



# Timing of dawn chorus in songbirds along an anthropization gradient

*Laurent Godet • Abel Prampart  
Vincent Lostanlen • Pierre Aumond*



# ***Introduction***

**How bird song is impacted  
by landscape anthropization?**



*The Auk* 123(3):639–649, 2006  
© The American Ornithologists' Union, 2006.  
Printed in USA.

## OVERVIEW

# AVIAN COMMUNICATION IN URBAN NOISE: CAUSES AND CONSEQUENCES OF VOCAL ADJUSTMENT

GAIL L. PATRICELLI<sup>1</sup> AND JESSICA L. BLICKLEY



Contents lists available at SciVerse ScienceDirect

Animal Behaviour

journal homepage: [www.elsevier.com/locate/anbehav](http://www.elsevier.com/locate/anbehav)



Special Issue

Songs of the city: noise-dependent spectral plasticity in the acoustic phenotype of urban birds

Hans Slabbekoorn\*

*Molecular Ecology* (2008) 17, 72–83

doi: 10.1111/j.1365-294X.2007.03487.x

# Birdsong and anthropogenic noise: implications and applications for conservation

HANS SLABBEKOORN and ERWIN A. P. RIPMEESTER



**IBIS**  
international journal of avian science



*Ibis* (2021)

doi: 10.1111/ibi.12949

Review

# A global synthesis of the impacts of urbanization on bird dawn choruses

OSCAR H. MARÍN-GÓMEZ,<sup>1</sup>  & IAN MACGREGOR-FORS,<sup>1,2,\*</sup> 

## *What is known?*

In human dominated landscapes, birds tend to sing **louder**, at a **higher frequency**;  
they may change their **song structure** and their **vocal activity**, and sing **earlier**



# *Knowledge gaps*

Dissociating different factors and hierarchizing their importance

LANDSCAPE



LIGHT & NOISE



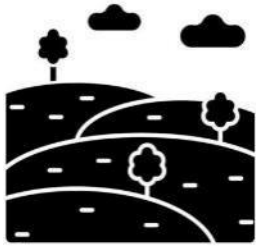
BIODIVERSITY



# Knowledge gaps

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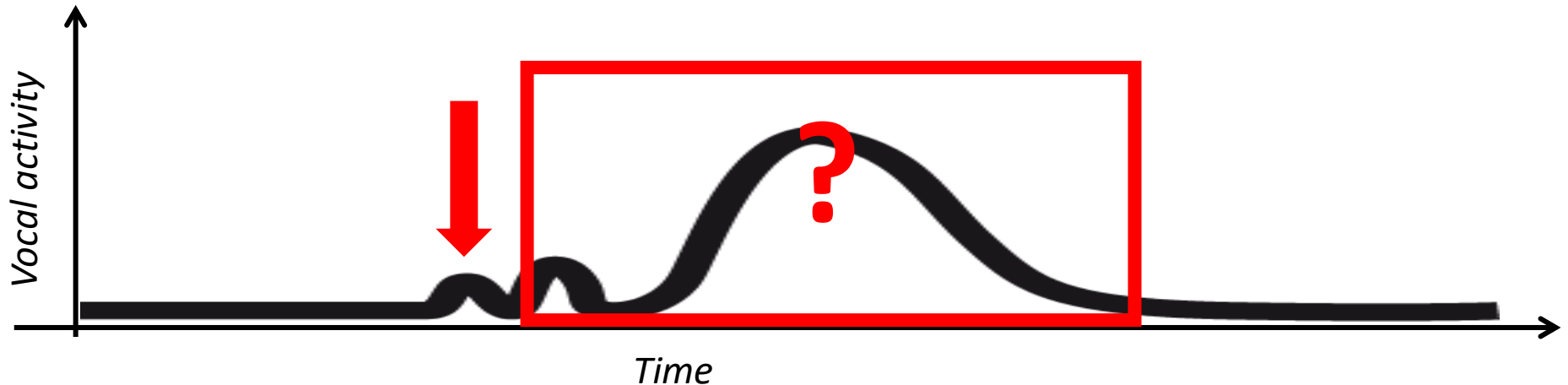
LIGHT & NOISE



BIODIVERSITY



Exploring further the timing of dawn chorus beyond chorus onset



# *Methods*



# *Sampling*

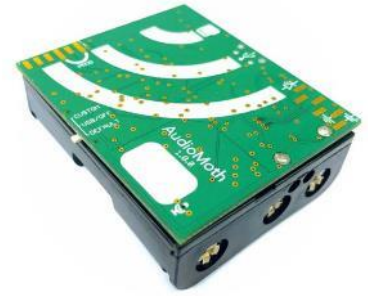




Regular sampling design  
36 Audiomoths (calibrated)

From city to countryside  
In wooded areas

One week  
From midnight to noon



0 1000 m



**One day, from midnight to noon, for each station, one minute every 10 minutes:  
number of individuals of each species heard singing**



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number of individuals of each species heard singing**



**A total of 44 full hours of annotated sounds**



## *Dependent variables*

- **First hour of the song**
- **Mean hour of the song**
- **Part of nocturnal song**
- **Song duration**

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Each species  
Each Station

*« The mean song hour of  
Robins in station #22  
is 50 min after midnight »*

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Each species  
Each Station

*« The mean song hour of Robins in station #22 is 50 min after midnight »*



Each species  
All stations

*« The mean song hour of Robins in the whole area is 70 min after midnight »*

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*« The mean song hour of Robins in the whole area is 70 min after midnight »*

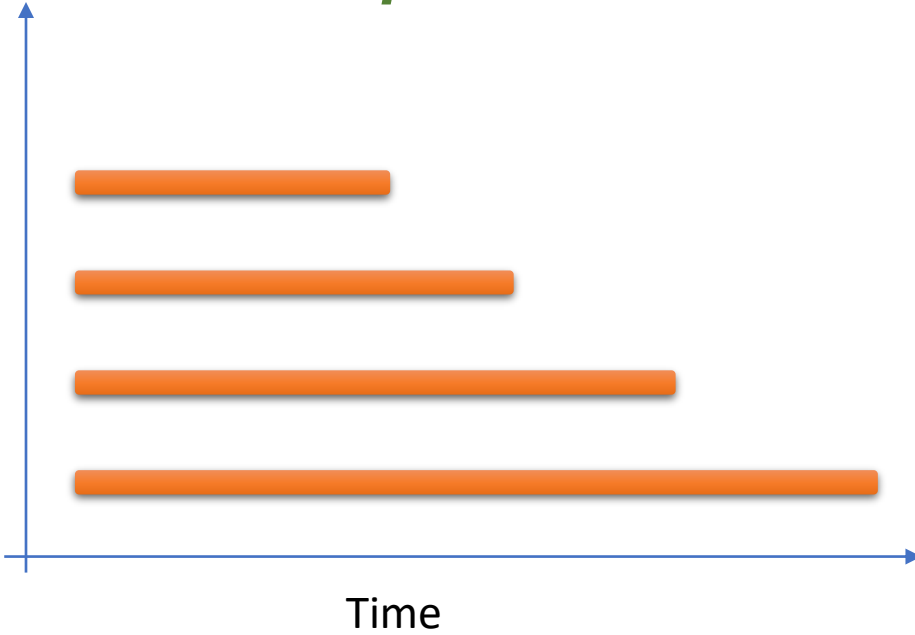


Community

*« The mean song hour of the community of station #36 is 40 min after midnight »*

