

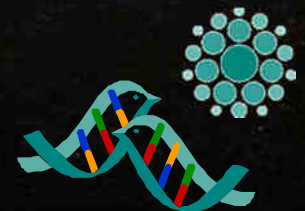
Artificial night lighting disrupts songbird reproductive behaviour

**Bart Kempenaers, Pernilla Borgström, Peter Loës,
Emmi Schlicht & Mihai Valcu**



MAX-PLANCK-GESellschaft

Max Planck Institute for Ornithology



Effects of light pollution on behaviour

- Effects on orientation, migration (birds, bats)

E.g. Stone et al (2009) Curr Biol



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- Effects on singing behaviour
Males start singing earlier

E.g. Miller (2006) Condor
but see Fuller et al. (2007) Biol Lett



Effects of light pollution on behaviour

- Effects on orientation, migration
(birds, bats)

E.g. Stone et al (2009) Curr Biol

- Effects on singing behaviour
Males start singing earlier

E.g. Miller (2006) Condor
but see Fuller et al. (2007) Biol Lett

- Effects on timing of reproduction
Females lay eggs earlier

E.g. Lambrechts et al (1997) PNAS



Effects of light pollution on behaviour ?



Fundamental to the biological clock

Light = Zeitgeber

—→ effects on circadian / circannual rhythms

Effects of street lights on breeding ecology of songbirds

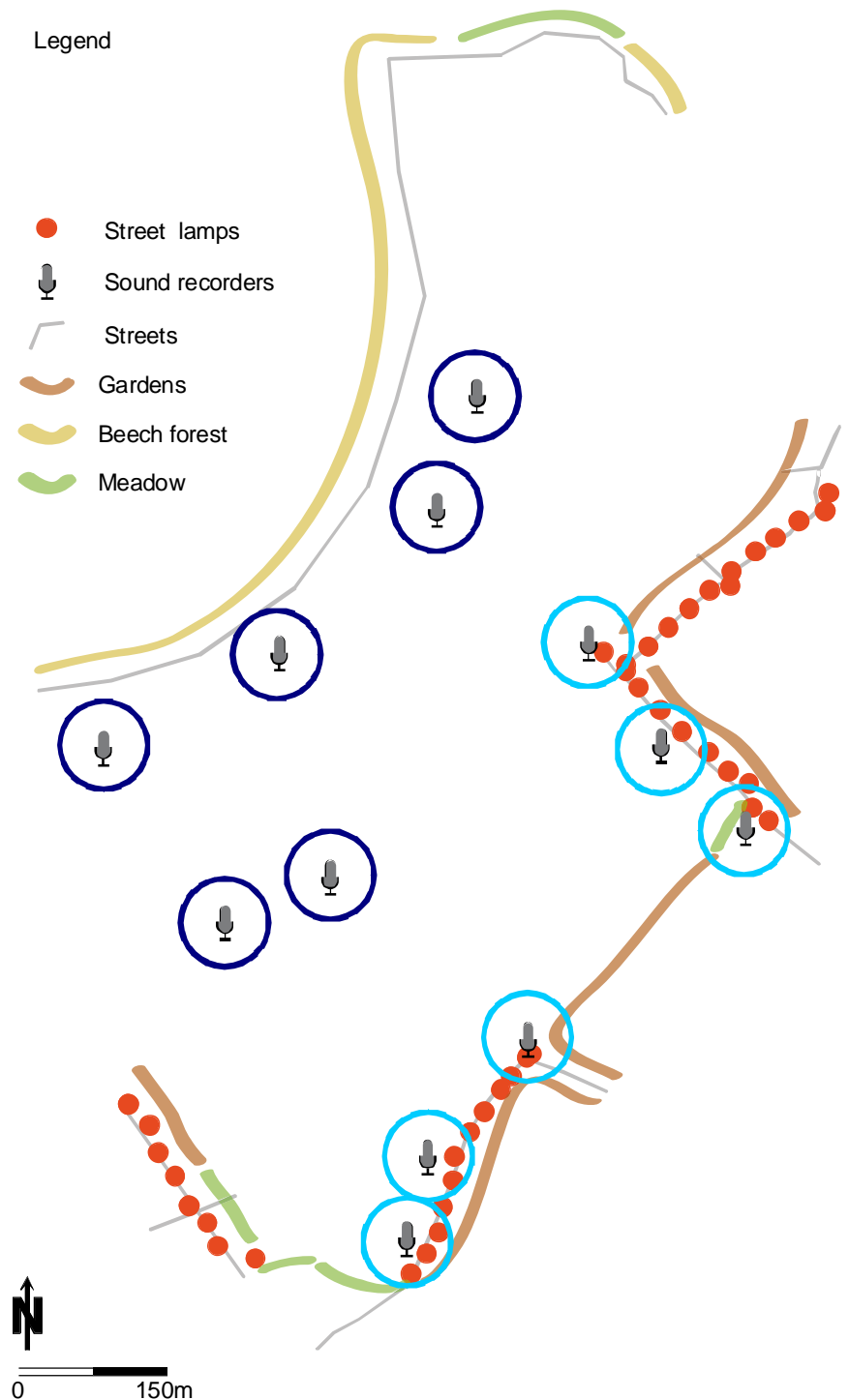


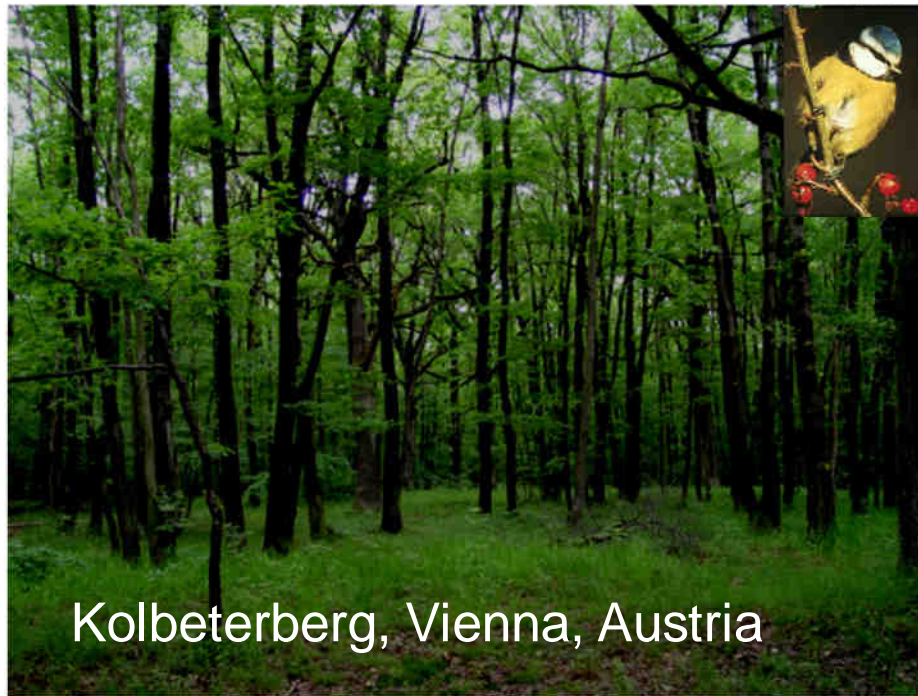


Automated recorders

- 6 lighted territories
- 6 dark territories

Recordings 3:00 – 6:30 am





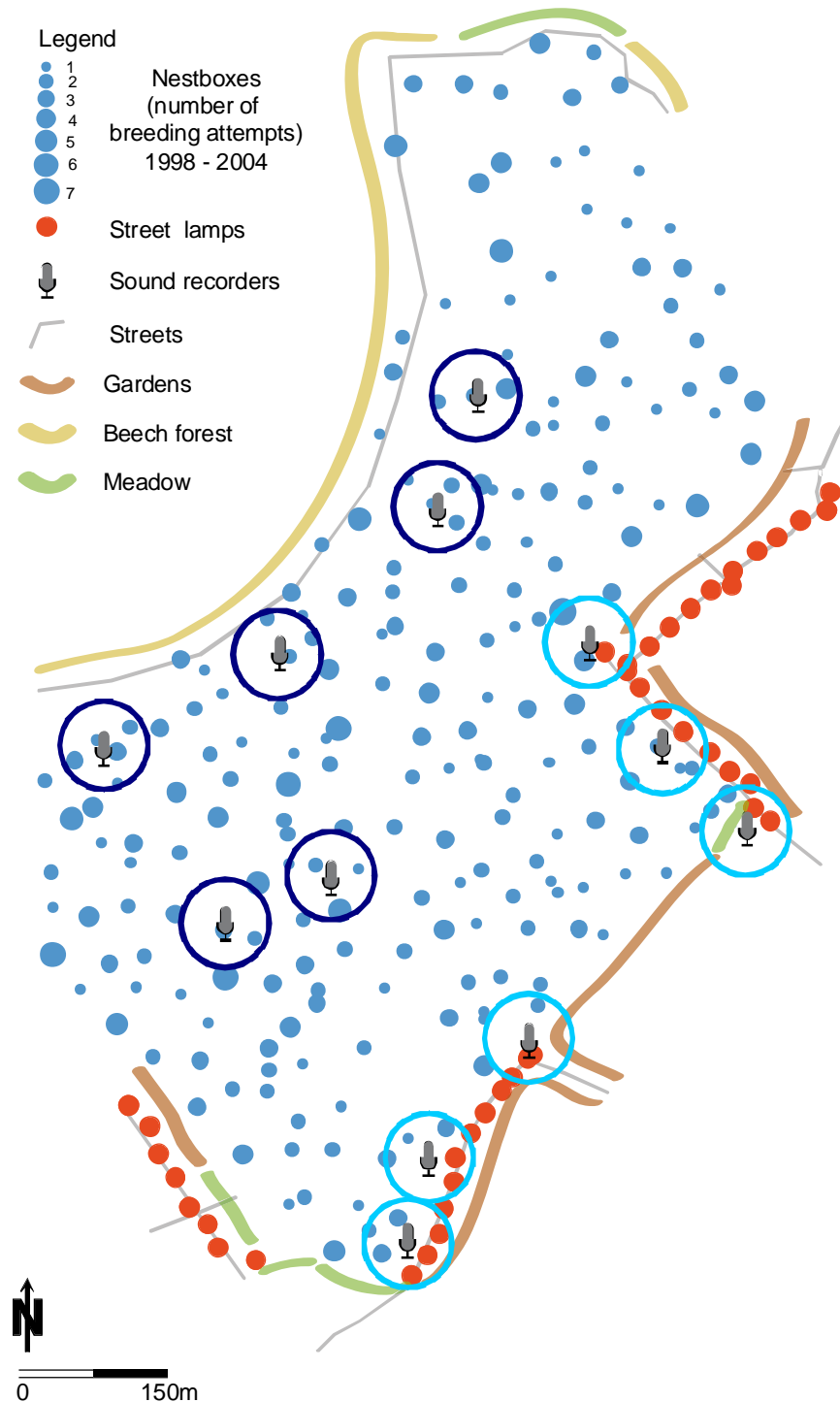
Automated recorders

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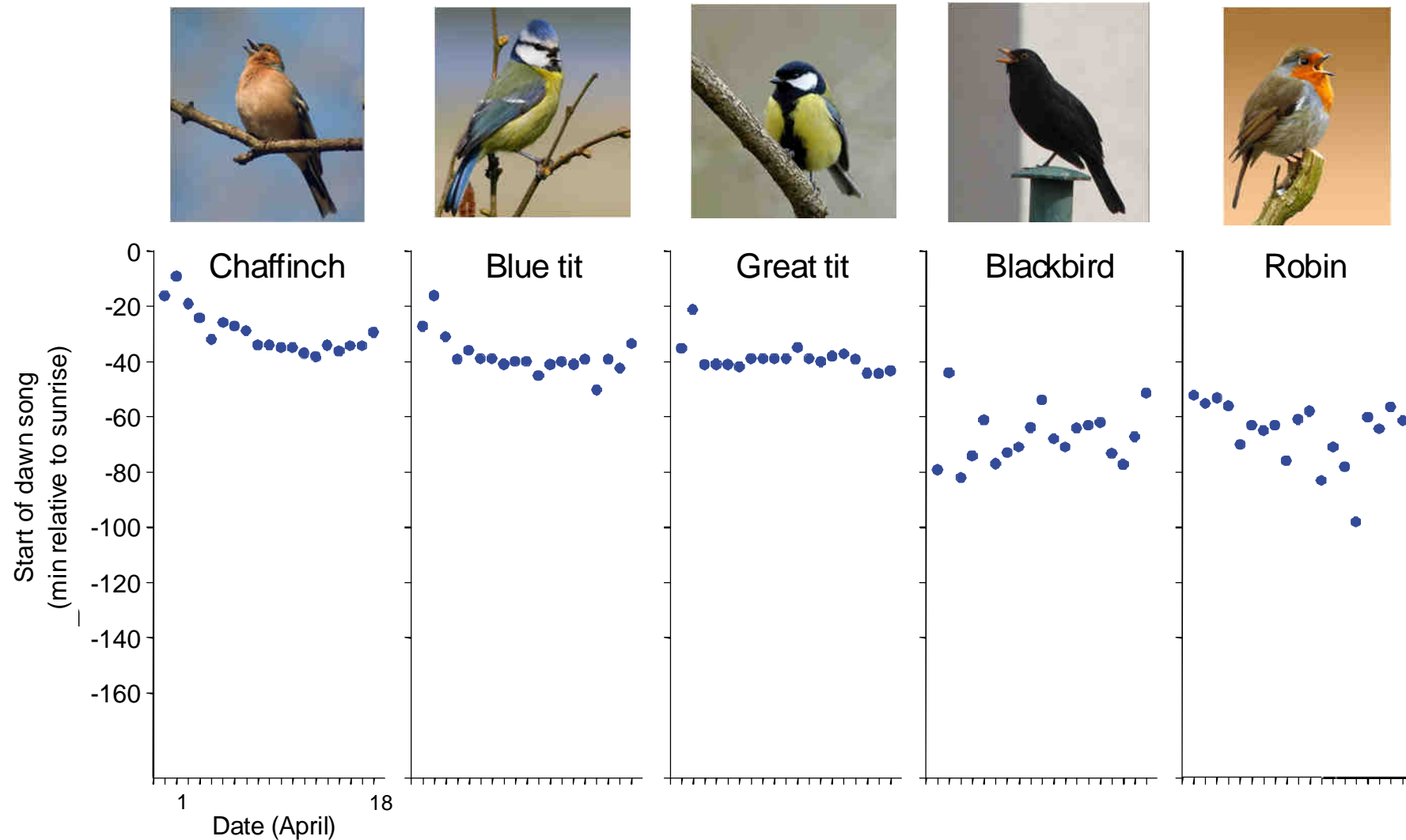
Recordings 1-18 April 2009

