Tracing a highly mobile gleaner

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Insights in the ecology of *Myotis emarginatus* in Germany and implications for conservation

Robert Brinkmann & Claude Steck
Tracing a highly mobile gleaner
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Insights in the ecology of *Myotis emarginatus* in Germany and implications for conservation

- Distribution
- Roost selection
- Foraging habitats / diet
- Range
- Conservation measures
- Focus on flight paths

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Maternity colonies in Germany
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Maternity colonies in Germany – our focus in the next slides
Insights in the ecology of *Myotis emarginatus* in Germany

**Maternity colonies in southwestern Germany**

Five colonies

Between 50 and 500 Individuals

Situated in the warmest parts of the country

140m to 420m above sea level

**Hibernation sites**

Mostly in the black forest mountains

Only two swarming sites known
Maternity colonies in southwestern Germany

Roosts of maternity colonies
Attics of buildings (4)
Cowshed (1)
Maternity colonies in southwestern Germany

Roosts of maternity colonies
Attics of buildings (4)
Cowshed (1)
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Maternity colonies in southwestern Germany

Use of multiple roosts (commuting systems)
Maternity colonies in southwestern Germany

On average increasing population size?
Roosts of solitary individuals (males and non-reproductive females)

Sommer:
Roof overhangs outside of buildings
(Trees-holes and loose bark)

Winter:
caves, mines
Foraging habitats

Study of habitat use of a selected colony in 2001
Foraging habitats

Study of habitat use of a selected colony in 2001
Foraging habitats

Study of habitat use of a selected colony in 2001

- Maternity roosts
- Flight pathways
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Foraging habitats

Study of habitat use of a selected colony in 2001

- Maternity roost
- Flight pathways
- Cowsheds
Feeding habitats

Study of habitat use of a selected colony in 2001

- Maternity roost
- Flight pathways
- Cowsheds
- Forest habitats
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Foraging habitats

Study of habitat use of a selected colony in 2001

percentage of time spent in diff. habitats

- **cowsheds**
- **parks, alleys**
- ** hedgerows, orchards**
- **forest**

- repr. female
- repr. female
- repr. female
- repr. female
- repr. female
- female not repr.
- female not repr.
- male
- male

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Foraging habitats

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**Foraging habitats**

Study of habitat use of a selected colony in 2001
Foraging habitats

Habitat use in forests
Foraging habitats

Habitat use in forests – Bavaria (Zahn et al. 2009)

Fig. 1 Forest composition in the whole area, at foraging sites (in % of all foraging sites) and at reference sites (in % of all reference sites)

Foraging habitats

Habitat use of tracked individuals (between 2001 and 2007)

- Freiburg (n=10)
- Vögisheim (n=5)
- Lahr (n=8)
- Hasel (n=5)

- Parks, alleys
- Hedgerows, orchards
- Forest
- Cowsheds
Foraging habitats

Habitat use of individuals tracked (between 2001 and 2007)

- **solitary ind.**
  - n=6
  -cowshed: [data]
  -woods: [data]

- **maternity colony**
  - n=19
  -cowshed: [data]
  -woods: [data]
Diet

Diet of selected colony (Steck & Brinkmann 2006)

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**Diet**

*Diet of selected colony (Freiburg 2001)*

*Musca domestica*  
*Stomoxys calcitrans*
Range size of individuals

M. emarginatus is a highly mobile species
Insights in the ecology of *Myotis emarginatus* in Germany

**Range size of individuals**

- **Solitary individual**
- **Maternity colony**

The graph shows the distribution of feeding habitats across different distances from individual roosts. The x-axis represents the distance from the individual roost in meters, while the y-axis shows the number of feeding habitats. The data is categorized into different distance intervals, ranging from 0-1000 m to 15001-16000 m.
Range size of individuals

- Solitary individual: n=9
- Maternity colony: n=18

Mean distance of feeding habitats (in meters)

range size of individuals
Range size of individuals

Crossing borders

Touching protected areas
Range size of individuals

- Crossing borders
- Touching reserves
- Bearing conflicts (highways)
Insights in the ecology of *Myotis emarginatus* in Germany

**Conservation**

The conservation of *Myotis emarginatus* in the cultural landscape is a highly complex task

- Protect roosts
- Preserve and improve feeding habitats
- Ensure connectivity between key-habitats (summer/winter roosts/feeding habitats)
Conservation

Protection of maternity roosts

- Three roosts are part of the natura2000 network
- All roosts are monitored by the voluntary bat conservation society
- Three roosts were subject to modifications – in two cases with negative outcome

Protection of maternity roosts is an ongoing challenge.
Conservation

Protection of hibernation sites

- Some sites known are part of the natura2000 network
- Most of the known sites are monitored by the voluntary bat conservation society.
- Only a small proportion of individuals are to be found at the known hibernation sites.