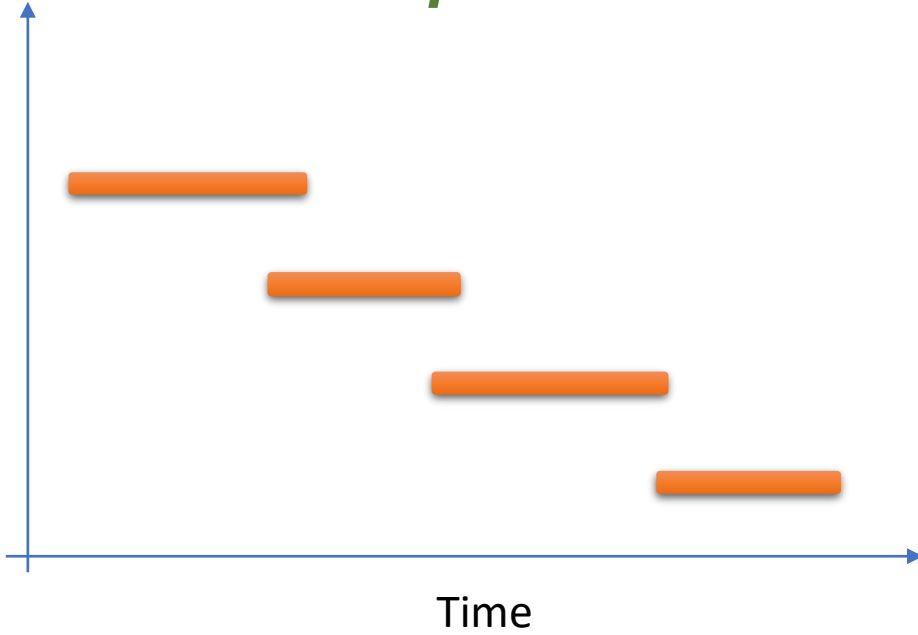
# Dependent variables

## Beta temporal nestedness



Baselga (2010) dissimilarity index ( $\beta_{nes}$ )

## Beta temporal turnover



Simpson (1943) dissimilarity index ( $\beta_{sim}$ )

Community





# ***Factors***

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## LANDSCAPE



- **Landscape diversity**
- **Wooded area**
- **Built area**

# ***Factors***

## LANDSCAPE



## LIGHT & NOISE



- **Landscape diversity**
- **Wooded area**
- **Built area**

- **Traffic Noise (L50)**
- **ALAN (VIIRS data – April 2022)**
- **Number of street lights**

# Factors

## LANDSCAPE



- Landscape diversity
- Wooded area
- Built area

## LIGHT & NOISE



- Traffic Noise (L50)
- ALAN (VIIRS data – April 2022)
- Number of street lights

## BIODIVERSITY



- Total abundance
- Species richness
- Species diversity
- Abundance conspecific

# *Dependent variables*

- First hour of the song
- Mean hour of the song
- Part of nocturnal song
- Song duration
- Temporal nestedness
- Temporal turnover



