. Therefore, we tested this by analysing whether the



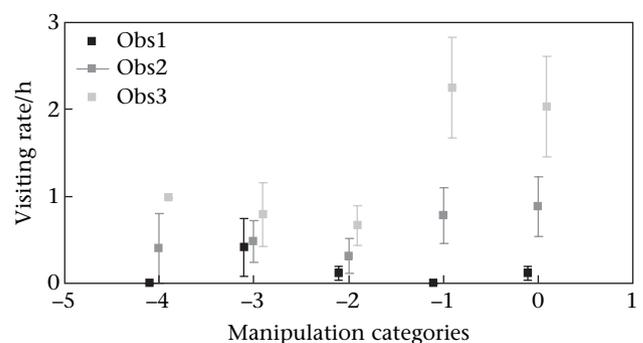
**Figure 1.** Brood size and parental provisioning rate (mean  $\pm$  SE) of the experimentally reduced and control spotless starling nests. Experimental manipulation consisted on the removal of 0, 1, 2, 3 or 4 hatchlings.

probability of visited nests at the two earlier nesting stages to be visited at a later stage was related to their success. We confirm this suggestion because the brood-size manipulation affected the probability of previously visited nestboxes to be revisited ( $\chi^2_3 = 9.13$ ,  $P = 0.028$ ,  $N = 18$  nests).

The visiting frequency, however, was affected by the interaction between the experimental manipulation and the nesting stage (LMM:  $F_{8,96} = 2.21$ ,  $P = 0.03$ ; Fig. 2) after accounting for the random effect of the nest ( $Z = 1.61$ ,  $P = 0.05$ ). The visiting frequency decreased with the manipulation mainly at the end of the nestling period but this relation was not so strong in the middle of that period and even not true at the beginning of it (Fig. 2). A model including brood size was better (AIC = 482.8) at predicting the visiting frequency than was the model including the parental feeding rate (AIC = 502.5). Hence, the negative effect of the brood size manipulation on visiting frequency seemed to be caused more by differences in brood size than by differences in parental feeding rate among the different manipulation categories. This first model showed that the visiting frequency was related to the interactive effect of the brood size at the nest with the nesting stage (GLMM:  $F_{1,103} = 24.93$ ,  $P < 0.0001$ ) after accounting for the random effect of the nest ( $Z = 1.39$ ,  $P = 0.08$ ). The model that included parental feeding rate also showed an interactive effect of parental feeding rate at the nest with the nesting stage ( $F_{1,103} = 21.46$ ,  $P < 0.0001$ ) after accounting for the random effect of the nest ( $Z = 1.37$ ,  $P = 0.08$ ). Moreover, a model testing simultaneously the effects of brood size and parental provisioning rate on visiting frequency only during the last nestling period revealed that the brood size had a stronger effect (multiple regression: partial correlation coefficient  $\pm$  SE =  $0.39 \pm 0.15$ ,  $t = 2.63$ ,  $P = 0.01$ ) than did the parental provisioning rate (multiple regression: partial correlation coefficient  $\pm$  SE =  $0.28 \pm 0.15$ ,  $t = 1.88$ ,  $P = 0.07$ ) on visiting frequency. Nevertheless, it should be noted that measurement error of parental feeding rate is likely to be markedly higher than that of brood size and consequently that this could affect the fit of the statistical models presented here.

## Nestbox Occupation

The probability of a nestbox to be used by a starling to breed during 2006 was explained by the year of



**Figure 2.** Visiting rate/h (mean  $\pm$  SE) for each observation in experimentally reduced and control spotless starling nests. Experimental manipulation consisted on the removal of 0, 1, 2, 3 or 4 hatchlings.

installation (logistic regression model: effect of the age of the nestbox as old or new:  $\chi^2 = 26.22$ ,  $P < 0.0001$ ,  $N = 122$ ). Actually, nestboxes installed during 2005 had a higher probability of being occupied in 2006 (mean  $\pm$  SE,  $N$ :  $0.74 \pm 0.063$ , 50) than nestboxes installed before the 2006 breeding season (mean  $\pm$  SE,  $N$ :  $0.28 \pm 0.05$ , 72).

## DISCUSSION

Our experiment shows a relation between the experimental manipulation on brood size and rate of visits by conspecific spotless starlings. These visits could be interpreted as prospecting to gather conspecific PI for future reproductive decisions. In addition, we detected that nestling age (i.e. nesting stage) was one important predictor of both probability and frequency of visiting, in accordance with the hypothesis that the reliability of the information influences the interest of gathering PI. This is because our experiment of decreasing brood size of nests led to a decline in the visiting frequency whenever chicks were more than 8 days old, when the reliability of PI increases.

The experimental manipulation did not affect the visiting probability and, regardless of the manipulation, each nest underwent the same chance of being visited. However, nests visited at an early stage had more probability to be revisited later if they were successful than unsuccessful. This result agrees with prospecting rate being similar among experimental treatments at the beginning, but not at the end of the nestling period. This possibility is feasible because spotless starlings are colonial species with nests very close to each other where frequency of nest visiting is quite high (54% in our population).

