Monitoring methods
Workshop Mavrovo
November 2005

Passive monitoring (PM): collecting second-hand information

Data that crop up „anyway“ are reported and compiled into a database attached to a GIS

Active monitoring (AM): periodic surveys and field procedures

Data are collected in a targeted and systematic way to assure that the sample is as homogenous as possible
The observations are assessed and classified according to the SCALP criteria:

- Category 1: hard facts
- Category 2: confirmed observations
- Category 3: unconfirmed observations

### Analysis and presentation of chance observations:

<table>
<thead>
<tr>
<th>Monitoring type</th>
<th>Analysis</th>
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<th>Reporting</th>
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</thead>
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Information to be integrated into a passive monitoring system:

1) Dead lynx

2) Livestock or wildlife killed by lynx

3) Chance observations (direct sightings, tracks, kills)
### Information to be integrated into a passive monitoring system:

1) **Dead lynx**

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### Methods:

- Lynx found dead must be collected in from the whole distribution area
- It is important to inform all institutions (e.g. wildlife and forest services, hunters, police, veterinarian) possibly involved on: how to collect a carcass or remaining parts; what data to record; where to send parts and forms
### Registration of lynx mortality:

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### Analysis and presentation of dead lynx:

- Map of Switzerland showing the distribution of dead lynx in 2004.

- Dead lynx locations indicated on the map.
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#### Interpretation of the data:

- C1 data (SCALP criteria)
- Mortality data are tricky to interpret as high losses can indicate both an increasing or decreasing population
- The evolution of the losses represents trends only over a longer period and with a delay of a few years
- For an interpretation over short periods they need to be compared with other datasets
- Provide information on reproduction

Mortality factors as well as genetic and taxonomic status can furthermore be collected. This is especially important for the Balkan lynx.
### Information to be integrated into a passive monitoring system:

1) **Dead lynx**
2) **Livestock or wildlife killed by lynx**

### Method:

- In many European countries, livestock killed by lynx are compensated, if confirmed by trained staff (game wardens, foresters, etc.)
- Reporting is high because of the compensation
- Wild ungulates killed are even better indicator but not often found
- Identification of kills requires trained and motivated network of observers and high public awareness
### Kill form:

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### Analysis and presentation of livestock killed by lynx:

![Map of livestock killed by lynx]

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Analysis and presentation of livestock killed by lynx:

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### Interpretation of the data:

- If the examination and reporting is done by a network of trained people, the amount of kills found per time unit in a certain area is the best category 2 dataset (C2, SCALP criteria).
- The quality of the dataset depends on the probability of finding kills.
- If the network is well established, kill frequency allow a relative comparison between different areas and years.
- The locality of wild ungulates kill sites gives good indication on the lynx distribution and habitat use.
- Livestock depredation is biased towards areas where small ruminants (sheep & goats) are available.
- Up to date, no case in Europe was reported where lynx were living mainly from livestock.
Information to be integrated into a passive monitoring system:

1) Livestock or wildlife killed by lynx
2) Dead lynx
3) Chance observations (direct sightings, tracks, kills)

Method:
- Chance observations should be collected in a systematic way
- The variation within the dataset should not be the consequence of an inconsistent data collection
- Chance observations are collected over a large area (e.g. country) and should be gathered over a larger area as the presumed distribution area
- Potential observers (e.g. hunters, farmers, ...) must be instructed about the importance of reporting occasional lynx observation
- The amount of data collected will depend on the propaganda made
Lynx observation form:

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Analysis and presentation of chance observations:

Category 1

- Dead lynx
- Extensive camera trapping
Analysis and presentation of chance observations:

Category 2

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<td>2004</td>
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<tr>
<td>Category 2</td>
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- Livestock
- Chance observations

Analysis and presentation of chance observations:

Category 3

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<tr>
<td>2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category 3</td>
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- Chance observations
Analysis and presentation of chance observations:

**Comparison with other data sets**

- **Trend lynx**
- **Chance observations**
- **Livestock killed by lynx**

### Interpretation of the data:

- Chance observations must be interpreted with care, as they likely include several biases.
- At the periphery of the known distribution area, presence or absence of random observations indicate expansion or loss of area.
- Within the known area of occupation, they can if collected consistently over years be an indicator for population trends.
- Information on reproduction can also be obtained.
Information to be integrated into an active monitoring system:

1) Periodical inquiries

2) Track transects

3) Camera trapping (extensive & intensive)

4) Captures and telemetry (VHF, GPS/GSM)
Interpretation of the data:

- It allows a quick and easy overview of the total distribution area
- Gaps in the lynx distribution area
- Gaps in the monitoring system
- Information on relative density and population trends
- Information on reproduction
- Important for the control of the interpretation of the passive monitoring and to adjust the monitoring if gaps have been identified
Information to be integrated into an active monitoring system:

1) Periodical inquiries
2) Track transect

Methods:

- Lynx tracks are searched in the snow along forest roads, paths or pre-defined transect lines.
- The survey is made 2-3 days after snowfall
- The number of lynx tracks crossing the transect lines and their direction is recorded
- All tracks are mapped and measured
- Double counting is avoided by backtracking all tracks or by ensuring that at least one transect without tracks lies between two transects with tracks
- Transect routes can either be positioned randomly or according to a strict pattern
- They should be placed in good lynx habitat and consider the movement pattern of lynx
### Monitoring Type

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### Interpretation of the data:

- Presence/absence of lynx tracks on survey routes
- Minimum estimations
- Comparisons between transects or years strongly depend on the variability of the weather conditions
Information to be integrated into an active monitoring system:

1) Periodical inquiries
2) Track transect
3) Camera trapping (intensive & extensive)

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<tr>
<td>Extensif camera trapping in CH</td>
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</tbody>
</table>

* People equipped with photo traps in CH
Active monitoring
Passive monitoring
Monitoring type
Analysis
Passive monitoring
Active monitoring
Reporting

Active monitoring
Passive monitoring
Monitoring type
Analysis
Passive monitoring
Active monitoring
Reporting

Active monitoring
Passive monitoring
Monitoring type
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Reporting

Active monitoring
Passive monitoring
Monitoring type
Analysis
Passive monitoring
Active monitoring
Reporting
Identification of lynx
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<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
</tbody>
</table>
Active monitoring
Passive monitoring
Monitoring type

Reportng
Analysis
• C1 data SCALP criteria
• Minimum number of lynx present in the area
• Confirm the presence of the species in a new area (hard facts)
• Information about reproduction
• Anecdotic information about dispersal
• Anecdotic information about spatial use
• Survival and population trend if conducted over several years
• Enables to collect pictures of both flanks of the individuals (important in case an intensive session is planned in the future)

Interpretation of the data:

Code:
U = could not be identified
L = only left flank
R = only right flank
B = both flanks
### Minimum number of lynx pictured

<table>
<thead>
<tr>
<th>Compartiment</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Jura</td>
<td>4-5 (+2 juv.)</td>
<td>5 (+4 juv.)</td>
<td>4</td>
</tr>
<tr>
<td>II North-eastern CH</td>
<td>0</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>III Central CH West</td>
<td>0</td>
<td>1-2</td>
<td>3</td>
</tr>
<tr>
<td>IV Central CH East</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V Grisons</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VI North-western CH Alpes</td>
<td>18-21 (+6 juv.)</td>
<td>17-20 (+1 juv.)</td>
<td>18-19 (+10 juv.)</td>
</tr>
<tr>
<td>VII Valais</td>
<td>0</td>
<td>0</td>
<td>(1 juv.)</td>
</tr>
<tr>
<td>VIII Ticino</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24-28 (+8 juv.)</strong></td>
<td><strong>27-32 (+5 juv.)</strong></td>
<td><strong>26-27 (+11 juv.)</strong></td>
</tr>
</tbody>
</table>

