CLA eradication in an extensively managed Scottish hill flock

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Caseous Lymphadenitis (CLA)

- Caused by the bacterium *Corynebacterium pseudotuberculosis*
- Leads to the formation of lymph node-associated abscesses
- External or internal abscesses
- Chronic cases associated with ill thrift / weight loss (“thin ewe syndrome”)





History of CLA in the UK

- First cases confirmed in two dairy goats in January 1990 (Lloyd et al. 1990)
- Animals had contact with 20 imported Boer goats from West Germany (imported in 1987)
- Tracings of movements of imported goats revealed another five infected premises
- June 1991: first cases in sheep
- Further tracings revealed seven infected sheep flocks without any contact to imported animals
- No further action taken, movement restrictions lifted

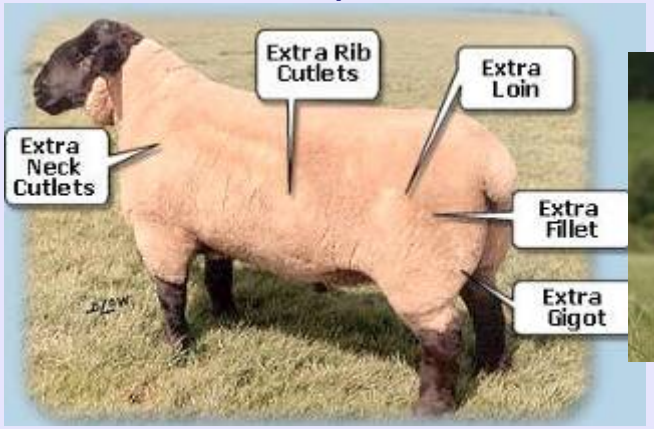
History of CLA in the UK

- Disease often stated as particular problem in “terminal sire breeds”
- Particularly prevalent in rams (up to 60% of adult males in some flocks => husbandry / particular management systems)
- More recently CLA also diagnosed in hill / upland breeds (NCC, Blackface)