The effects of our experimental manipulation on visiting frequency could be explained by either brood size or parental provisioning rates detected during observations. Both variables were affected by the experimental manipulation performed, which resulted in brood size and parental provisioning rate decreasing from control nests to those with the stronger manipulation (four hatchlings removed). However, brood size seems to be the important cue gathered during visiting: first, the statistical model that considered brood size explained the variation in visiting frequency better than did the model that included the parental provisioning rate. Second, in a statistical model that included both variables, the visiting frequency at the end of the nestling period was explained mainly by brood size. Finally, all visitors entered nestboxes during inspection. This risky behaviour would not be needed if parental feeding rate was the cue gathered because this activity can be observed from a distance. There are at least two possible mechanisms by which visitors may detect larger broods: (1) by visiting the maximum possible number of nests at the beginning of the nestling period and then remembering nests with large broods to be revisited; and (2) by cueing on begging because in parental absence, spotless starling chicks indulge in begging and this behaviour increases with increasing brood size (E. Bulmer, P. Celis & D. Gil, personal comment). Alternatively, however, spotless

starlings could be interested in these two cues, brood size and parental provisioning rate, and gather this information in a hierarchical way. Therefore, we could imagine a scenario in which visitors first cued on parental provisioning rate to detect more successful nests and then visited nests to confirm the previously acquired information. In any case, it is likely that brood size predicts better reproductive success of birds at each nest location than parental provisioning rate because the latter may be highly variable through time, depending on fluctuations in food availability or in response to predation risk (Martin et al. 2000).

Our experimental manipulation was performed randomly after hatching and, thus, variation in visits cannot be explained by either extrapair males or parasitic females with offspring within the experimental brood. Therefore, the most likely explanation to our experimental results is that visitors try to gather information on potential sites (nests or colonies) for the next breeding event. This possibility is in line with results from other studies showing that prospectors bred close to areas where they prospected during the previous season (e.g. Schjorring et al. 1999; Pärt & Doligez 2003; Dittmann et al. 2005; Pöysä 2006). We base this assertion on three different facts: (1) in our population, most prospectors were males and they choose nest sites; (2) nest visits occurred mainly at the end of the nestling period; (3) finally, but not less importantly, nestboxes installed during 2005 had a higher probability of being occupied in 2006 than nestboxes installed before the 2006 breeding season. It is clear that the longer a nestbox is exposed the higher the chance of being visited and then occupied. However, nestboxes installed and used during 2005, but not empty boxes in 2005 and boxes installed in 2006, could also provide with information on conspecific breeding performance. Nevertheless, visitors could alternatively or additionally be gathering information on potential mates for the next breeding season. It is possible that visitors evaluated potential mates for next breeding opportunities by using the reproductive success of their nests. However, this alternative is highly unlikely in this species because most visitors are males and in this polygynous species, the females choose the mates.

In summary, we found experimental evidence that brood size affects the rate of nest visiting by spotless starlings, which could be interpreted as evidence for the importance of prospecting to gather PI in this species.