### Examples of spatial use
Examples of dispersal

Intensive camera trapping in CH
<table>
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<tbody>
<tr>
<td>37 sites</td>
<td></td>
<td></td>
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<tr>
<td>Area of 558 km$^2$</td>
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- 35 lynx pictures

- 3 of them could not be clearly identified

- Both side of the lynx could be pictured in 49% of the cases

- The combination of pictures from the extensive session and the slaves enable to identify both flanks of 11 individuals out of 12
• Provides a population and density estimation with a confidence interval
• If the confidence interval is too high (small sample size) than it is still possible to estimate a minimum number of individuals in the study area
• If conducted over several years it gives an excellent indication of the population trend, enable to estimate survival rates, and rate of population change
• Information such as reproduction; spatial use, and last but not least information about other species than lynx

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<tbody>
<tr>
<td>Interpretation</td>
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Information to be integrated into an active monitoring system:

1) Periodical inquiries
2) Track transect
3) Camera trapping (intensive & extensive)
4) Captures and telemetry (VHF, GPS/GSM)

Non invasive methods
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<tr>
<td>Captures: footsnares (Breitenmoser 1989)</td>
<td><img src="image1.png" alt="Image" /></td>
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<tr>
<td>Captures: MICS (Ryser et al. 2005)</td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
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</table>
### Monitoring type | Analysis | Passive monitoring | Active monitoring | Reporting
---|---|---|---|---
Captures: box traps (Haller & Breitenmoser 1986)
### Monitoring Types

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<tr>
<td>Radio-telemetry:</td>
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**Active monitoring**
- Radio-telemetry, camera trapping

**Passive monitoring**
- Polygons: Home ranges resident males, females
- Lynx symbols: Resident males, females confirmed presence (C1, C2), camera trapping
- Footprints: Males, females assumed from indirect observations

**Absolute abundance**
(Eurasian lynx)
Telemetry studies:

Radio telemetry is the most efficient way to study the biology and ecology of the lynx in the field. Only the aspects of direct importance for the monitoring area outlined

- Provides information that can be used to calibrate the results of the monitoring
- Enables to optimise the design of monitoring programmes
- The resulting home range and population density can be used to estimate the population size or regional abundance from the relative values gained with the monitoring programme
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<td><strong>Switzerland</strong></td>
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- Explications
- 1. Introduction
- 2. Statut du lynx
- 3. Monitoring en Suisse
  - 3.1. Données classées selon les critères SCALP
  - 3.2. Observations occasionnelles
  - 3.3. Enquêtes auprès des gardes-faune
  - 3.4. Animaux de rente indemnisés
  - 3.5. Lynx trouvés morts ou retirés de la population
  - 3.6. Reproduction
- 4. Monitoring au sein des compartiments
  - 4.1. Compartiment I Jura
  - 4.2. Compartiment II Nord-est de la Suisse
  - 4.3. Compartiment III Ouest de la Suisse centrale
  - 4.4. Compartiment IV est de la Suisse centrale
  - 4.5. Compartiment V Alpes orientales
  - 4.6. Compartiment VI Nord-ouest des Alpes
  - 4.7. Compartiment VII Valais
  - 4.8. Compartiment VIII Alpes méridionales
  - 4.9. Pièges-photographiques extensifs
  - 4.10. Pièges-photographiques intensifs

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<td><strong>Alpine countries</strong></td>
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- Hystrix 10(1), 1998
  - Period: from the re-introduction until 1995
- Hystrix 12(2), 2001
  - Period: from 1995 until 1999
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<td><em>ELOIS</em></td>
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Status and conservation of the Eurasian lynx (*Lynx lynx*) in Europe in 2001

KORA
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**Active monitoring**

**Passive monitoring**

**Analysis**

**Reporting**
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Thank you for your attention