

Automatized tracking of free-ranging wild song birds using the Encounternet

Marc Naguib and Lysanne Snijders

Behavioural Ecology Group, Wageningen University, Wageningen, The Netherlands

Understanding the ecology and evolution of animals requires fundamental insights into the decision making of individuals. Animal populations are characterized by individuals usually moving in space and time to explore and exploit resources, find partners, or escape predators. Thus many decisions they make have a spatial component, potentially affecting reproduction and survival. Decisions where to move when has implications for access to information about the environment and for encountering predators, potential mates and competitors and thus for the social dynamics. Yet, despite a profound understanding on selection pressures on animals, we still have very little information about individual spatial activities as it is very difficult to track free ranging animals over a prolonged period of time. Even though GPS devices can provide high accuracy tracking data, they are limited to larger animals. Also novel light-weight GPS tags are limited for continuous tracking, due to their (still) low battery life time (Wikelski *et al.* 2007). For small animals, radio-tracking has been a successful alternative as light weight senders can last for several weeks. Yet, radio tracking usually requires a person to follow a given individual and mark its locations at regular time intervals which is a time consuming expedition specifically for mobile small animals, such as songbirds (Naef-Daenzer 1994; Naguib *et al.* 2001; Amrhein *et al.* 2004; Roth *et al.* 2009).

Songbirds are a key model organism for research on the ecology and evolution of vertebrate behaviour. Studies on the song of the males as well as less variable traits, like colour ornaments have provided important insights into how selection acts on these traits and in many species reproductive success can be readily determined, allowing to link behaviour and life history traits to environmental factors and fitness. Yet, due to the difficulty of following individuals over prolonged periods of time, many of the behavioural mechanisms underlying fitness effects are not well understood. Where and when do individuals forage? How do they explore their environment and how are the spatial associations among neighbouring birds? Are females near males when these males sing, and if so, how long do they stay nearby and listen? Advances in understanding such questions require to follow individuals, at best, continuously in space and time, allowing to also determine individual's position within a social network (Croft *et al.* 2007).

By using the Encounternet (Burtsoft, Portland, Oregon), a state-of-the-art technology of digital radio tags (Mennill *et al.* 2012), combined with a grid of receivers placed at the study site we were able to collect unprecedented data on spatial movements of several individuals at the same time and their social connectivity in a natural population of wild great tits (*Parus major*). Great tits are resident, non-migratory songbirds. During their breeding season they are territorial, yet have large home ranges, encountering each other regularly (Hinde 1952). These novel tracking techniques allow to determine home ranges of many individuals simultaneously and to determine which individuals meet where and when.

In this presentation we will provide insights into the functioning of this tracking system and show data on spatial movements and social network structure of great tits.

References

Amrhein, V., Kunc, H. P. & Naguib, M. 2004. Non-territorial nightingales prospect territories during the dawn chorus. *Proceedings Royal Society B*, 271, S167-S169.

- Croft, D. P., James, R. & Krause, J. 2007. Exploring animal social networks. Princeton: Princeton University Press.
- Hinde, R. A. 1952. The behaviour of the great tit (*Parus major*) and some other related species. Behavioural Processes, 2, Supplement, 1-201.
- Mennill, D. J., Doucet, S. M., Ward, K. A. A., Maynard, D. F., Otis, B. & Burt, J. M. 2012. A novel digital telemetry system for tracking wild animals: a field test for studying mate choice in a lekking tropical bird. Methods in Ecology and Evolution, 3, 663-672.
- Naef-Daenzer, B. 1994. Radiotracking of great and blue tits: new tools to assess territoriality, home-range and resource distribution. Ardea, 82, 335-347.
- Naguib, M., Altenkamp, R. & Gießmann, B. 2001. Nightingales in space: song and extra-territorial forays of radio tagged song birds. Journal of Ornithology, 142, 306-312.
- Roth, T., Sprau, P., Schmidt, R., Naguib, M. & Amrhein, V. 2009. Sex-specific timing of mate searching and territory prospecting in the nightingale: nocturnal life of females. Proceedings Royal Society London B, 276, 2045-2050.
- Wikelski, M., Kays, R. W., Kasdin, N. J., Thorup, K., Smith, J. A. & Swenson, G. W., Jr. 2007. Going wild: what a global small-animal tracking system could do for experimental biologists. Journal of Experimental Biology, 210, 181-186.