Medical aspects of lesser kestrel (*Falco naumanni*) captive breeding and reintroduction programme

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Overview

- Introduction
- The lesser kestrel captive breeding and reintroduction programme in Catalonia
- Medical aspects and main studies
- Discussion
LESSE KESTREL
CONSERVATION

- Publicity and public education
- Divulgation project and results

- Population dynamics
- Food and nest availability
- Interspecies relation & predators

- Protection of habitat
- Law enforcement
- Long term economic support
- Economic compensations

- Preventive medicine
- Disease surveillance
- Mortality causes

MULTIDISCIPLINARY APPROACH

EDUCATION

POLITICS

ECOLOGY & HABITAT

HEALTH

En Xori i el Cap de Creus
Lesser Kestrel Status in Catalonia

1986 last pair in Catalonia
1988 start captive breeding programme
1991 breeding pairs in Girona
1993 breeding pairs in Lleida

2011 127 breeding pairs, 41 in Girona and 86 Lleida
Evolution of lesser kestrel population in Catalonia
More than 25,000 ha. specific protection of lesser kestrel

Natura 2000 network in Catalonia more than 30% territory

Girona

Lleida
Lesser kestrel programme

Field work

- Monitoring breeding pairs and their offspring
- Biometry
- Ringing (includes special coloured distance rings)
- Telemetry, home range
- Maintenance work (nests, predator avoidance)
Lesser kestrel programme

**Captivity**
- Breeding activities
- Health checks
- Data collection
- Preparation for release (ringing of hacking chicks)
- Maintenance work (aviaries, nests, incubation room)
Management of eggs

• Natural incubation

• Artificial incubation
  – Humidity: 40%
  – Temperature: 37,4º C
  – Automatic turning

**Periodic controls**: weight, candling, buddy digital monitoring

**Expected weight loss**: 12-18%
*(15% OPTIMAL)*
Management of eggs

Clutch size: 3-6 eggs
Incubation period: 23 days

Hatching.
Chick pips air chamber (internal pip)
Chick breaks egg-shell (external pip)

Egg transferred to hatcher incubator (humidity 70%)

Chicks usually hatch within 2-3 days. Some chicks need assistance.
Management of chicks

FIRST DAY OF LIVE

• General appearance, weight
• Disinfection navel with iodine
• In hatcher incubator until dry
• First meal (after 6 hours)
Management of chicks

- Chicks placed in trays with gravel (marked colour)
- Temperature controlled by probe and thermostat to maintain 37ºC-39ºC
- Transferred to nest before 10 days (marked rings)
Management of chicks

HAND- FEEDING (1-10 days)

• Rat mince offered 5 times a day
• Check crops before feeding!
• Feed until crop is full or begging stops; do not overfeed
• Minimum contact to avoid imprinting
Medical aspects

- Preventive medicine
  Quarantine
  Health checks
  Clinical attention of adults and chicks
  Necropsies

- Studies
  Establishment of reference values
  Mycoplasma in *Falco naumanni*

Quarantine

WHY?
Detection of pathogens
Avoid entrance of diseases
Acclimatation process
New facility, food, keepers, weather… STRESS
Quarantine

Work routine
- Quarantine animals **last**
- Do not move back and forth between areas
- Do not mix materials, each area should have minimal equipment
- Quarantine staff clothing
Quarantine

- Duration: minimum 30 days
- Physical examination
- Radiology (mammography)
- Sampling
  - Blood: haematology/biochemistry
  - Faeces: parasites, *Salmonella*, (*Campylobacter*)
  - Ocular conjuntiva, choana, cloaca:
    - Ag *Chlamydophila*
Stock health checks

- **Twice a year**, before and after breeding season
- Physical exam
- Sampling (haematology, serum chemistry, microbiology, parasitology)
- Detection of asymptomatic carriers *Salmonella*
- Beak and nail trimming
Microbiology

What is the normal flora?

Bacterial isolates from choana healthy lesser kestrel (n=64)

- Staphylococcus: 33
- Micrococcus: 32
- Cocobacillus: 32
- Others: 2
Microbiology

Faecal isolates include enterobacteria and mixed gram positive bacteria.