Blue tit population (1998-2006)

- mean first egg: 2 April \pm 5 d
- mean laying: 9 April \pm 4 d

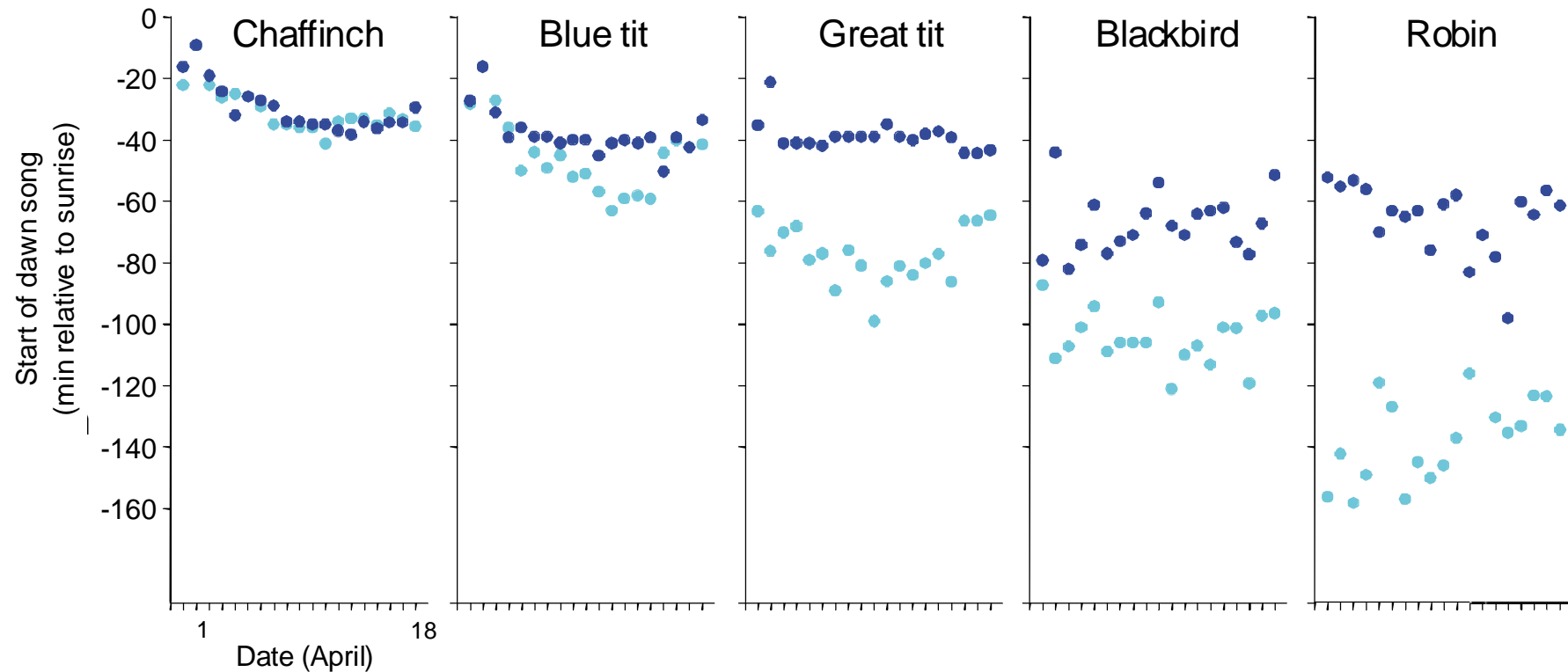
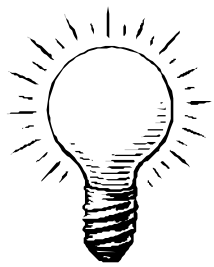