**Multiple linear regressions  
+ Hierar. partitionning of variance**

# *Factors*

**LANDSCAPE  
(3)**

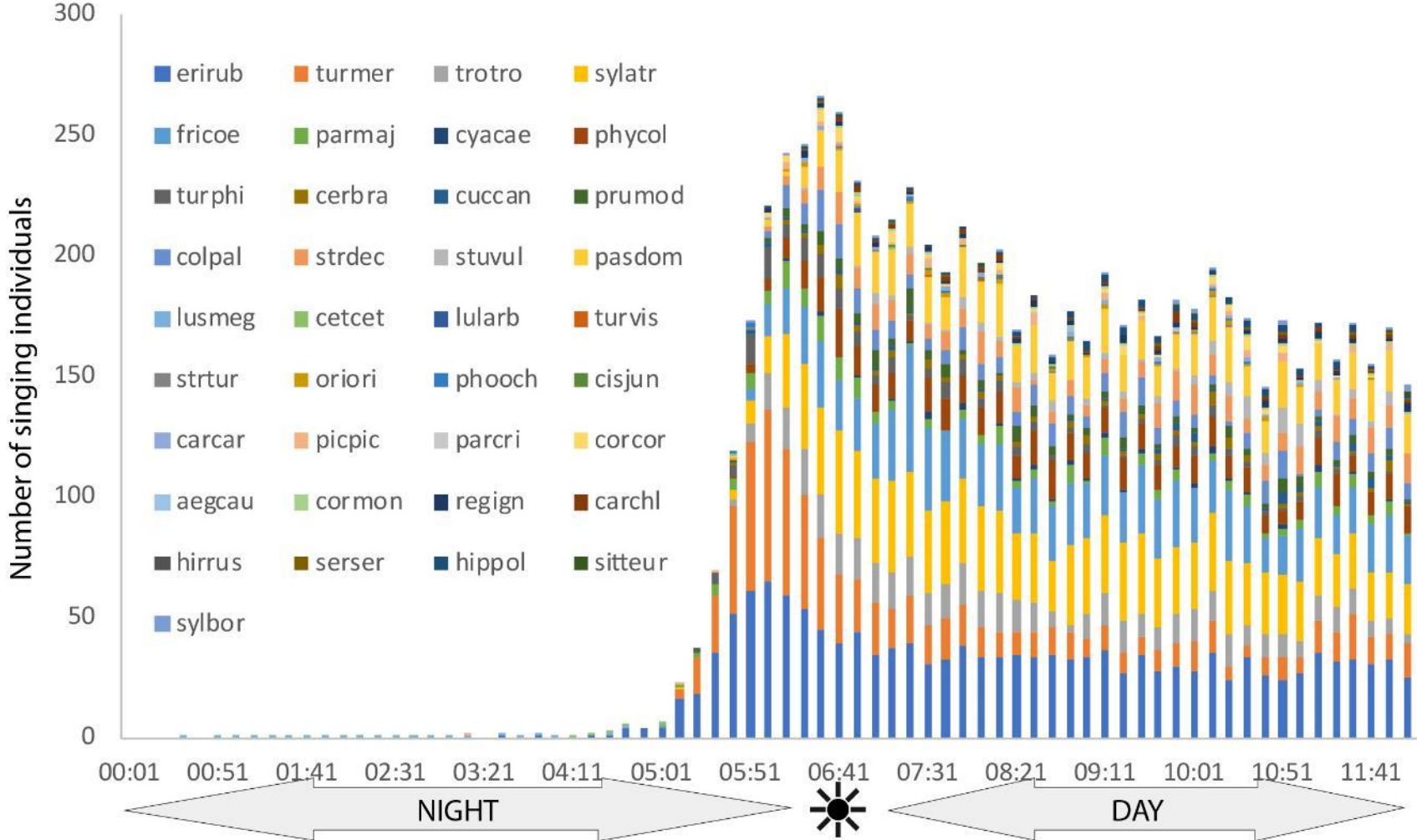
**LIGHT & NOISE  
(3)**

**BIODIVERSITY  
(4)**

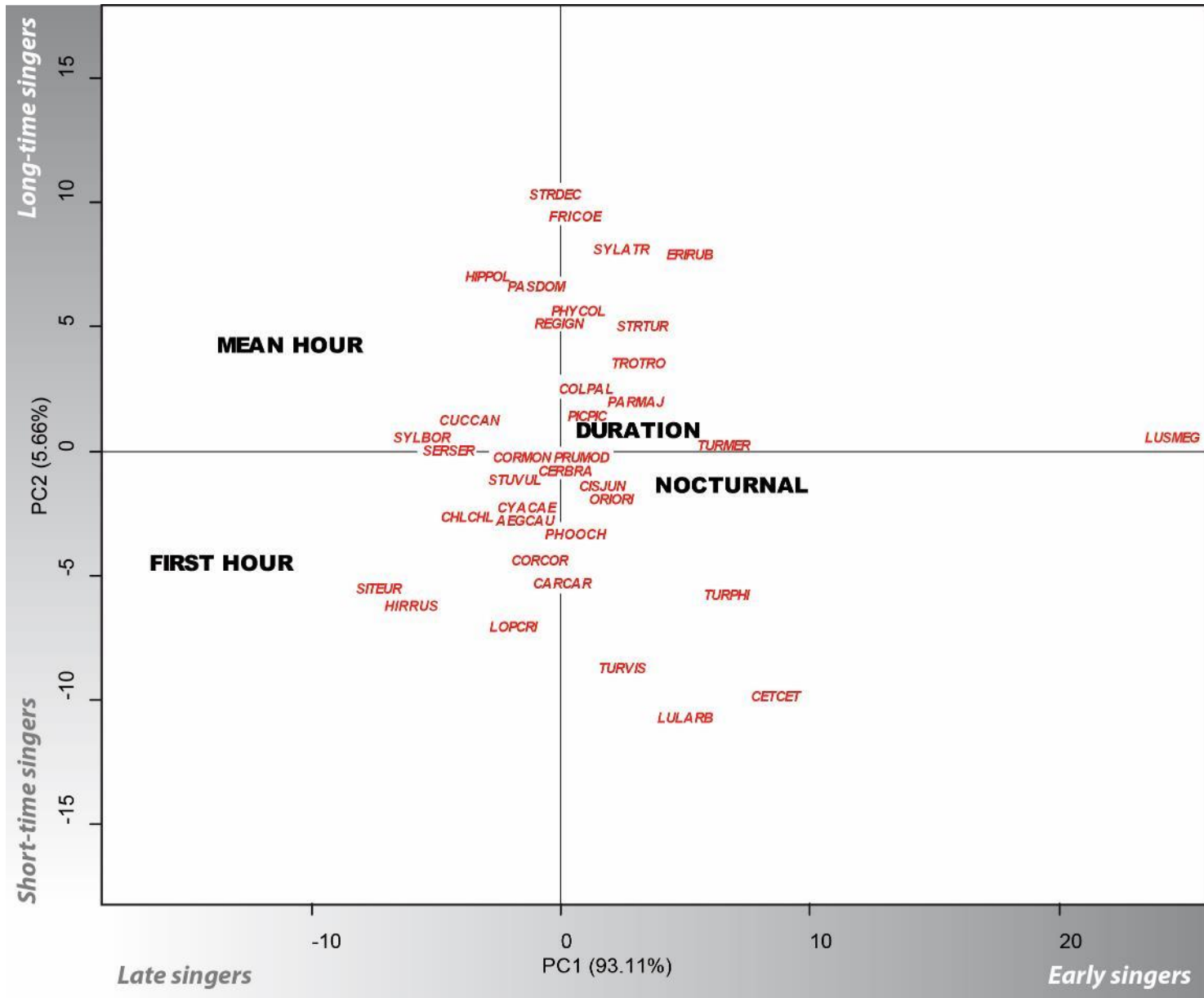
# *Results*



# A well-defined dawn chorus around sunrise

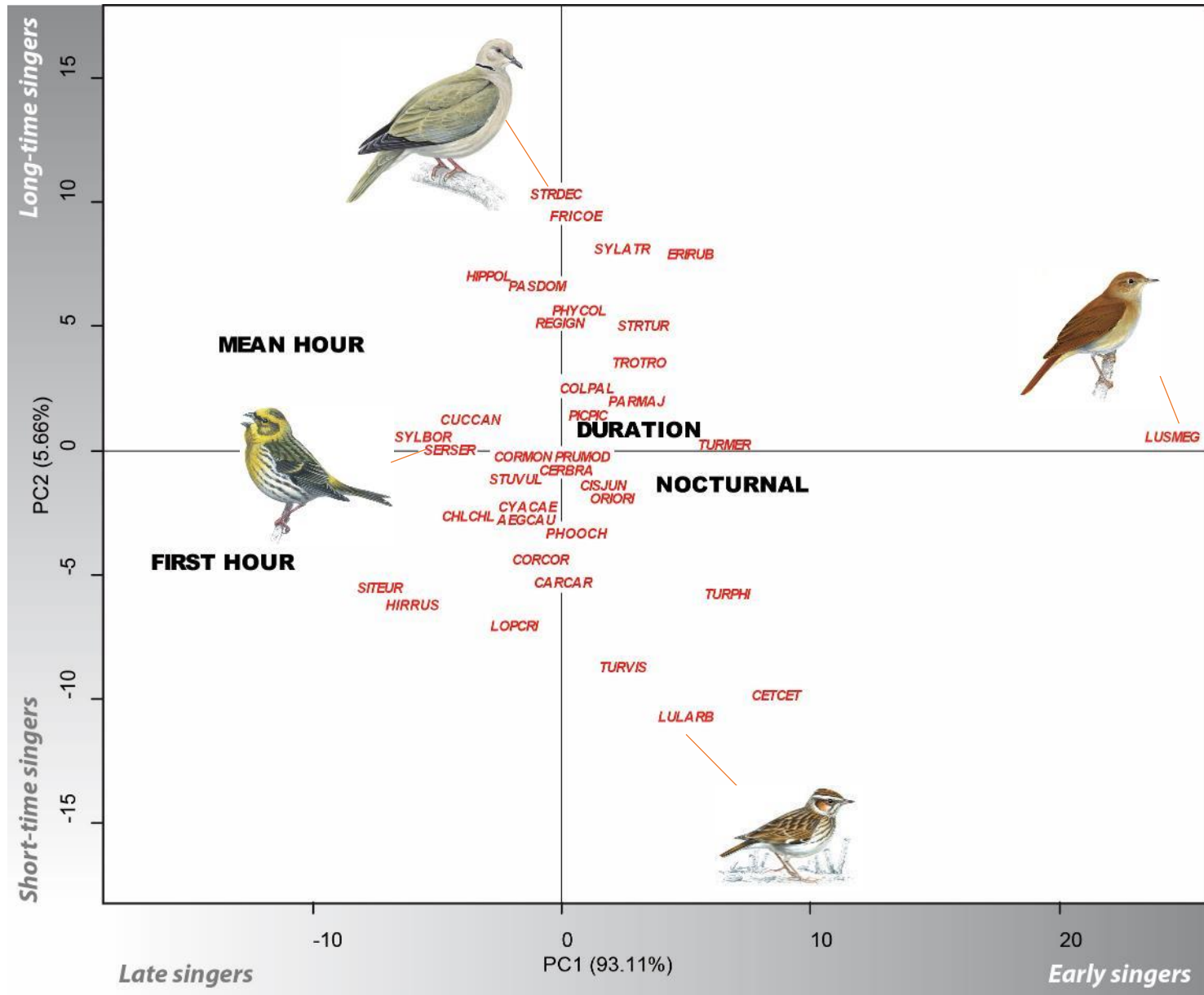


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*Community mean hour index*

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## *Community mean hour index*