*Salmonella* is not normal isolate and should be investigated in all breeding pairs.
Parasitology - faeces

Macro and microscopical exam

Fecal sample
- Positive
- Negative

Treatment
- Positive
- Negative

Confirmation (2 times)
Parasitology - others

- Crop swab, detection of *Tricomonas* sp.
- Blood smear, detection of hemoparasites.
- Feathers exam, detection of ectoparasites.
  Preventive use of fipronil spray.
Clinical findings - adults

Upper respiratory tract problems
Rhinitis (plugged nares)
Sinusitis
Clinical findings - adults

Beak defects and overgrowth
Clinical findings - adults

Ocular alterations
Clinical findings - adults

Pododermatitis grade I-II
Main problems in captive bred chicks (2007-2011)

Total number chicks 2007-2011 was 469
Clinical findings - Chicks

Failure of yolk sac retraction and inflammation of navel

NORMAL

ABNORMAL

28 CASES WERE OBSERVED, 19 SURVIVED, 9 DIED
Clinical findings - Chicks

Retarded growth and feather problems

25 CASES WERE OBSERVED, 23 SURVIVED, 2 DIED
Clinical findings - Chicks

Parental aggression

14 cases were observed, 3 survived, 11 died
Clinical findings - Chicks

Skeletal deformities

13 CASES WERE OBSERVED, 11 SURVIVED, 2 DIED
Clinical findings - Chicks

Bacterial sinusitis

6 CASES WERE OBSERVED, 3 SURVIVED, 3 DIED
Clinical findings - Chicks

Subcutaneous abscesses
Serum chemistry values

- Age, only adults (age > 2 years)
- Both sexes
- Before and after breeding season
- Healthy birds
- Fasting 12h
## Lesser kestrel serum chemistry

<table>
<thead>
<tr>
<th>Parameter</th>
<th>n</th>
<th>P 2,5-P 97,5</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST (U/l)</td>
<td>76</td>
<td>34,63-293,68</td>
<td>77,25</td>
<td>57,692</td>
</tr>
<tr>
<td>CK (UI/l)</td>
<td>63</td>
<td>407,8-1909,2</td>
<td>795,49</td>
<td>315,16</td>
</tr>
<tr>
<td>GGT (UI/l)</td>
<td>19</td>
<td>57 (Upper value)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Amylase (U/l)</td>
<td>57</td>
<td>161,8-1113,8</td>
<td>606,87</td>
<td>230,746</td>
</tr>
<tr>
<td>Lipase (UI/l)</td>
<td>63</td>
<td>&lt;5</td>
<td>2,7</td>
<td>1,7</td>
</tr>
<tr>
<td>Bile acids (umol/l)</td>
<td>57</td>
<td>1,33-84,36</td>
<td>14,65</td>
<td>16,62</td>
</tr>
<tr>
<td>Urea (mmol/l)</td>
<td>57</td>
<td>1,01-2,61</td>
<td>1,51</td>
<td>0,38</td>
</tr>
<tr>
<td>Uric acid (µmol/l)</td>
<td>76</td>
<td>134,57-1363,87</td>
<td>426,85</td>
<td>281,94</td>
</tr>
<tr>
<td>Creatinine (µmol/l)</td>
<td>24</td>
<td>38,89 (39,1-56,79)</td>
<td>47,18</td>
<td>4,51</td>
</tr>
<tr>
<td>Triglycerides (mmol/l)</td>
<td>47</td>
<td>0,88-2,34</td>
<td>1,61</td>
<td>0,36</td>
</tr>
<tr>
<td>Cholesterol (mmol/l)</td>
<td>76</td>
<td>4,29-12,77</td>
<td>7,05</td>
<td>1,99</td>
</tr>
<tr>
<td>Total protein (g/l)</td>
<td>76</td>
<td>23,75-60,45</td>
<td>32,74</td>
<td>8,68</td>
</tr>
<tr>
<td>Prealbumin (g/l) (%)</td>
<td>76</td>
<td>4,96-10,1 (18,62-23,98)</td>
<td>7,07 (21,58)</td>
<td>1,87 (1,36)</td>
</tr>
<tr>
<td>Albumin (g/l) (%)</td>
<td>76</td>
<td>10,14-29,39 (38,45-49,58)</td>
<td>14,62 (44,6)</td>
<td>3,86(2,82)</td>
</tr>
<tr>
<td>Alpha 1 (g/l) (%)</td>
<td>76</td>
<td>1,30-5,9 (3,95-16,31)</td>
<td>3,12 (9,62)</td>
<td>1,02 (2,38)</td>
</tr>
<tr>
<td>Alpha 2 (g/l) (%)</td>
<td>76</td>
<td>1,1-3,92 (3,8-10,63)</td>
<td>2,019 (6,24)</td>
<td>0,61 (1,43)</td>
</tr>
<tr>
<td>Beta (g/l) (%)</td>
<td>76</td>
<td>2,33-8,98 (8,79-15,94)</td>
<td>4,01(12,21)</td>
<td>1,34 (2,03)</td>
</tr>
<tr>
<td>Gamma (g/l) (%)</td>
<td>76</td>
<td>0,81-4,8 (2,79-11,51)</td>
<td>1,97 (5,7)</td>
<td>1,85 (3,09)</td>
</tr>
<tr>
<td>A:G ratio</td>
<td>76</td>
<td>1,37-2,77</td>
<td>1,99</td>
<td>0,33</td>
</tr>
</tbody>
</table>
Mycoplasma study