The current strategy to protect the known hibernation sites covers less than 10% of the population
Conservation

Preservation of foraging habitats

- We have no direct influence on the number and "suitability" of cowsheds. However, we do not know how important they really are for the survival of *Myotis emarginatus*.

- Some foraging habitats in forests are situated in sites of the natura2000 network – here, we have influence (recommendations in management plans).

- We do not foresee the consequences of climate change on foraging habitats and prey availability.

Availability of foraging habitats in cowsheds is potentially a critical factor.
Conservation

Connectivity between colonies and feeding habitats

- We do little know about the most important pathways between roosts and foraging habitats.
- Conflicts are existing at highways and major railways.
- At the moment, mitigation measures can be implemented only if highways and railways are under construction (new or upgrade).
- Connectivity can principally be considered in management plans for natura2000 sites.
Conservation

Connectivity between colonies and feeding habitats

- We do little know about the most important pathways between roosts and feeding habitats.
- Conflicts are definitively existing at highways and railways.
- At the moment, mitigation measures can be implemented only if highways and railways are under construction (new or upgrade).
- Connectivity can principally be considered in management plans for natura2000 sites and in the regional plan.
Conservation

Considering connectivity in natura2000 management plans

- Major challenge: only few observations

Picture: Klaus Echle
Conservation

Considering connectivity in natura2000 management plans

- Major challenge: only few observations

- Approach: *modelling pathways*
Conservation

Considering connectivity in natura2000 management plans

- Major challenge: only few observations

- Approach: modelling pathways

- Aim: pathways with high probability of occurrence
Conservation

Modelling pathways between maternity roosts and potential foraging habitats

Basic data: observed flight-pathways
Conservation

Modelling pathways between maternity roosts and potential foraging habitats

**Basic data**: observed flight-pathways

**Statistical model**: compare presence data with pseudo-absences
Conservation

**Modelling pathways between maternity roosts and potential foraging habitats**

**Basic data**: observed flight-pathways

**Statistical model**: compare presence data with pseudo-absences

**Environmental variables**:
- Distance to rivers
- Vegetation structure (laserscanning data)
Conservation

Modelling pathways between maternity roosts and potential foraging habitats

Aerial photograph

Normalized digital surface model
= height of vegetation structure
Conservation

Modelling pathways between maternity roosts and potential foraging habitats

Basic data: observed flight-pathways

Statistical model: compare presence data with pseudo-absences

Environmental variables:
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Conservation

Modelling pathways between maternity roosts and potential foraging habitats

Basic data: observed flight-pathways

Statistical model: compare presence data with pseudo-absences

Environmental variables:
  • Distance to rivers
  • Vegetation structure (laser scanning data)

Output: „pathway suitability“
Conservation

Modelling pathways between maternity roosts and potential foraging habitats

**Basic data:** observed flight-pathways

**Statistical model:** compare presence data with pseudo-absences

**Environmental variables:**
- Distance to rivers
- Vegetation structure (laserscanning data)

**Output:** „pathway suitability“

**Final steps:** transform model-output to cost-raster and calculation of least-cost pathways between colonies and potential foraging habitats
Conservation

Modelling pathways between maternity roosts and potential foraging habitats

„pathway-suitability“
Conservation

Modelling pathways between maternity roosts and potential foraging habitats

Cost-raster for calculating least-cost pathways
Conservation

Modelling pathways between maternity roosts and potential foraging habitats

Results:
pathways with a relatively high probability of finding *Myotis emarginatus*
Conservation

Modelling pathways between maternity roosts and potential feeding habitats

Results:
pathways with a relatively high probability of finding Myotis emarginatus

The results match reality in many cases.
Conservation

Implementation of the results in conservation

Natura2000 management plans:
• Measures inside and outside reserves to preserve and improve connectivity
• Identification of critical points (highways, major railways)

Regional plan:
• Wildlife corridors between core areas
• Identification of critical points (highways, major railways)
Conservation

Connectivity between colonies and feeding habitats

- We do little know about the most important pathways between roosts and feeding habitats.
- Conflicts are definitively existing at highways and railways.
- At the moment, mitigation measures can be implemented only if highways and railways are under construction (new or upgrade).
- Connectivity can principally be considered in management plans for natura2000 sites.

The most important actually used pathways are still to be identified.
Conclusions

We still need to know more about…

- hibernation sites.

- predictability of „long-distance“ pathways.

- impact of climate change and landscape change
  - We suggest a study incorporating all available data at the European scale.
Conclusions

Studying the ecology of *M. emarginatus* at the European scale
Conclusions

Studying the ecology of *M. emarginatus* at the European scale
Conclusions

Let’s stay in touch …