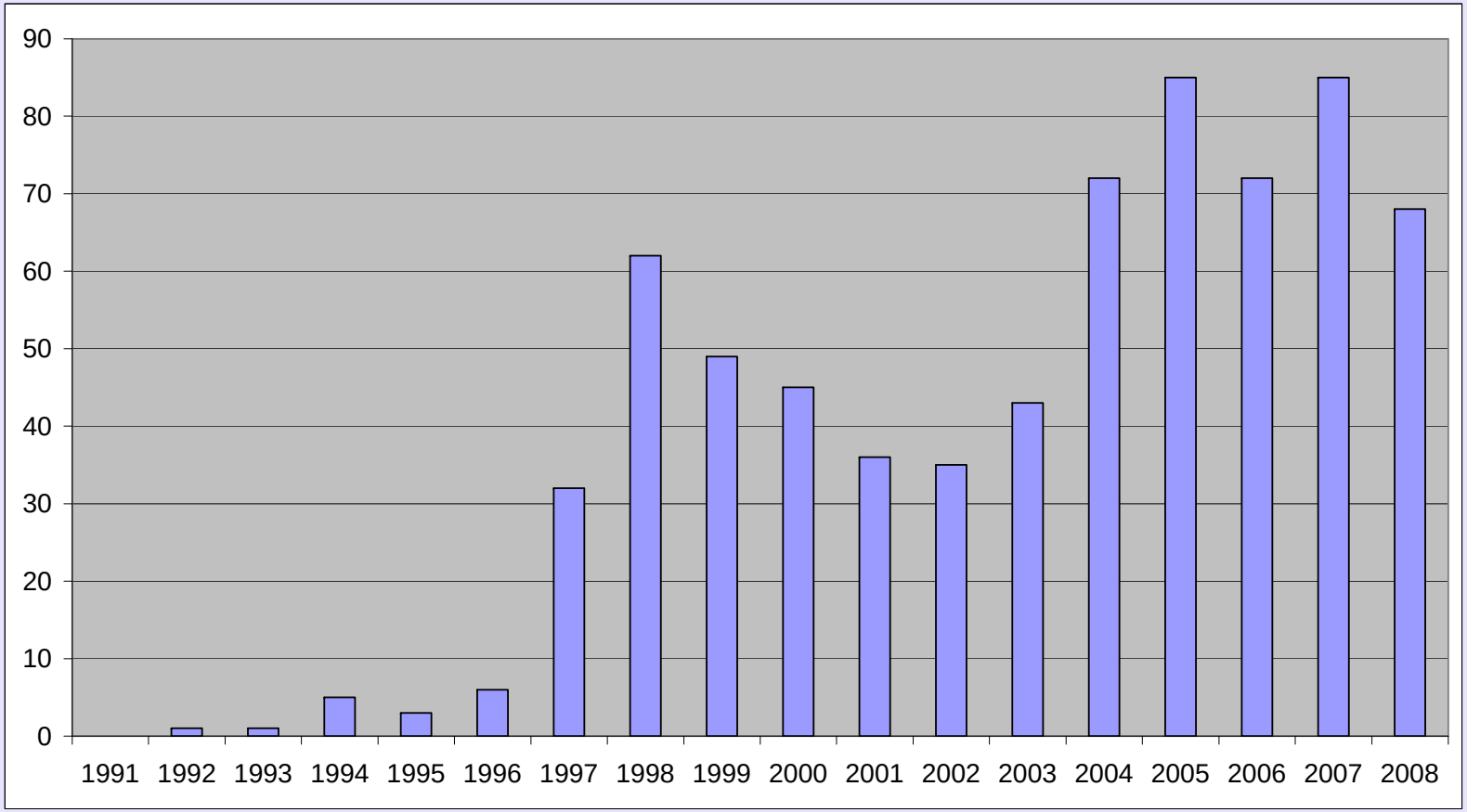






History of CLA in the UK

- Recorded outbreaks of CLA in GB sheep flocks from 1991 to 2008 (VIDA data)



History of CLA in the UK

- 2000: Survey in terminal sire breeds (rams and Health scheme members only, Baird et al. 2000)
  - 2538 samples from 745 flocks
  - Dutch ELISA (Dercksen et al. 2000), sensitivity 79% (+/- 5), specificity 99% (+/- 1)
  - 224 samples positive 9,93%
  - 18% of flocks positive (36% of which with >1 positive animal)



FIG 1: Results of a survey in 2000 showing regions or counties of Great Britain with sheep flocks containing rams seropositive for caseous lymphadenitis (blue shading)

The **Veterinary Record**, April 17, 2004

History of CLA in the UK

- Seen as a disease of rams
- Lesions mainly at head and neck, farmers initially see no major economic impact
  - Terminal sire breeds (meat breeds)
  - Bred in small to medium-sized pedigree flocks
  - Attending shows and sales
  - Fighting amongst ram groups may have facilitated spread