• **Background** (2006)
  One euthanized chick with retarded growth and perosis type deformity. Positive culture of mycoplasma. Investigation of some captive adults, also positive!!

Are Mycoplasmas a problem in our captive stock?
But...what are Mycoplasmas?

- Very small bacteria lacking cell walls that belong to various genera within the class *Mollicutes*
- Culture: require very complex, nutritionally enriched media
- Known pathogens in poultry industry
Mycoplasma study

In the past
Detection of mycoplasmas in diseased raptor diagnosis of mycoplasmosis

Recent investigations
Mycoplasmas in different raptor populations commonly detected

More confusion added! Are Mycoplasmas a problem in raptors?
Mycoplasma study

Captivity

1) Adults
2) Chicks
   2.1) Retarded growth
       2.1.1) with adult contact
       2.1.2) without adult contact (nursery)
   2.2) Normal
       2.2.1) with adult contact
       2.2.2) without adult contact (nursery)
3) Non-hatched eggs

Wild population

1) Adults
2) Juveniles
3) Non-hatched eggs

Control population ARAGON

Samples consisted in choanal swabs (birds) or swabs yolk sac membrane (eggs)
Mycoplasma study

Mycoplasma results eggs. PCR Genus specific negative

<table>
<thead>
<tr>
<th>Category</th>
<th>Stage not determined</th>
<th>dead-in-shell</th>
<th>Aborted. Early stage</th>
<th>Aborted. Late stage</th>
<th>Infertile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild- Aragon</td>
<td>3</td>
<td>10</td>
<td>13</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Wild- Catalonia</td>
<td>9</td>
<td>10</td>
<td>13</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Captivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captivity Infertile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captivity Aborted. Early stage</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Captivity Aborted. Late stage</td>
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<td></td>
<td></td>
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<tr>
<td>Captivity dead-in-shell</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Wild- Aragon Stage not determined</td>
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<tr>
<td>Wild- Catalonia Stage not determined</td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

ALL 72 EGGS WERE NEGATIVE
Table 1. Isolation and differentiation of mycoplasmas from captive and free-ranging lesser kestrels in Spain with regard to their age and geographical origin.