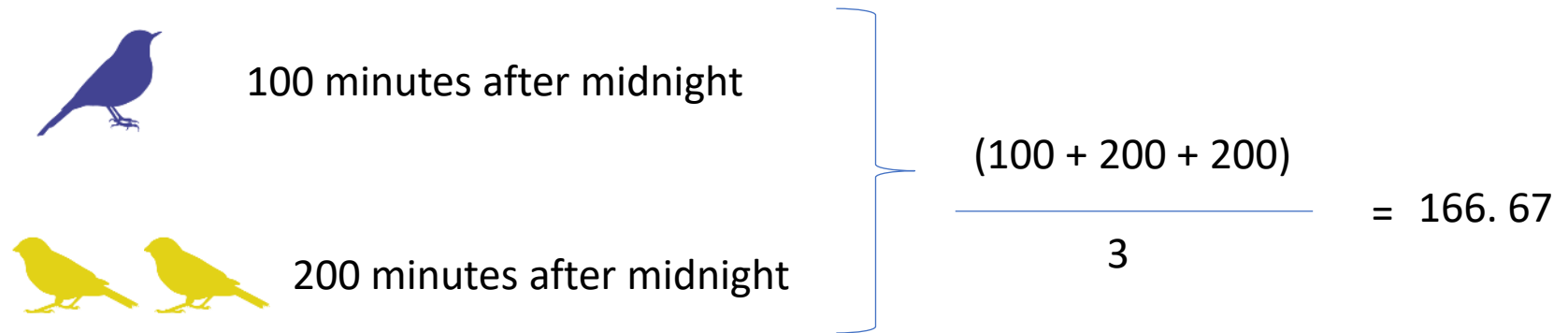
100 minutes after midnight



200 minutes after midnight

# Community reassembly according to song characteristics is driven by anthropogenic variables

## *Community mean hour index*

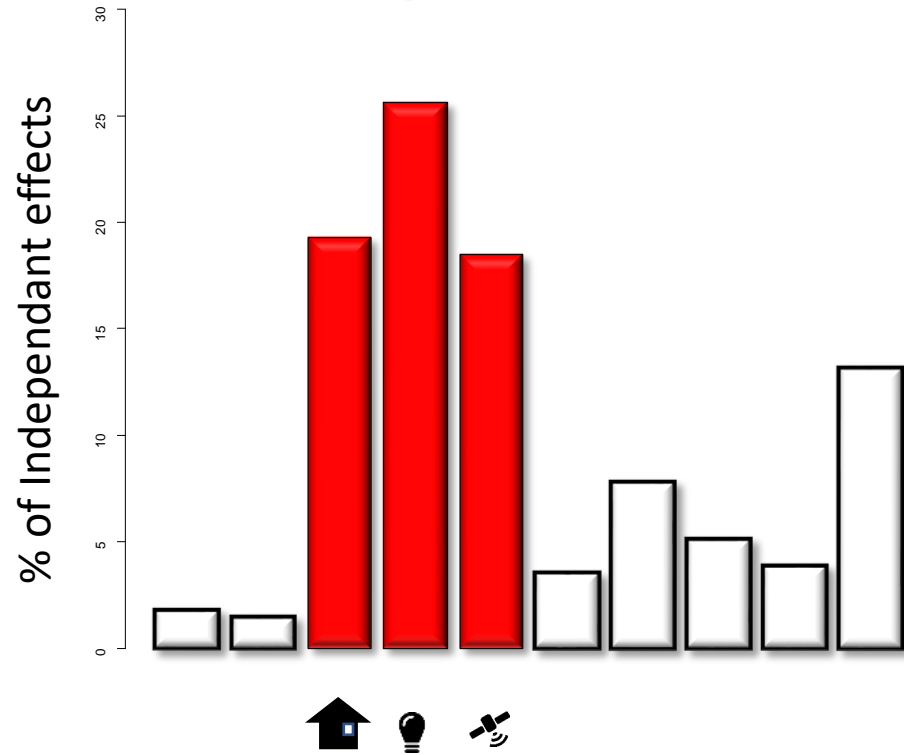


When the community index is high, the community is dominated by late singing species

When the community index is low, the community is dominated by early singing species