Effects of artificial night lighting on dawn song



Kempenaers et al. (2010) Curr Biol

Effects of artificial night lighting on dawn song



Kempenaers et al. (2010) Curr Biol

Start of dawn song affects paternity gain, but not loss

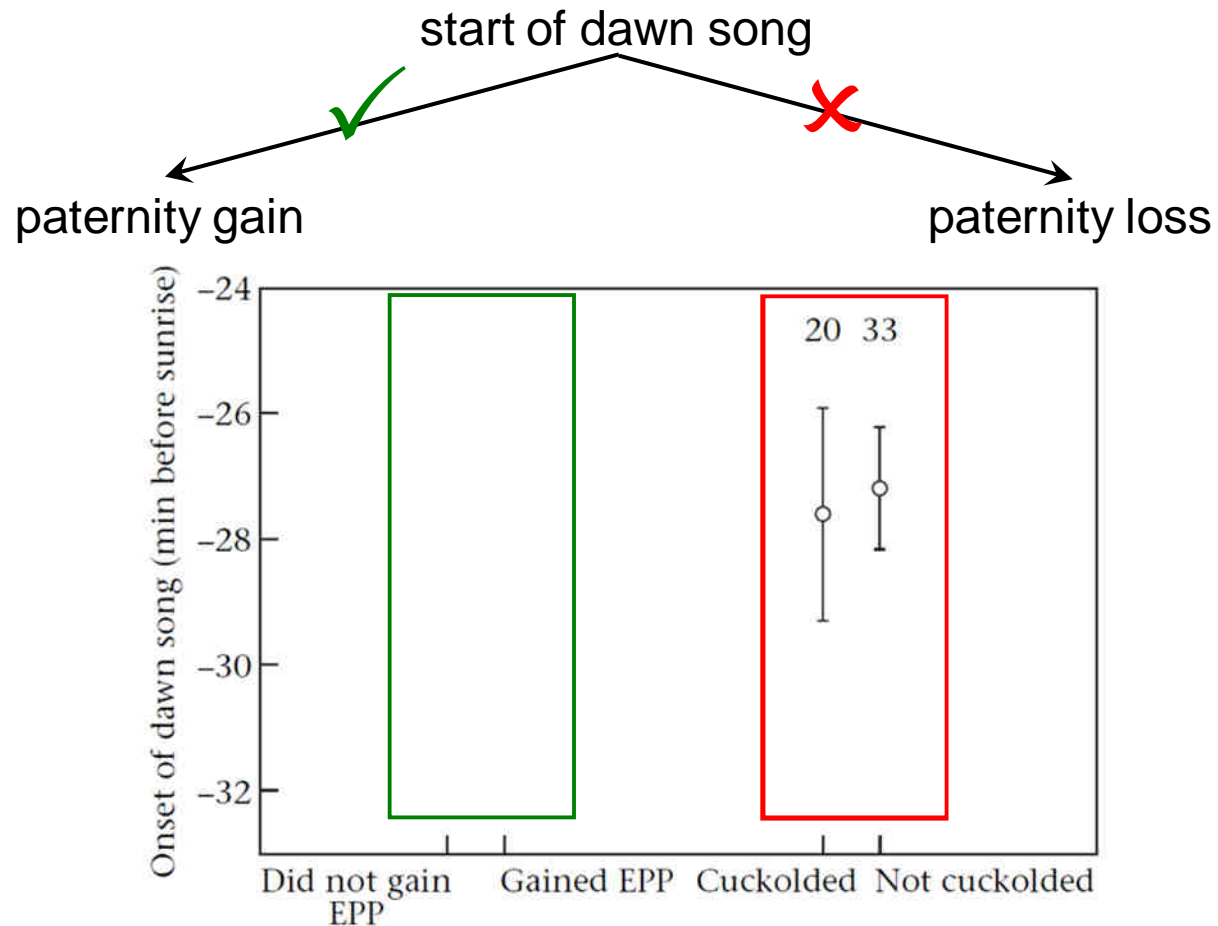
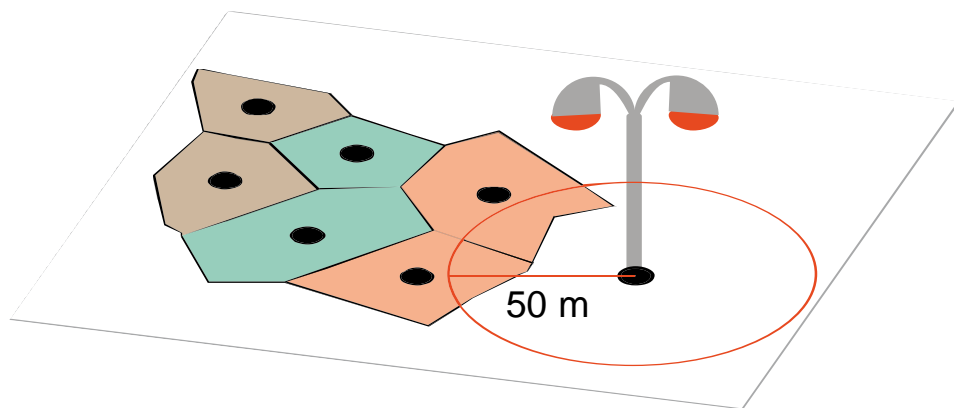
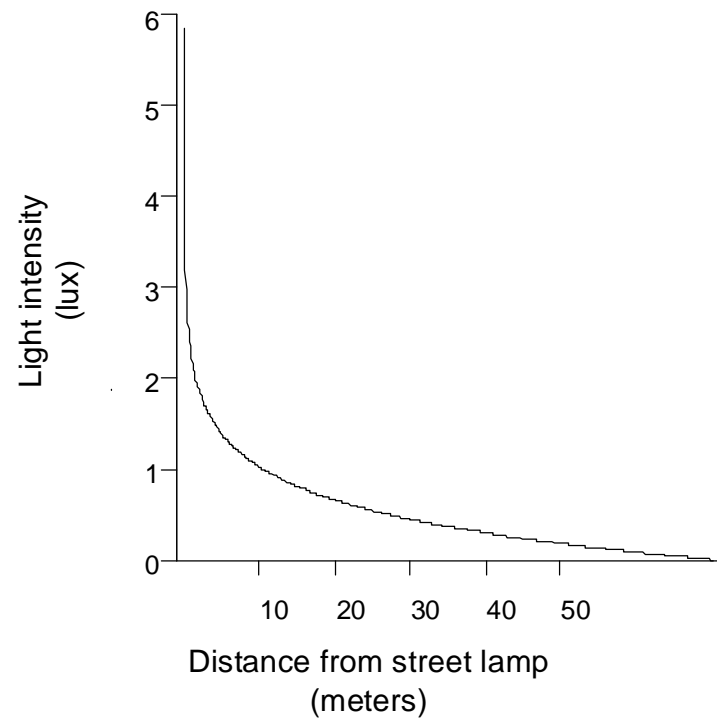
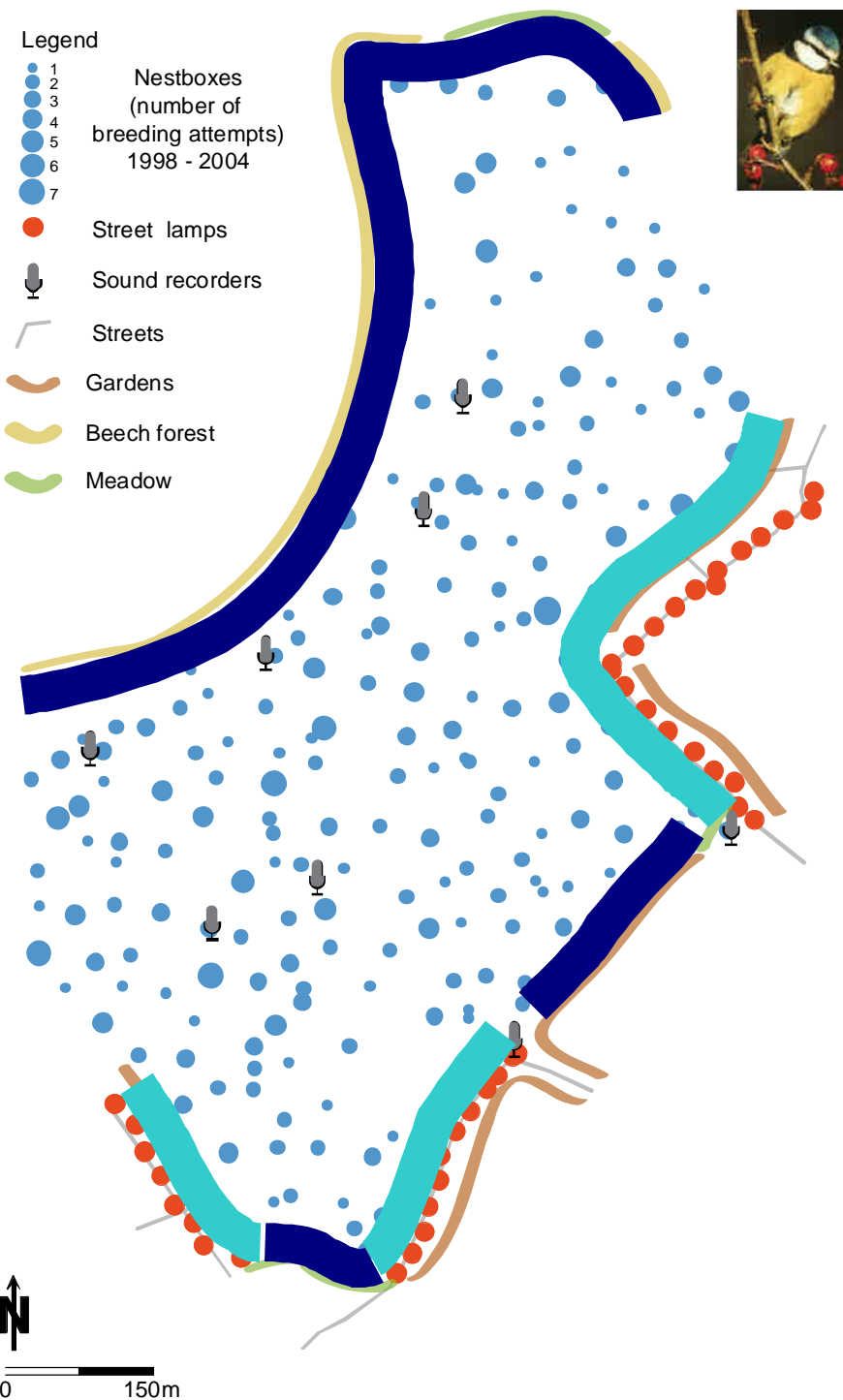