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## References

- Boulinier, T., McCoy, K. D. & Sorci, G. 2001. Dispersal and parasitism. In: *Dispersal* (Ed. by J. Clobert, J. D. Nichols, E. Danchin & A. Dhondt), pp. 169–179. Oxford: Oxford University Press.
- Brown, C. R. & Brown, M. B. 1996. *Coloniality in the Cliff Swallow: The Effect of Group Size on Social Behaviour*. Chicago, Illinois: University of Chicago Press.
- Cadiou, B., Monnat, J. Y. & Danchin, E. 1994. Prospecting in the kittiwake, *Rissa tridactyla*: different behavioural patterns and the role of squatting in recruitment. *Animal Behaviour*, **47**, 847–856.
- Cam, E., Cadiou, B., Hines, J. E. & Monnat, J. Y. 2002. Influence of behavioural tactics on recruitment and reproductive trajectory in the kittiwake. *Journal of Applied Statistics*, **29**, 163–185.
- Cramp, S. 1998. *Cramp's the Complete Birds of the Western Palearctic*. Oxford: Optimedia, Oxford University Press.
- Danchin, E., Boulinier, T. & Massot, M. 1998. Conspecific reproductive success and breeding habitat selection: implications for the study of coloniality. *Ecology*, **79**, 2415–2428.
- Danchin, E., Giraldeau, L. A., Valone, T. J. & Wagner, R. H. 2004. Public information: from nosy neighbors to cultural evolution. *Science*, **305**, 487–491.
- Dittmann, T., Zinsmeister, D. & Becker, P. H. 2005. Dispersal decisions: common terns, *Sterna hirundo*, choose between colonies during prospecting. *Animal Behaviour*, **70**, 13–20.
- Doligez, B., Danchin, E. & Clobert, J. 2002. Public information and breeding habitat selection in a wild bird population. *Science*, **297**, 1168–1170.
- Doligez, B., Pärt, T. & Danchin, E. 2004. Prospecting in the collared flycatcher: gathering public information for future breeding habitat selection? *Animal Behaviour*, **67**, 457–466.
- Martin, T. E., Scott, J. & Menge, C. 2000. Nest predation increases with parental activity: separating nest site and parental activity effects. *Proceedings of the Royal Society of London, Series B*, **267**, 2287–2293.
- Monkkönen, M., Helle, P. & Soppela, K. 1990. Numerical and behavioural responses of migrant passerines to experimental manipulation of resident tits (*Parus* spp): heterospecific attraction in Northern breeding bird communities. *Oecologia*, **85**, 218–225.
- Moreno, J., Veiga, J. P., Cordero, P. J. & Mínguez, E. 1999. Effects of paternal care on reproductive success in the polygynous spotless starling *Sturnus unicolor*. *Behavioral Ecology and Sociobiology*, **47**, 47–53.
- Müller, K. L., Stamps, J. A., Krishnan, V. V. & Willist, N. H. 1997. The effects of conspecific attraction and habitat quality on habitat selection in territorial birds (*Troglodytes aedon*). *American Naturalist*, **150**, 650–661.
- Orians, G. H. & Wittenberger, J. F. 1991. Spatial and temporal scales in habitat selection. *American Naturalist*, **137**, S29–S49.
- Ottosson, U., Backman, J. & Smith, H. G. 2001. Nest-attenders in the pied flycatchers (*Ficedula hypoleuca*) during nestling rearing: a possible case of prospective resource exploitation. *Auk*, **118**, 1069–1072.
- Pärt, T. 1994. Male philopatry confers a mating advantage in the migratory collared flycatcher, *Ficedula albicollis*. *Animal Behaviour*, **48**, 401–409.
- Pärt, T. & Doligez, B. 2003. Gathering public information for habitat selection: prospecting birds cue on parental activity. *Proceedings of the Royal Society of London, Series B*, **270**, 1809–1813.
- Piper, W. H., Walcott, C., Mager, J. N., Perala, M., Tischler, K. B., Harrington, E., Turcotte, A. J., Schwabenlander, M. & Banfield, N. 2006. Prospecting in a solitary breeder: chick production elicits territorial intrusions in common loons. *Behavioral Ecology*, **17**, 881–888.
- Pöysä, H. 1999. Conspecific nest parasitism is associated with inequality in nest predation risk in the common goldeneye (*Bucephala clangula*). *Behavioral Ecology*, **10**, 533–540.
- Pöysä, H. 2003. Parasitic common goldeneye (*Bucephala clangula*) females lay preferentially in safe neighbourhoods. *Behavioral Ecology and Sociobiology*, **54**, 30–35.
- Pöysä, H. 2006. Public information and conspecific nest parasitism in goldeneyes: targeting safe nests by parasites. *Behavioral Ecology*, **17**, 459–465.
- Reed, J. M. & Dobson, A. P. 1993. Behavioral constraints and conservation biology: conspecific attraction and recruitment. *Trends in Ecology & Evolution*, **8**, 253–256.
- Reed, J. M., Boulinier, T., Danchin, E. & Oring, L. W. 1999. Informed dispersal: prospecting by birds for breeding sites. In: *Current Ornithology* (Ed. by V. Nolan Jr, et al.), pp. 189–259. New York: Kluwer Academic/Plenum Publishers.
- Sandell, M. I. & Diemer, M. 1999. Intraspecific brood parasitism: a strategy for floating females in the European starling. *Animal Behaviour*, **57**, 197–202.
- Schjorring, S., Gregersen, J. & Bregnballe, T. 1999. Prospecting enhances breeding success of first-time breeders in the great cormorant, *Phalacrocorax carbo sinensis*. *Animal Behaviour*, **57**, 647–654.
- Stamps, J. A. 1988. Conspecific attraction and aggregation in territorial species. *American Naturalist*, **131**, 329–347.
- Tobler, M. & Smith, H. G. 2004. Specific floater home ranges and prospective behaviour in the European starling, *Sturnus vulgaris*. *Naturwissenschaften*, **91**, 85–89.
- Valone, T. J. & Templeton, J. J. 2002. Public information for the assessment of quality: a widespread social phenomenon. *Philosophical Transactions of the Royal Society of London, Series B*, **357**, 1549–1557.
- Veiga, J. P., Moreno, J., Cordero, P. J. & Mínguez, E. 2001. Territory size and polygyny in the spotless starling: resource-holding potential or social inertia? *Canadian Journal of Zoology*, **79**, 1951–1956.
- Veiga, J. P., Moreno, J., Arenas, M. & Sánchez, S. 2002. Reproductive consequences for males of paternal vs territorial strategies in the polygynous spotless starling under variable ecological and social conditions. *Behaviour*, **139**, 677–693.
- Ward, M. P. 2005. Habitat selection by dispersing yellow-headed blackbirds: evidence of prospecting and the use of public information. *Oecologia*, **145**, 650–657.