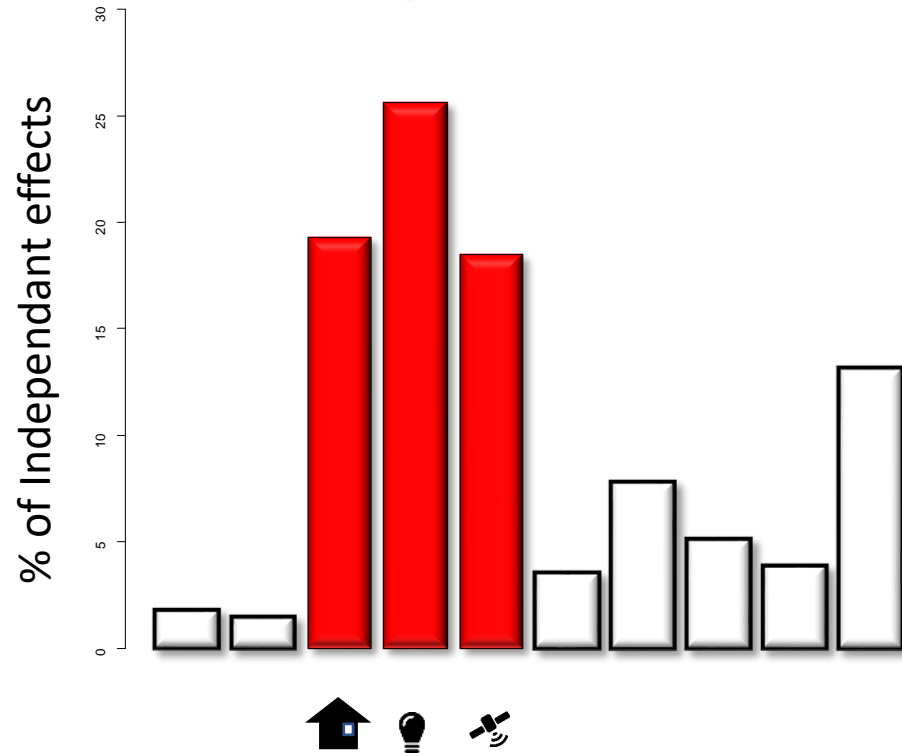
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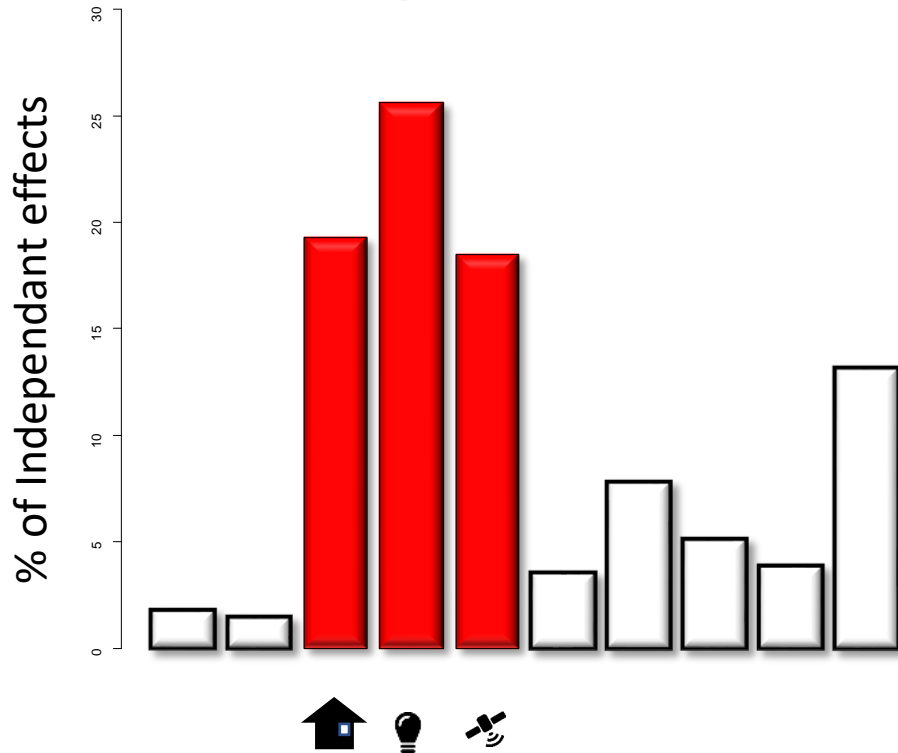
**Highly built and lit areas promote abundance of late singing species**