Figure 2. Mean \pm SE onset of dawn song in blue tits for (a) males that did or did not gain extrapair paternity (EPP) and (b) males that lost paternity (cuckolded) or did not lose paternity in their own nest. Sample sizes are shown above data points.

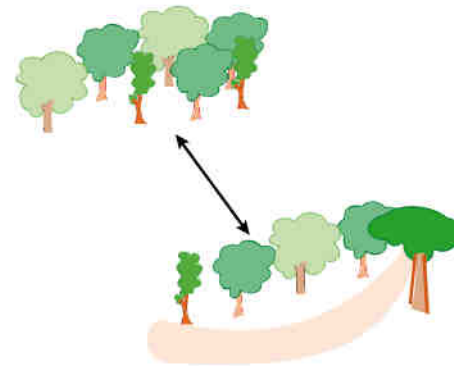
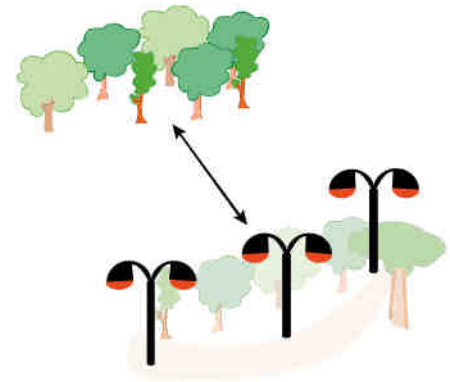
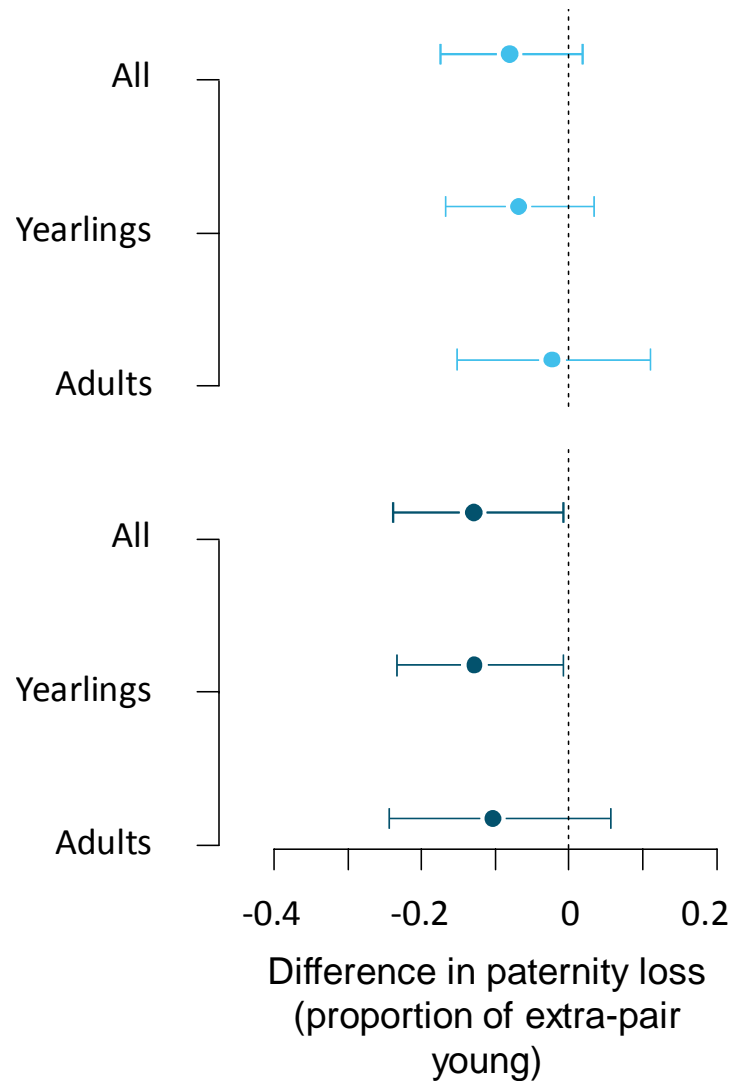