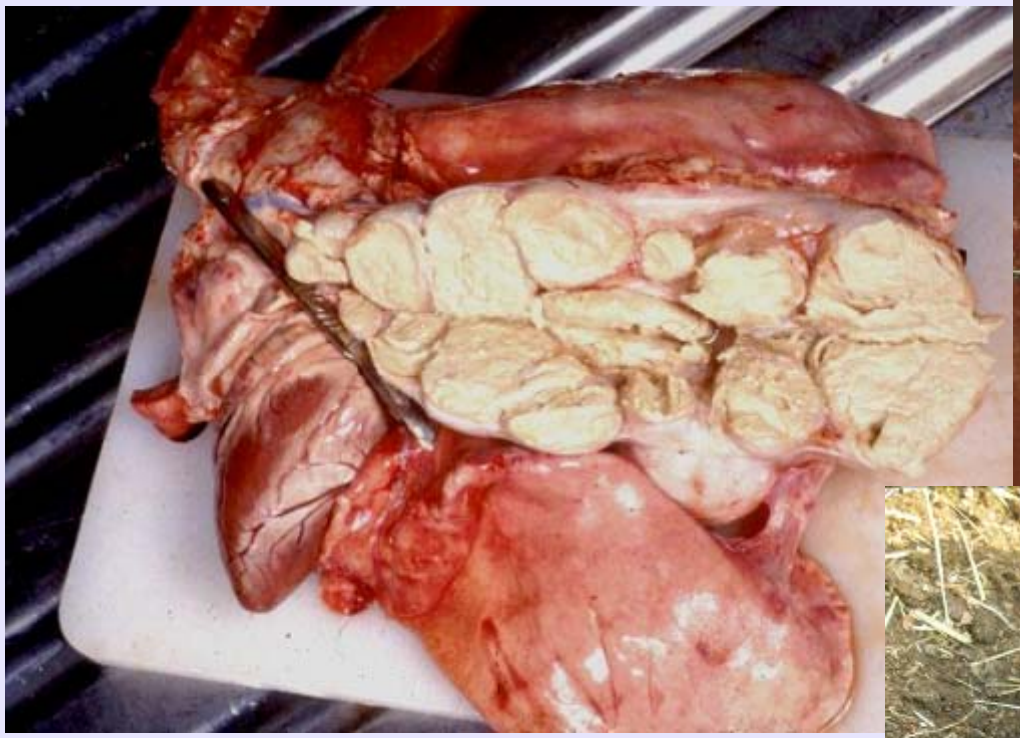
History of CLA in the UK

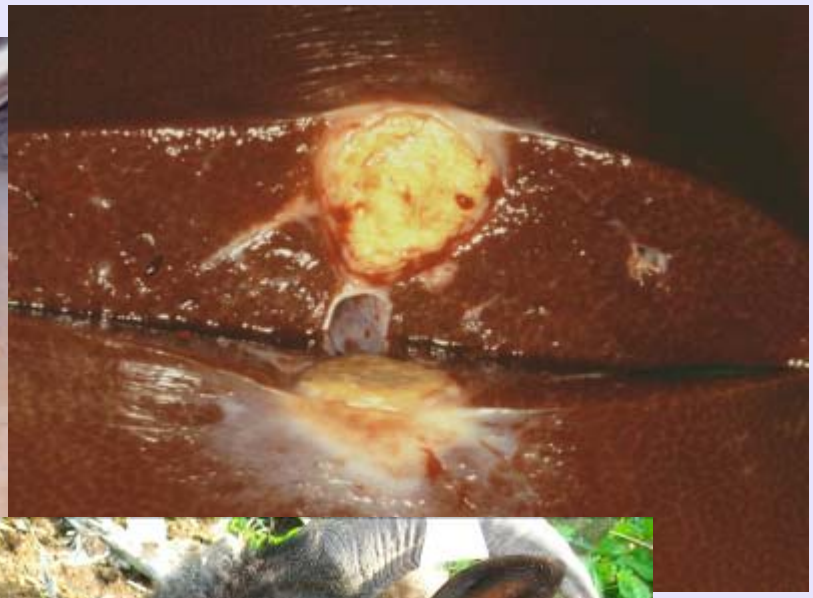
- Only recently cases recognized in females
- Cases in hill and upland flocks
  - Internal lesions
  - No survey data available on numbers of affected commercial flocks
  - Anecdotal data suggests continuous spread within the UK sheep population



History of CLA in the UK

- So far very rare, but probably still to come:







Economic impact

- Losses at meat inspection and in wool production
- Study in UK abbatoirs: 0.004% of carcasses
- Losses to Australian meat industry estimated 12-15 million A$ per annum

  (Paton et al 2003)
- Losses to Australian wool industry estimated 17 million A$ per annum

  (Paton et al 1994)