# Community reassembly according to song characteristics is driven by anthropogenic variables

## *Community mean hour index*

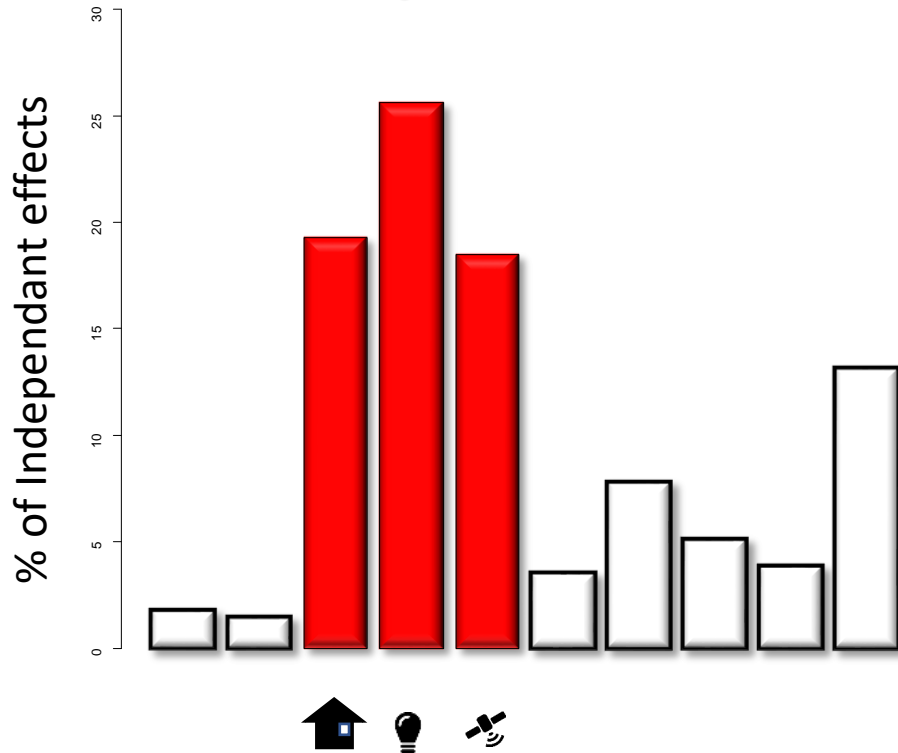
## *Community duration index*



**Highly built and lit areas promote abundance of late singing species**

# Community reassembly according to song characteristics is driven by anthropogenic variables

## *Community mean hour index*



**Highly built and lit areas promote abundance of late singing species**

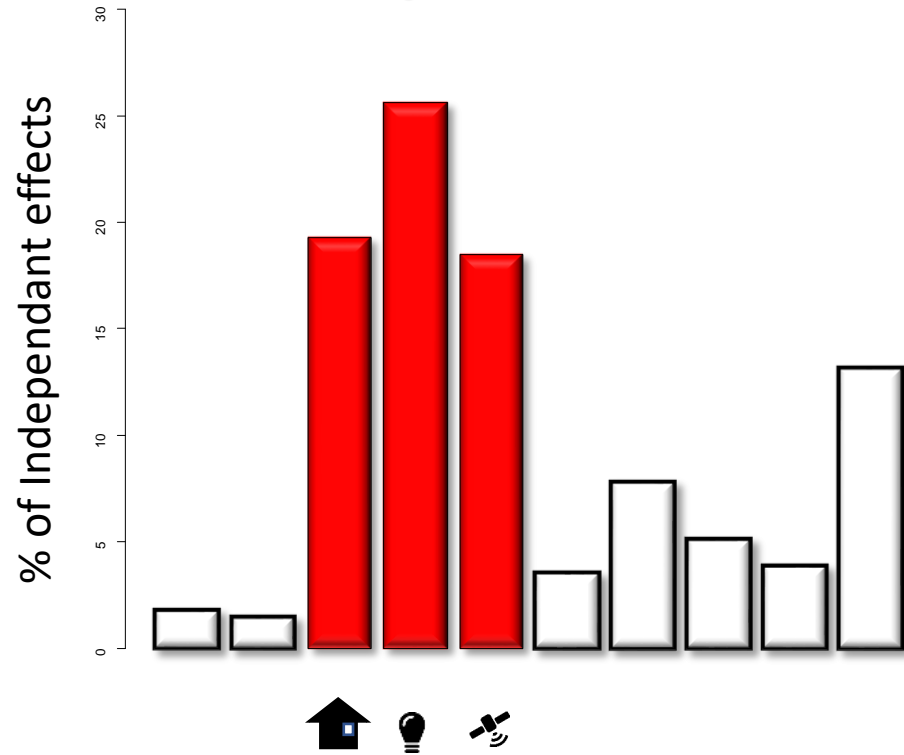
## *Community duration index*

If high: the community is dominated by long-term singing species

If low: the community is dominated by short-term singing species

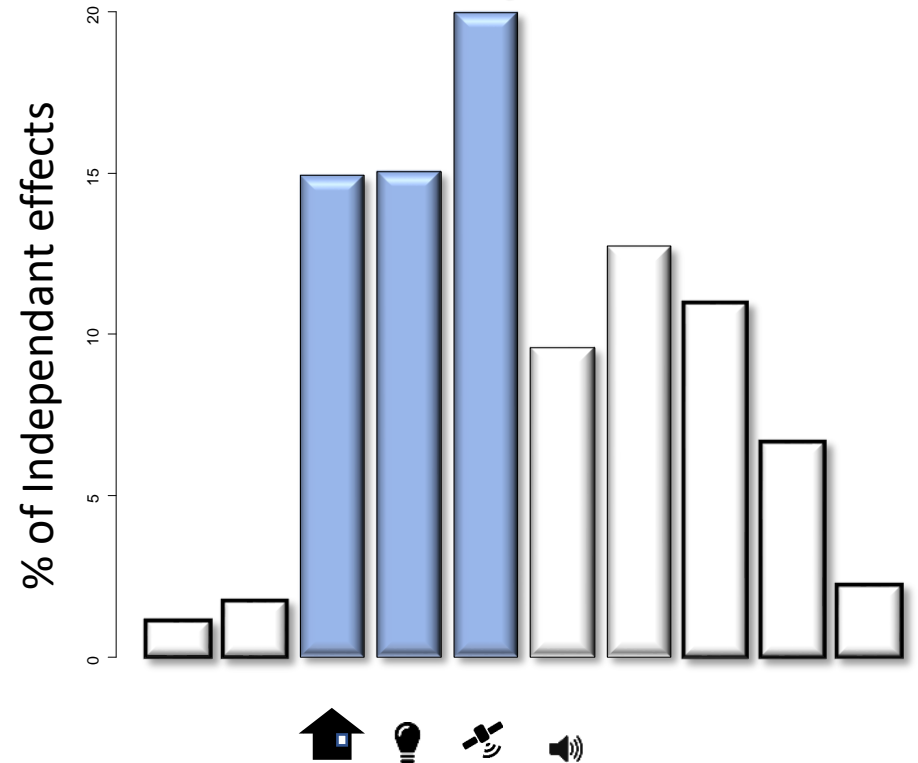
# Community reassembly according to song characteristics is driven by anthropogenic variables

## Community mean hour index



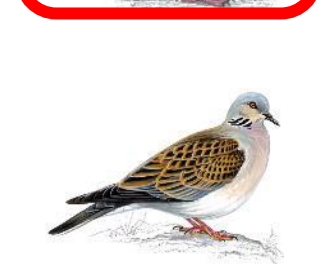
Highly built and lit areas promote abundance of late singing species

## Community duration index



Highly built, lit, noisy areas promote abundance of short-time singing species

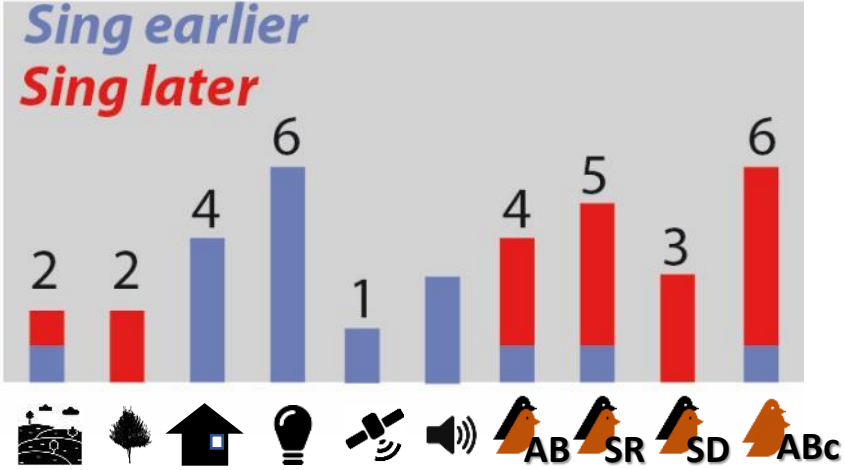




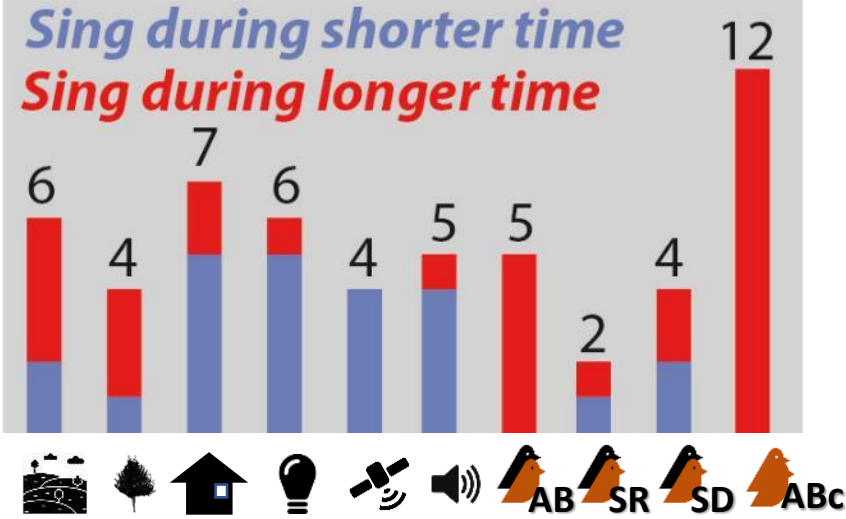
**Number of species whose song characteristics are significantly linked to factors**