Legend

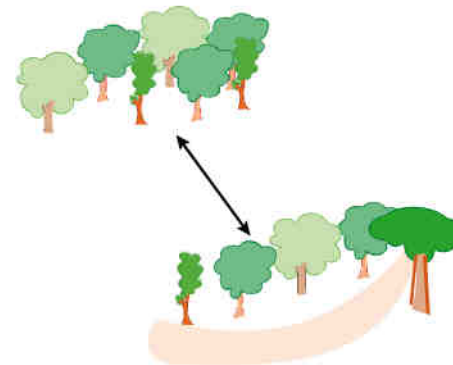
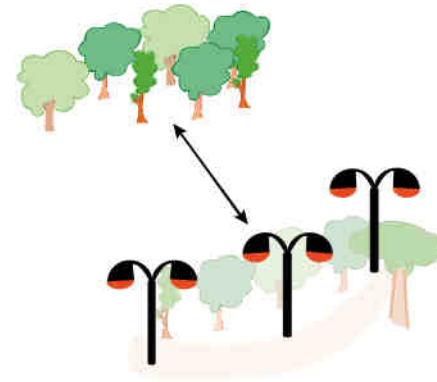
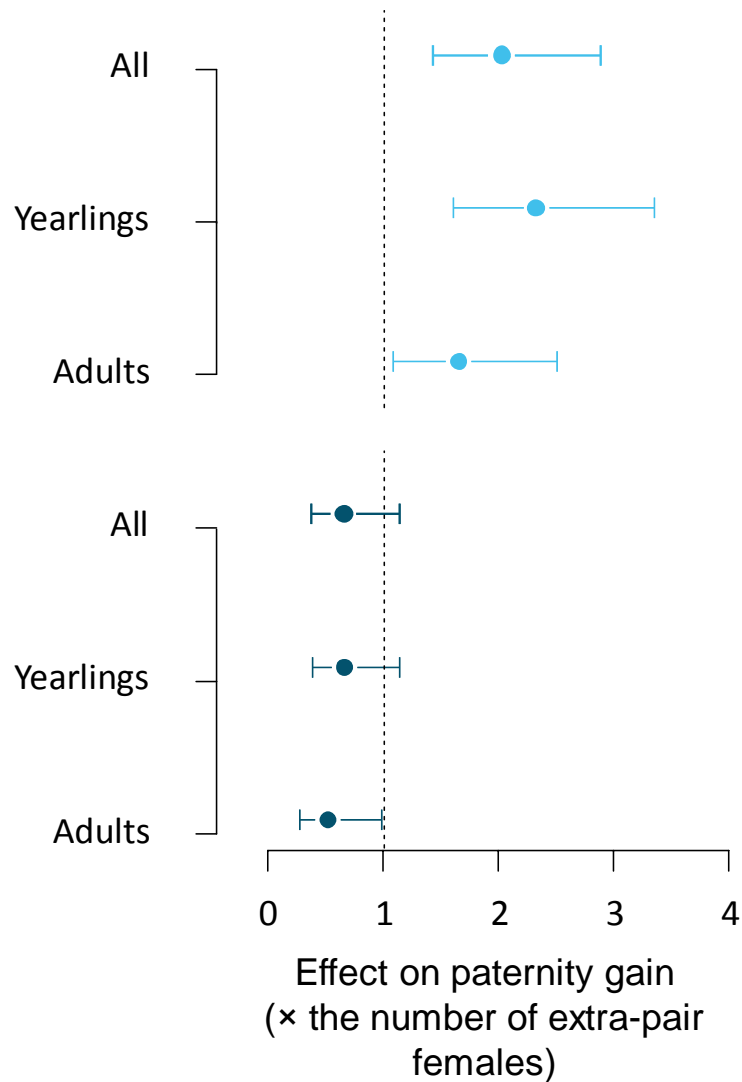
- 1 Nestboxes (number of breeding attempts 1998 - 2004)
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
- Street lamps
 - Sound recorders
 - Streets
 - Gardens
 - Beech forest
 - Meadow



Paternity loss: edge effect, but no light effect



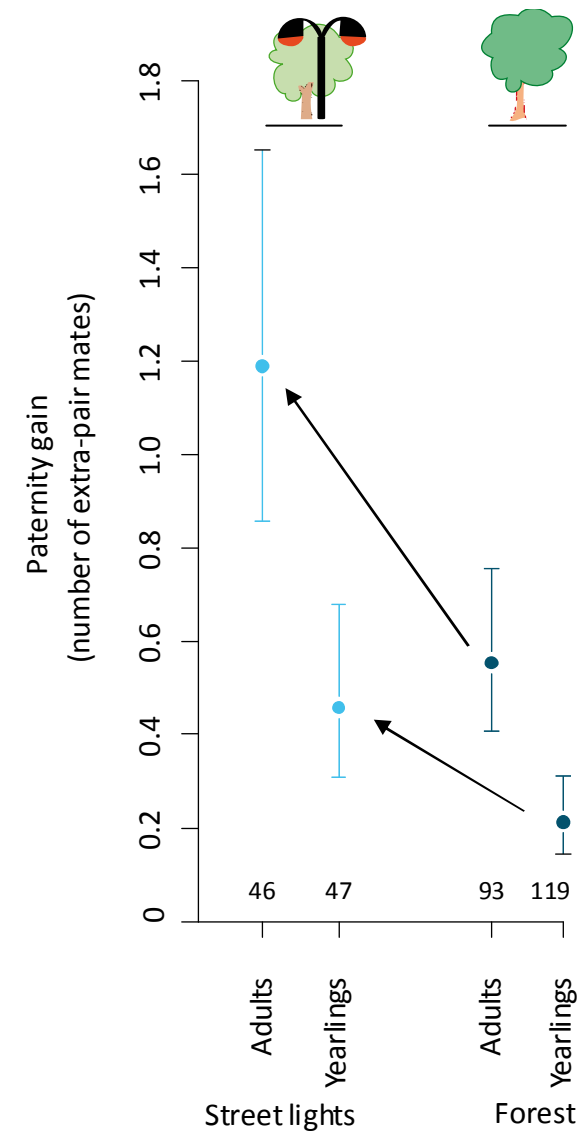
Paternity gain: edge effect & strong light effect