<table>
<thead>
<tr>
<th>Origin/age</th>
<th>Negative&lt;sup&gt;A&lt;/sup&gt;</th>
<th>PCR positive&lt;sup&gt;B&lt;/sup&gt;</th>
<th>Culture positive&lt;sup&gt;C&lt;/sup&gt;</th>
<th>M. falcónis&lt;sup&gt;D&lt;/sup&gt;</th>
<th>M. buteonis&lt;sup&gt;D&lt;/sup&gt;</th>
<th>n.i.&lt;sup&gt;E&lt;/sup&gt;</th>
<th>Mixed infection&lt;sup&gt;F&lt;/sup&gt;</th>
<th>Name of isolate/size of sequenced 16S rRNA product (bp)/GenBank accession no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captive/adult (&lt;i&gt;n = 6&lt;/i&gt;)</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>M200-2-C12/1346/EU684060</td>
</tr>
<tr>
<td>Captive/nestlings (hand-reared; &lt;i&gt;n = 9&lt;/i&gt;)</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Captive/nestlings (parent-reared; &lt;i&gt;n = 9&lt;/i&gt;)</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>Chicks without adult contact remain negative</td>
<td></td>
</tr>
<tr>
<td>Free-ranging/adults, province of Lleida&lt;sup&gt;G&lt;/sup&gt; (&lt;i&gt;n = 11&lt;/i&gt;)</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>8</td>
<td>1</td>
<td>7</td>
<td>6</td>
<td>M222-2-C12/395/EU684062  M222-5-C11/1373/EU684058</td>
</tr>
<tr>
<td>Free-ranging/nestlings, province of Lleida&lt;sup&gt;G&lt;/sup&gt; (&lt;i&gt;n = 6&lt;/i&gt;)</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Free-ranging/adults, province of Girona&lt;sup&gt;G&lt;/sup&gt; (&lt;i&gt;n = 7&lt;/i&gt;)</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>M209-7-C12/1326/EU684061</td>
</tr>
<tr>
<td>Free-ranging/nestlings, province of Girona&lt;sup&gt;G&lt;/sup&gt; (&lt;i&gt;n = 1&lt;/i&gt;)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>M209-8-C12/1259/EU684063</td>
</tr>
<tr>
<td>Free-ranging/adults, province of Zaragoza&lt;sup&gt;H&lt;/sup&gt; (&lt;i&gt;n = 10&lt;/i&gt;)</td>
<td>0</td>
<td>3</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>M221-9-C12/679/EU684064  M221-9-C12/1360/EU684059</td>
</tr>
<tr>
<td>Free-ranging/nestlings, province of Zaragoza&lt;sup&gt;H&lt;/sup&gt; (&lt;i&gt;n = 6&lt;/i&gt;)</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>M.buteonis was not detected in Zaragoza</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total free-ranging/adults (&lt;i&gt;n = 28&lt;/i&gt;)</td>
<td>2 (7.1%)</td>
<td>5</td>
<td>21 (75%)</td>
<td>20 (71%)</td>
<td>3 (10.7%)</td>
<td>18 (64.3%)</td>
<td>18 (64.3%)</td>
<td></td>
</tr>
<tr>
<td>Total free-ranging/nestlings (&lt;i&gt;n = 13&lt;/i&gt;)</td>
<td>0</td>
<td>3</td>
<td>10 (76.9%)</td>
<td>9 (69.2%)</td>
<td>0</td>
<td>9 (69.2%)</td>
<td>8 (61.5%)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>A</sup>Negative in Mycoplasma culture and Mycoplasma-genus–specific PCR performed according to Lierz et al. (16).

<sup>B</sup>Negative or contaminated in Mycoplasma culture but positive in Mycoplasma-genus–specific PCR performed according to Lierz et al. (16).

<sup>C</sup>Mycoplasma-genus–specific PCR not done.

<sup>D</sup>Identified by an immunobinding assay performed according to Kotani and McGarrity (13).

<sup>E</sup>Isolates could not be identified in the immunobinding assay by using antisera against: M. buteonis, M. falcónis, M. gallisepticum, M. gypis, M. lipophilicus, and M. meleagrisid.

<sup>F</sup>More than one Mycoplasma isolate was obtained from one bird.

<sup>G</sup>Free-ranging population into where captive bred nestlings were released.

<sup>H</sup>Free-ranging population without any relation to the captive breeding stock.
CONCLUSIONS

- No detection in aborted eggs, dead in shell or chicks in nursery. The cause for infertility and embryonic death not related to Mycoplasma

- Common finding in both captive and wild adults with global prevalence 92.6%, similar to other birds of prey

- There are many unidentified Mycoplasma isolates
Discussion

✓ Captive breeding and reintroduction programmes are best managed from a multidisciplinary approach.

✓ *Prevention is better than cure*, good quarantine, regular health checks and strict control animals prior release into wild.

✓ Get to know your species! Establish reference values for physiological and medical parameters.
Thanks to all the staff and volunteers of the centre

And thanks to Mr. Manel Pomarol and Dr. Michael Lierz
THANK YOU

Please follow the line!