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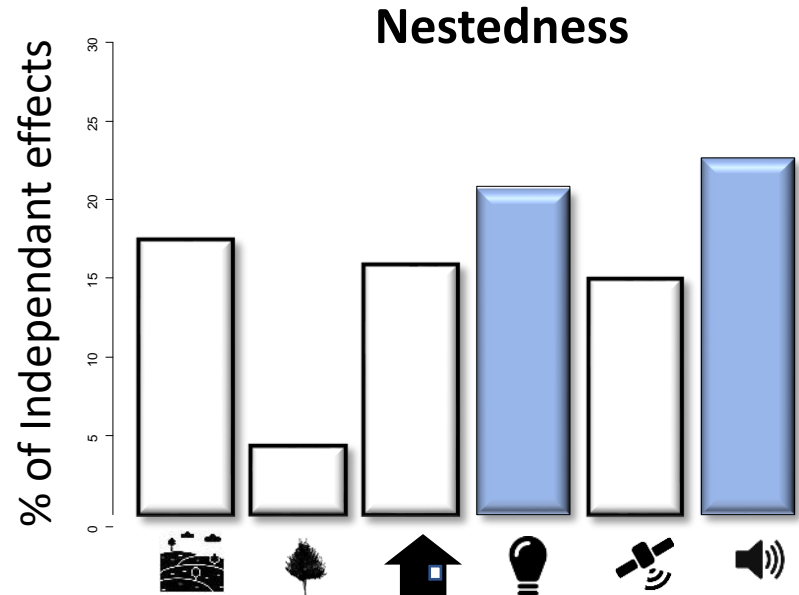
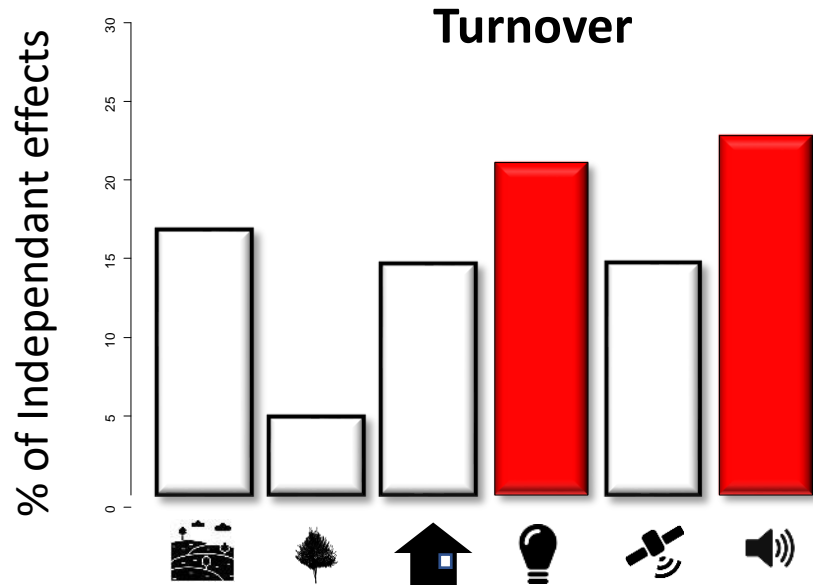
# Song mean hour



# Song duration



# The most lit and noisy area promote temporal song turnover but decrease temporal nestedness



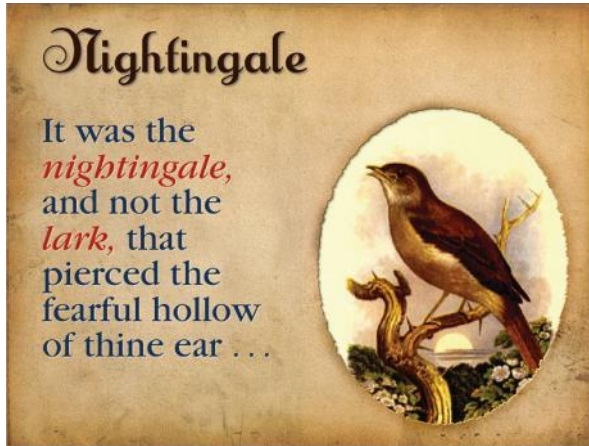


# *Discussion*

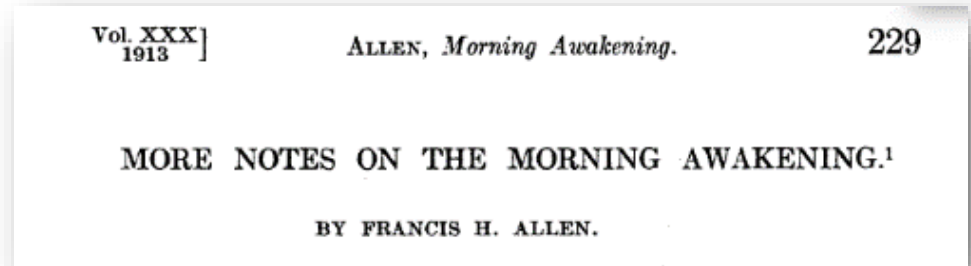


# *On old story: each species has his own song timing*

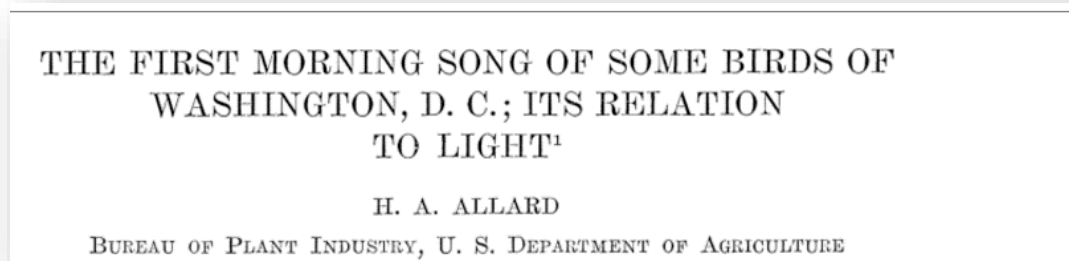
Shakespeare, 1597



Allen, 1913



Allard, 1930



**A broadening of knowledge:**

**individuals of the same species adjust their song timing to their environment**

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*Birds sing earlier and during shorter periods in anthropized areas*

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9 species among 20 sang earlier in the more artificially lit areas



Kempenaers et al. 2010  
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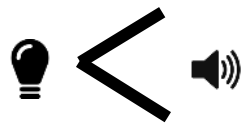


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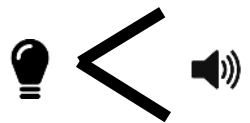


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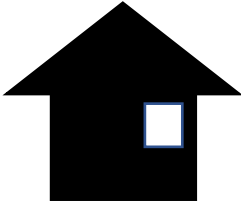
Nordt & Klenke 2013, Arroyo-Solís et al. 2012, Dorado-Correa et al. 2016



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Fuller et al. 2007 , Dorado-Correa et al. 2016



7 species among 20 sing earlier in highly built areas



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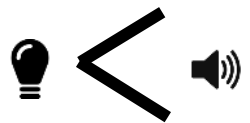


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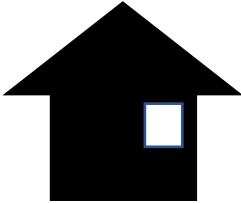
Nordt & Klenke 2013, Arroyo-Solís et al. 2012, Dorado-Correa et al. 2016



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Fuller et al. (2007) , Dorado-Correa et al. (2016)