Economic impact

- Inability to market sheep with CLA lesions



Epidemiology / sources of infection

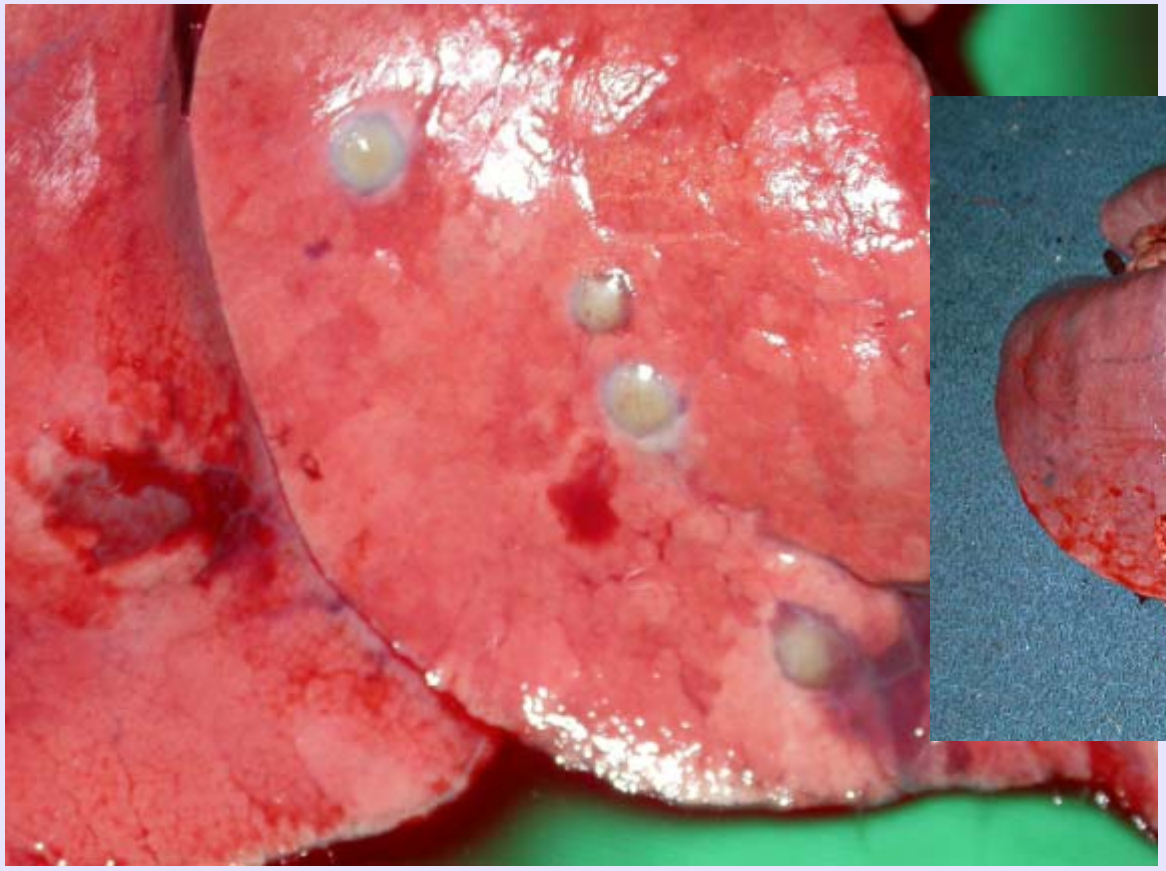
- Disease usually „bought-in“ with subclinically infected animals
- Direct contact with infected animals at shows / sales / from neighbouring flocks
- Abscesses contain large numbers of bacteria

