LIFE13 BIO/IT/000204 U-SAVEREDS
Management of grey squirrel in Umbria: conservation of red squirrel and preventing loss of biodiversity in Apennines

HEALTH STATUS OF GREY SQUIRRELS (Sciurus carolinensis):

RESULTS OF LIFE PROJECT U-SAVEREDS

Crotti S., Paoloni D., Costarelli S., Casciari C., Felici A., Gavaudan S., Pesca C., Papa P., Cruciani D.
LIFE13 BIO/IT/000204 PROJECT U-SAVEREDS

October 2014 – October 2018

Conservation of the native Red squirrel in Umbria

Eradication of Grey squirrel population

Biodiversity protection of forest ecosystems in central Italy

HOW???

- Direct removal: capture and euthanasia
- Indirect removal: capture, surgical sterilization and release

WHY???

EU Regulation n. 1143/2014 for removal of grey squirrel
EASTERN GREY SQUIRREL *Sciurus carolinensis*

- **Invasive Alien Species (IAS)**
- Species that can be close to humans
  - Found in urban areas
  - "Competitive exclusion" with red squirrel

**Ecological and sanitary** negative impacts
ACTION C.4: POIS application

ACTION A.5: Protocol for Sanitary Screening (POIS)

Istituto Zooprofilattico Sperimentale dell’Umbria e delle Marche “Togo Rosati” (IZSUM)
✓ Scientific literature
(articles, reviews, ...)

✓ Selection of pathogens
to investigate

- **Direct** diagnostic tests
- **Indirect** diagnostic tests
SAMPLING PROTOCOL (Action C.1)

- **Sciurus carolinensis**
  - captured and euthanised

- **Sciurus sp.**
  - road killed

- **Sciurus vulgaris**
  - captured, tagged and released
SAMPLING PROTOCOL (Action C.1)

- 1500 grey squirrels
- LC: 95%
- Prevalence: 1%

Direct removal of 271 grey squirrels:

1. Capture by Tomahawk Live Trap
2. Euthanasia by CO₂ inhalation
3. Data collection (alphanumeric code, sex, weight, reproductive conditions)
4. Field sampling: intracardiac blood, ectoparasites
5. POIS application at IZUM "Togo Rosati" (Action C.4)
POIS APPLICATION (Action C.4)

**CAPTURE AND EUTHANASIA**

- **Toxoplasma gondii**
  - Matrix: Serum (CNS)
  - Diagnostic technique: Latex test (PCR if positive)

- **Leptospira spp.**
  - Matrix: Serum (Kidney)
  - Diagnostic technique: MAT (PCR if positive)

- **Francisella tularensis**
  - Matrix: Serum (Spleen, liver, kidney)
  - Diagnostic technique: MAT (PCR if positive)

- **Chlamydia spp.**
  - Matrix: Serum (Lung, reproductive apparatus)
  - Diagnostic technique: CFT (PCR if positive)

- **Poxvirus**
  - Matrix: Serum (Eyelid)
  - Diagnostic technique: ELISA (PCR if positive)

**NECROPSY**
# NECROPSY

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Matrix</th>
<th>Diagnostic technique</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BACTERIOLOGY LAB</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacteria</td>
<td>Rectal swab</td>
<td>Standard bacteriological examination</td>
</tr>
<tr>
<td></td>
<td>Liver, brain, lung</td>
<td></td>
</tr>
<tr>
<td>Dermatophytes</td>
<td>Fur</td>
<td>Cultural exam (PCR if positive)</td>
</tr>
<tr>
<td><strong>MYCOLOGY LAB</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yeast</td>
<td>Oral swab</td>
<td>Cultural exam</td>
</tr>
<tr>
<td></td>
<td>Rectal swab</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Utero-vaginal swab</td>
<td></td>
</tr>
<tr>
<td><strong>MOLECULAR BIOLOGY LAB</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coxiella burnetii</td>
<td>Spleen, ticks</td>
<td>PCR</td>
</tr>
<tr>
<td>Borrelia spp.</td>
<td>Spleen, ticks</td>
<td>PCR</td>
</tr>
<tr>
<td>Rickettsia spp.</td>
<td>Spleen, ticks</td>
<td>PCR</td>
</tr>
<tr>
<td>Babesia spp.</td>
<td>Spleen, ticks</td>
<td>PCR</td>
</tr>
<tr>
<td>Anaplasma spp.</td>
<td>Spleen, ticks</td>
<td>PCR</td>
</tr>
<tr>
<td>Flavivirus</td>
<td>Spleen, ticks</td>
<td>PCR</td>
</tr>
<tr>
<td>Adenovirus</td>
<td>Liver, intestine</td>
<td>PCR</td>
</tr>
<tr>
<td><strong>VIROLOGY LAB</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MANAGEMENT FEEDBACK

NO POSITIVITY

NOTIFABLE DISEASES

Keeping current management activities according to the BMP (Action A.8)