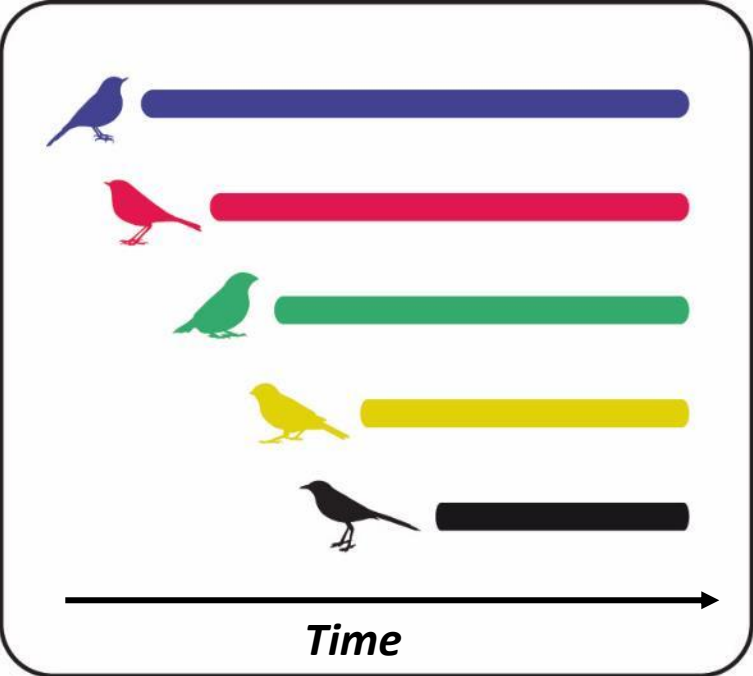


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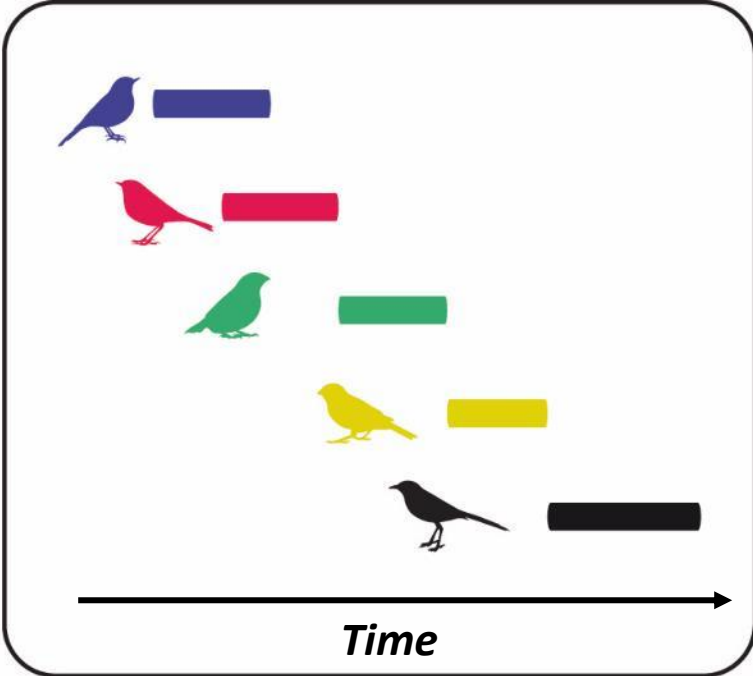
*Birds sing during longer periods where conspecific are abundant*

# A new step: anthropization changes song timing of bird communities

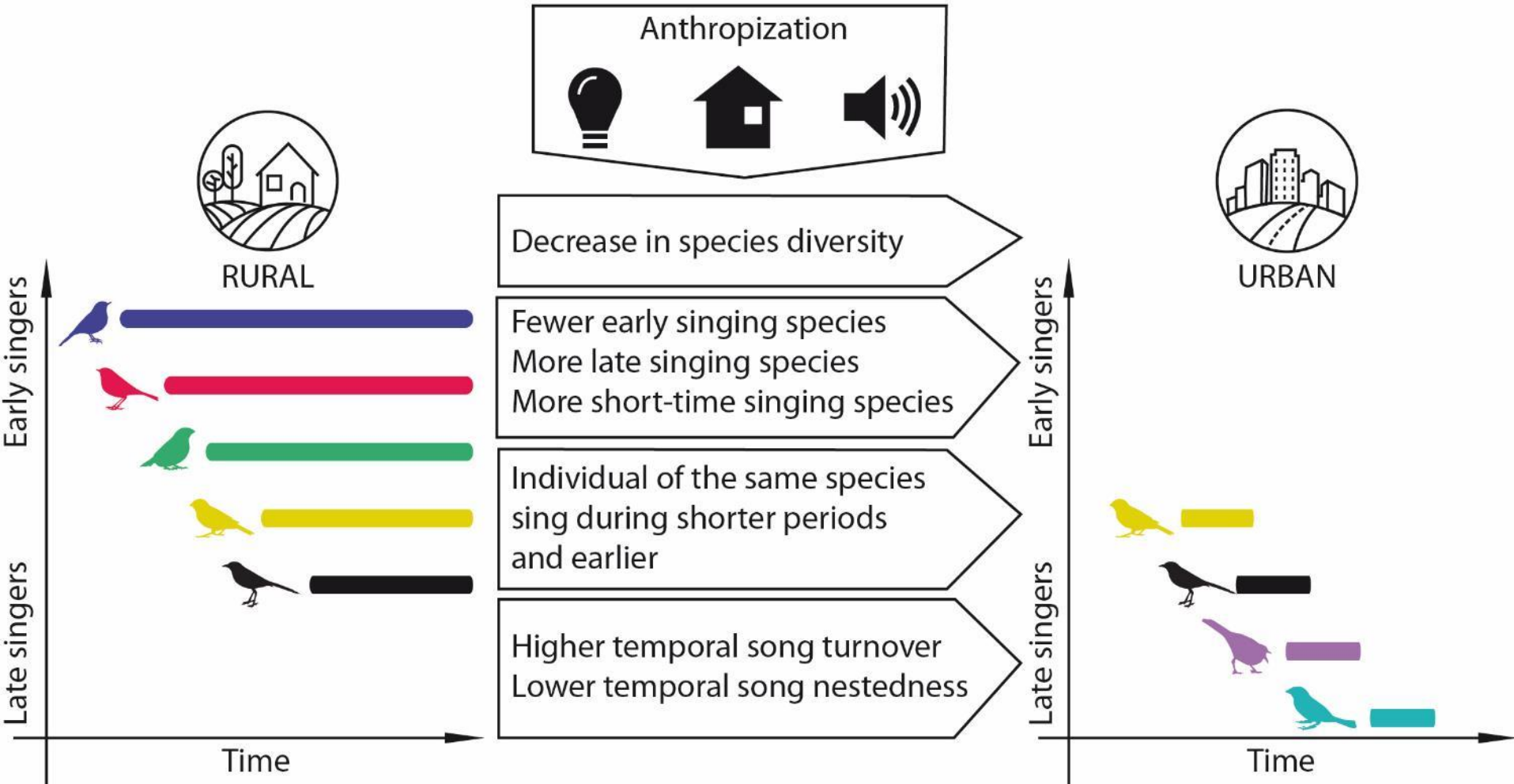
Nestedness



Turnover



# CONCLUSION



**Wake up!  
I'm done!**