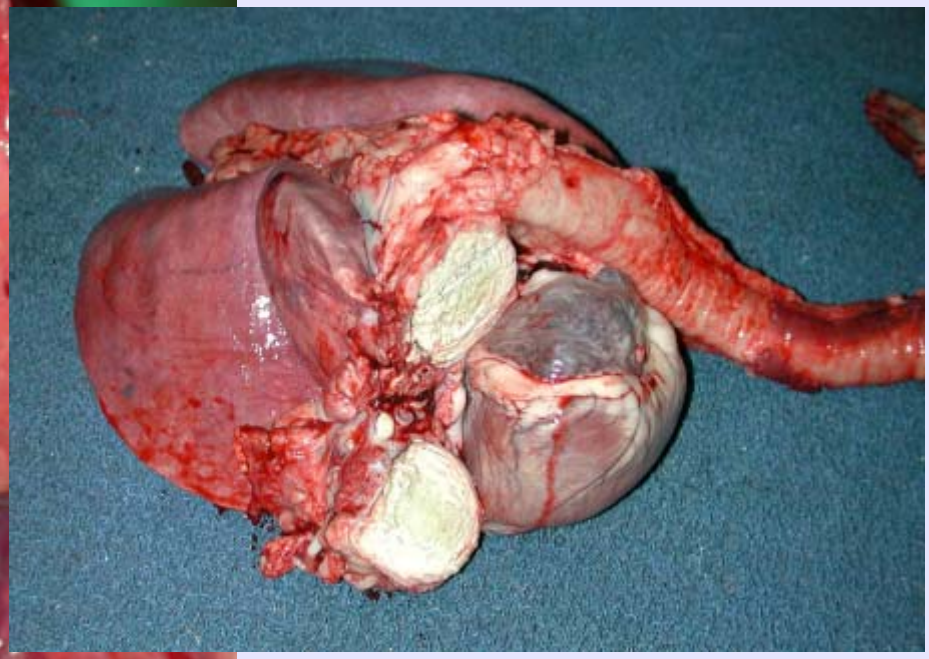




Epidemiology / sources of infection

- Aerosol transmission – organism can penetrate intact skin or infect wounds / scratches





Epidemiology / sources of infection

- Yarding, housing, gathering, close confinement







Epidemiology / sources of infection

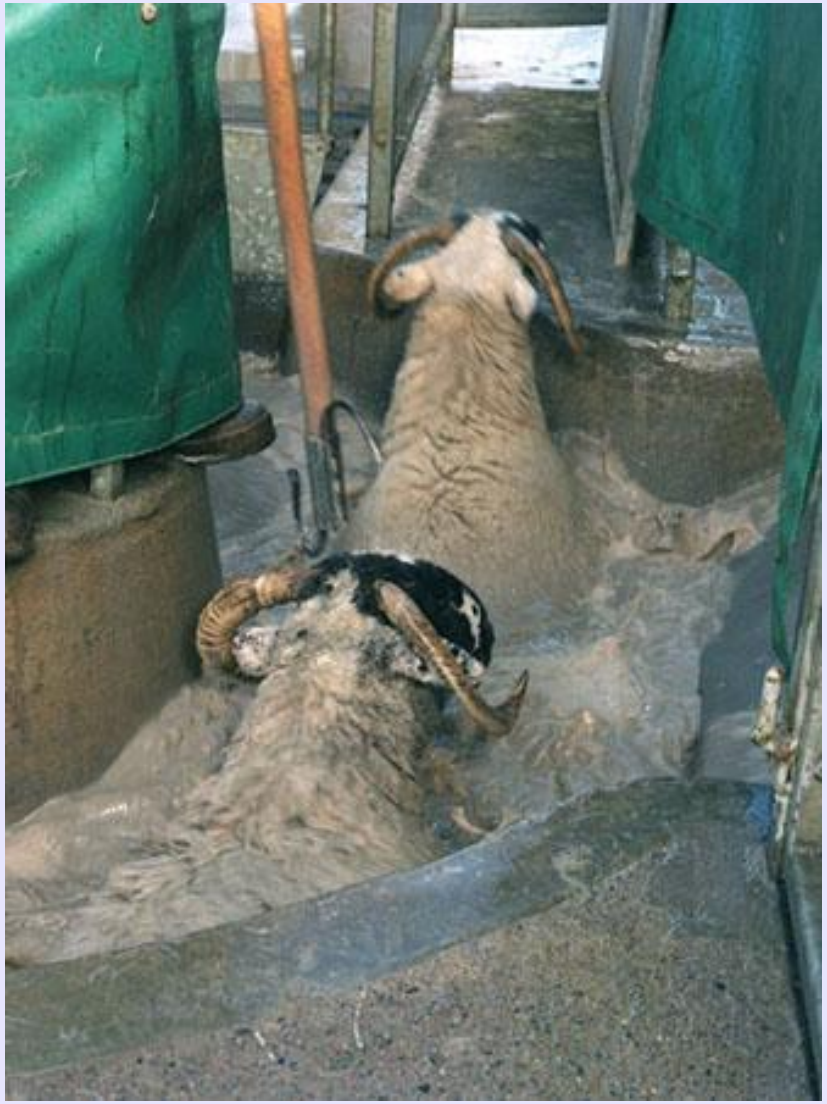
- Shearing





Epidemiology / sources of infection

- Dipping
- *C. pseudotuberculosis* can survive in sheep dip for up to 24 hours
- As little as 25 bacteria / ml of dip solution can cause infection