AT LEAST ONE POSITIVITY

NOT NOTIFABLE DISEASES

Approach remodulation according to the BMP (Action A.8)

- World Organisation for Animal Health (D.P.R. 8 febbraio 1954, n. 320)
- Regolamento di Polizia Veterinaria e Decreto Ministeriale 15 dicembre 1990
- Sistema informativo delle malattie infettive e diffusive
NOTIFIABLE DISEASES:
- Q Fever (C. burnetii)
- Rickettsiosis (Rickettsia spp.)
- Tularemia (F. tularensis)
- Leptospirosis (Leptospira spp.)
- Psittacosis (C. psittaci)
- Dermatophytosis (dermatophytes)

INDIVIDUAL-DPENDENT RESPONSE:
- Increase catch rate
- NO sterilization or release of grey squirrels

AREA-DPENDENT RESPONSE:
- NO translocation or reinforcement of red squirrel populations
- NO release of sterilized grey squirrel
Other diseases:
- transmissible to humans (zoonosis)
- transmissible to other wild animals
- transmissible to pets

Examples:
- "City center and high-density neighborhoods"
- "Urbanized area with a high percentage of public/private parks"
- "Urbanized area immersed in the wooded matrix"
- "Città della Domenica"

> Sample size for sanitary investigations
RESULTS
(at January 2018)

142 grey squirrels analyzed:

- good body conditions
- NO external lesions or macroscopically evident internal lesions at necropsy
- EXCEPT alopecic areas in some animals
- NO pathogenic germs at Standard Bacteriological Examination
  - EXCEPT Candida albicans: 4 positives
  - BUT not to be considered alarming for public health
- EXCEPT Escherichia coli isolated from several rectal swabs but considered as part of the normal intestinal flora
RESULTS
(at January 2018)

**Coxiella burnetii:**
2 positives (1,4%)
(MU 28)

**Borrelia lusitaniae:**
1 positive (0,7%)
(MU 26)

Q Fever

Notifiable disease:
Individual-dipendent response
+ Area-dipendent response

On 142 grey squirrels analyzed
RESULTS (at January 2018)

Dermatophytes: 46 positive samples on 142 analyzed (32.4%)

4 different fungal species:

<table>
<thead>
<tr>
<th>ID</th>
<th>N° of analyzed</th>
<th>N° of positives</th>
<th>N° positives/dermatophyte</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2</td>
<td>1 (50%)</td>
<td>1 Microsporum cookei</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>0</td>
<td>/</td>
</tr>
<tr>
<td>23</td>
<td>3</td>
<td>1 (33,3%)</td>
<td>1 Microsporum cookei</td>
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<tr>
<td>26</td>
<td>10</td>
<td>3 (30%)</td>
<td>3 Microsporum cookei</td>
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<tr>
<td>27</td>
<td>14</td>
<td>0</td>
<td>/</td>
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<tr>
<td>28</td>
<td>41</td>
<td>18 (43,9%)</td>
<td>3 Trichophyton mentagrophytes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>13 Microsporum cookei</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>2 Trichophyton ajelloi</td>
</tr>
<tr>
<td>33</td>
<td>28</td>
<td>10 (35,7%)</td>
<td>4 Trichophyton mentagrophytes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6 Microsporum cookei</td>
</tr>
<tr>
<td>37</td>
<td>4</td>
<td>0</td>
<td>/</td>
</tr>
<tr>
<td>38</td>
<td>3</td>
<td>2 (66,7%)</td>
<td>2 Microsporum cookei</td>
</tr>
<tr>
<td>39</td>
<td>3</td>
<td>2 (66,7%)</td>
<td>2 Microsporum cookei</td>
</tr>
<tr>
<td>44</td>
<td>16</td>
<td>1 (6,25%)</td>
<td>1 Trichophyton mentagrophytes</td>
</tr>
<tr>
<td>46</td>
<td>3</td>
<td>2 (66,7%)</td>
<td>1 Microsporum cookei</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1 Trichophyton thuringiense</td>
</tr>
<tr>
<td>64</td>
<td>8</td>
<td>3 (37,5%)</td>
<td>2 Microsporum cookei</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1 Trichophyton thuringiense</td>
</tr>
<tr>
<td>65</td>
<td>6</td>
<td>3 (50%)</td>
<td>1 Trichophyton ajelloi</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 Microsporum cookei</td>
</tr>
</tbody>
</table>

23,2% M. cookei (Foto: IZSUM)

2,1% Trichophyton spp. (Foto: IZSUM)

5,6% T. mentagrophytes (Foto: IZSUM)

1,4% Trichophyton spp. (Foto: IZSUM)
CONCLUSIONS

Potential source of zoonosis
- Children
- Elders
- Immunodeficient people

Dermatophytosis
- Overabundance
- Direct contact
- Environmental load

Further investigations
- Serum
- Organs

YOPI

THANK YOU FOR YOUR ATTENTION