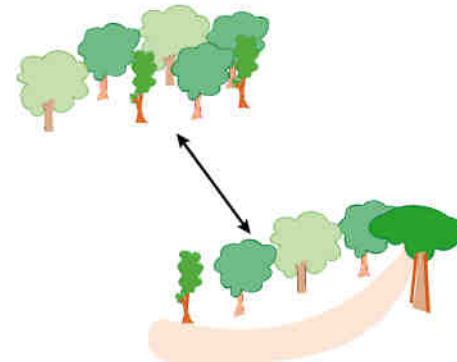
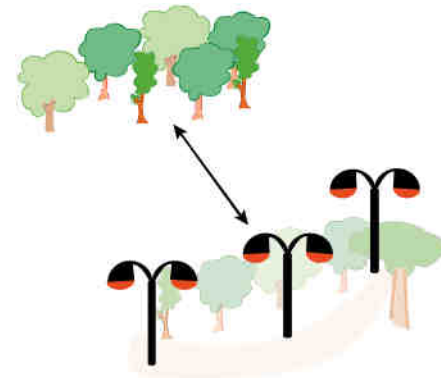
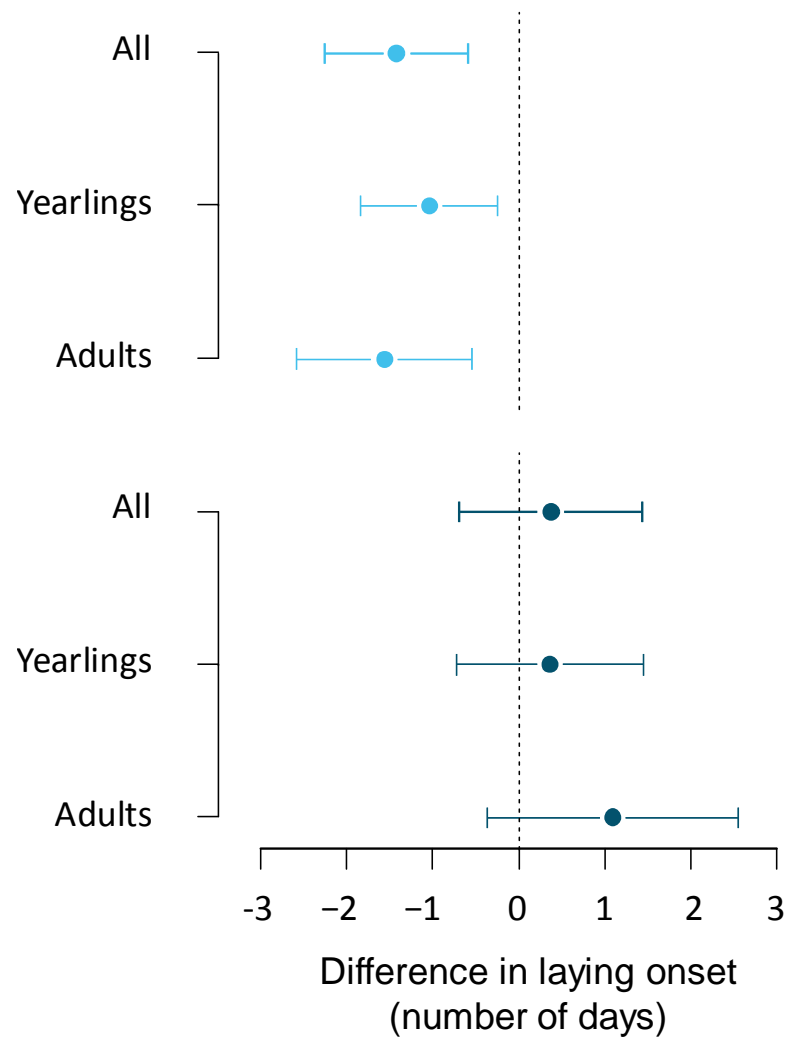
Effects of artificial night lighting on paternity gain



Kempenaers et al. (2010) Curr Biol

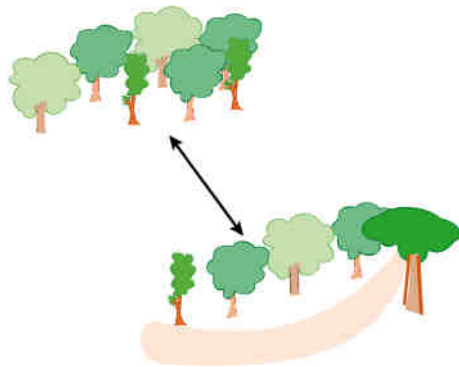
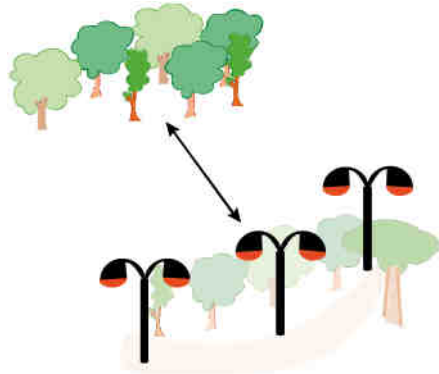


Laying date: no edge effect, but light effect

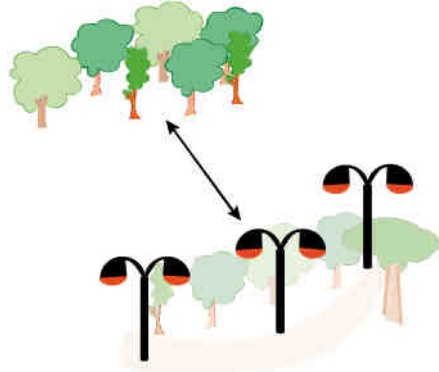


Conclusion: night lighting affects timing of behaviour

1. Females lay earlier in season
- *effect on circannual rhythm*

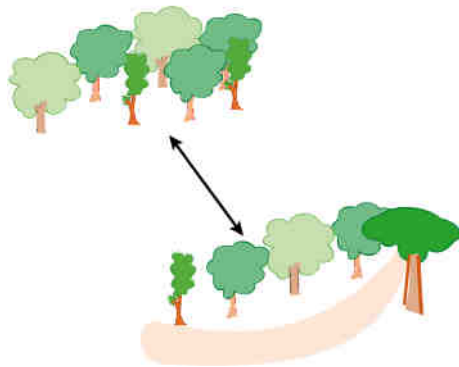


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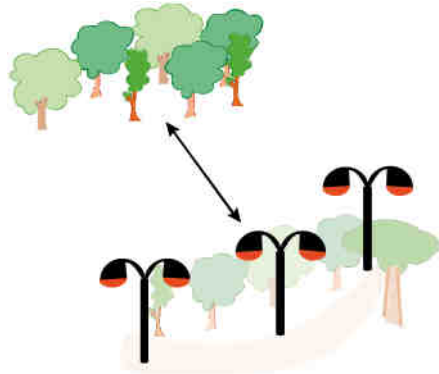


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2. Males sing earlier in morning
- *effect on circadian rhythm*



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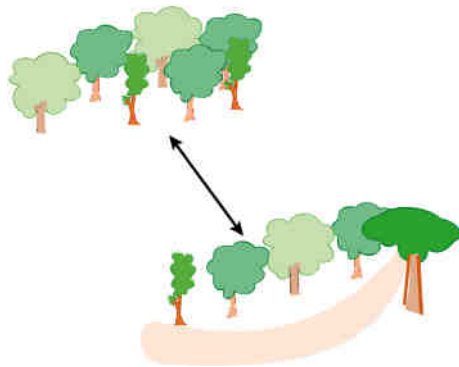


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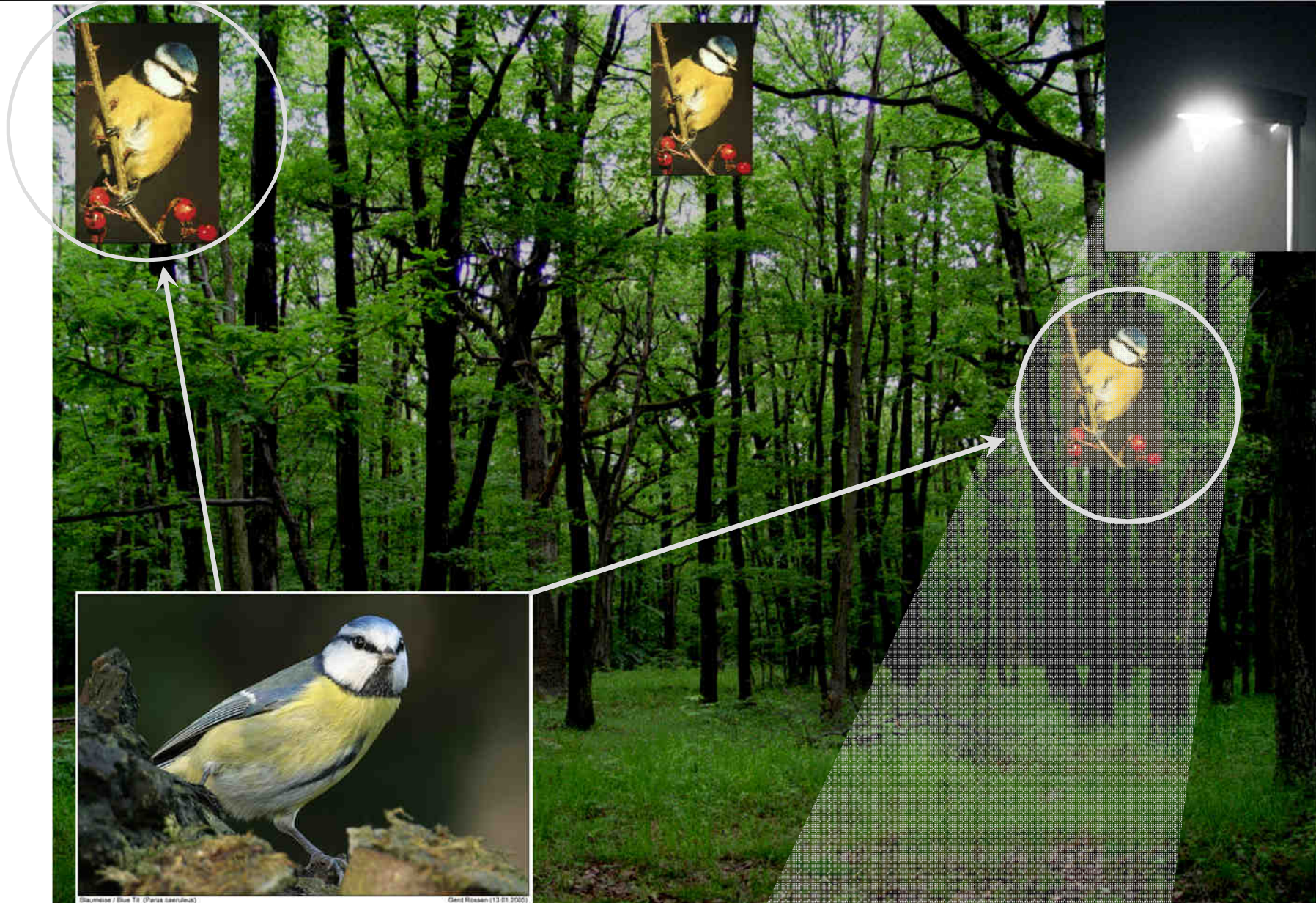


3. Males sire more extra-pair young



Fitness consequences ?

Light pollution disrupts the honesty of the signal



Outlook



Thanks!



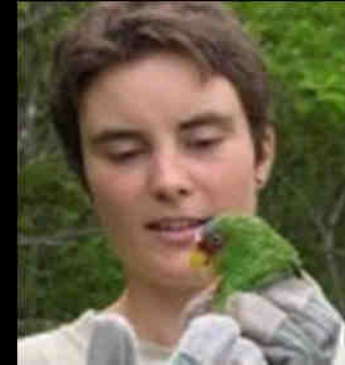
Kaspar Delhey



Anne Peters



Kathi Foerster



Angelika Poesel



Hansjoerg Kunc

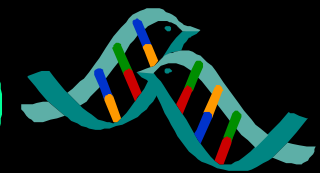


Sylvia Kuhn, Kim Teltscher, Agnes Tuerk & many field assistants

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MAX-PLANCK-GESellschaft



Dept Behavioral
Ecology & Evolutionary
Genetics

Questions?



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