Epidemiology / sources of infection

- Indirect transmission (troughs, handling equipment, tagging / worming equipment)
- *C. pseudotuberculosis* can survive in the environment for up to several months





Case report – Scottish hill flock



Case history

- Initial complaint
  - Unusually high number of female stock with lymph node associated abscesses in June 2007 (parotid, mandibular, pre-scapular, pre-femoral)

- Flock details
  - Approx. 750 predominantly Scottish Blackface ewes
  - Production of mule lambs for sale as breeding stock, purebred Blackface as replacements
  - Small number of mules kept on farm, crossed with terminal sire breeds (Suffolk, Charolais, Texel)



Case history

- Flock details
  - Main income from sale of high-quality mule lambs and gimmers for breeding



Case history – risk factors

- Flock details
  - Closed female flock, only rams introduced
  - Female replacements away-wintered on other lowland farms (no direct contact to other sheep)
  - Health Scheme member (EAE)
  - Rough hill grazing, some grassland



Case history – risk factors

- Only twin-bearing ewes housed for short period at lambing time
- No contract shearers
- Ewes routinely dipped in autumn, lambs dipped in summer for tick control



Case history

- History of CLA in the flock
  - 2003: CLA diagnosed in two bought-in rams (Texel & Charolais)
  - Abscesses lanced and flushed - lesions healed
  - Affected rams retained for breeding
  - One ram later developed multiple CLA lesions and was eventually culled
  - Four further cases in ram group 2005 - 2006 (including Blackface)
  - 2005: One abscess in female investigated - *A. lignieresii*

Case history

- History of CLA in the flock
  - From 2005: repeated serological testing of ram group, CLA positive rams culled
  - 2006: no further clinical cases in ram group, all rams repeatedly sero-negative
  - Spring/summer 2007: high number of females with lymph node associated abscesses

Initial investigation

- Initial investigation June 2007
  - CLA diagnosed in 12 out of 25 animals sampled (culture and / or serology)
  - Estimated prevalence of “lumps” in female stock approx. 5%
  - Another 30 ewes with suspicious lesions discovered at shearing (July 2007)



Initial investigation

- Further investigation autumn 2007
  - Flock seroprevalence (ELITEST CLA (Hyphen Biomed, France))
  - 1010 sheep blood sampled in Nov 2007
  - Clinical inspection for swellings / abscesses
  - Swabs taken if possible



First flock test (n = 1010)

- Bacteriology: *Corynebacterium pseudotuberculosis* isolated from 8 / 15 abscesses sampled

- Other isolates:

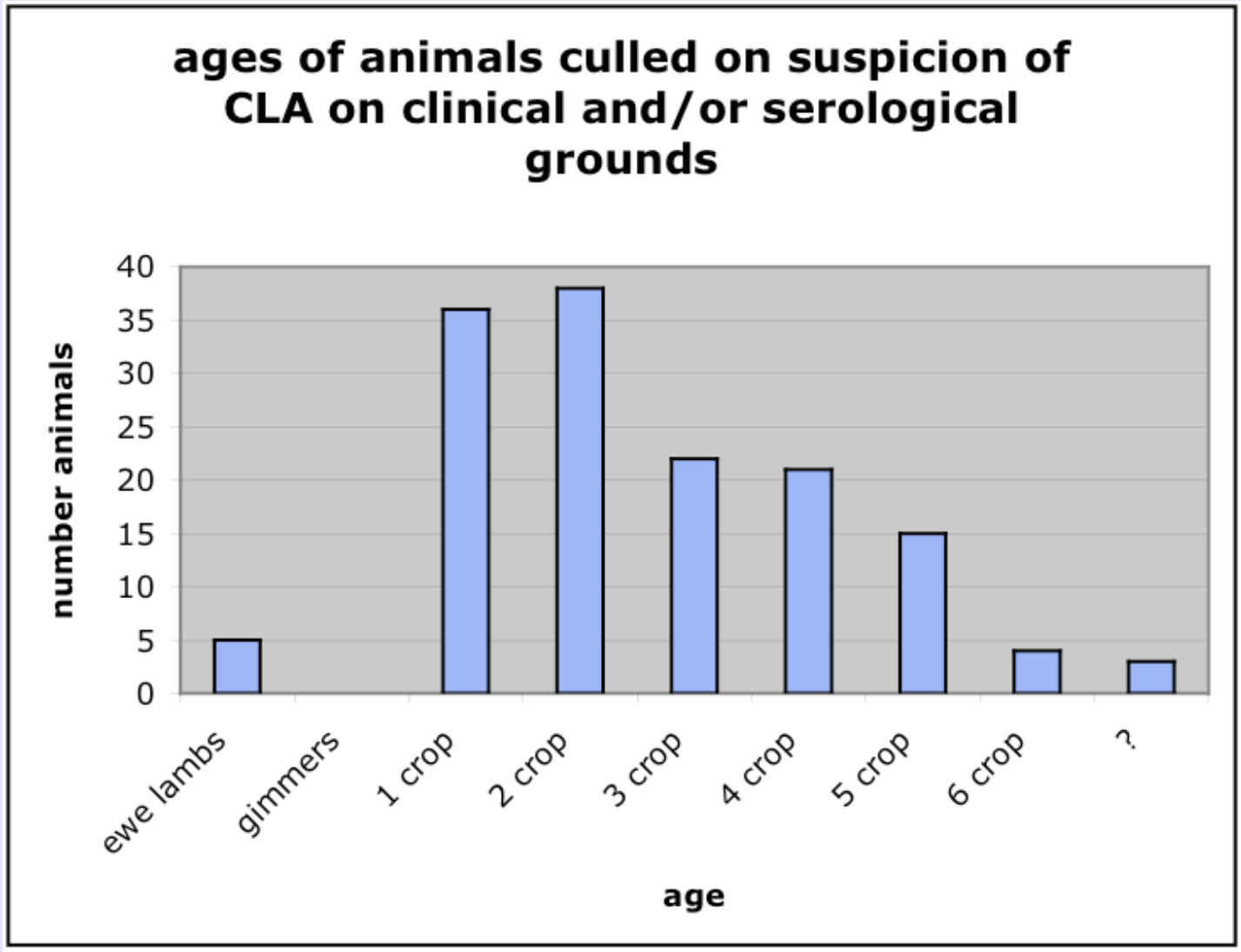
  A. pyogenes (1), *Actinomyces hyovaginalis* (1), *Actinobacillus lignieresii* (3), *Bibersteinia trehalosi* (1), sterile (1)



First flock test (n = 1010)

- Clinical inspection: 87 sheep with a history of “lumps” (8.6%)
  - parotid, sub-mandibular, pre-scapular and pre-femoral sites
- Overall seroprevalence (n=1010): 10%
  - Ram group (n=23): 0%
  - Ewe lambs (n=228): 1.8%
  - Cull ewes (n=206): 27.3%
  - Remaining flock (n=554): 7.4%
- 144 ewes culled on suspicion of CLA (14.25%)
  - (clinical and / or serological)

First flock test (n = 1010)



Immediate action

- All animals with a history of abscesses culled
- All sero-positive animals culled
- Stop dipping (use of pour-on and injectable products)
- Good hygiene at shearing
- Cleaning and disinfection measures for equipment and handling areas

Control options

- Problem: Sale of breeding stock of otherwise high health status
  - Change in farm policy (production of lambs for slaughter)?
  - Vaccination?
  - Live with the disease?
  - Eradication?

Previous eradication efforts elsewhere

- Successful eradication from goat herds in the Netherlands (Dercksen *et al.* 1996)
- Successful eradication from two Dutch sheep flocks (Schreuder *et al.* 1994)
- Successful eradication from small sheep flocks in the UK (Baird *et al.* 2010)
- Successful eradication by motherless rearing of lambs in Norway (Nord *et al.* 1998) and Germany (author's observations)

Eradication trial

- Quarterly blood sampling plus clinical inspection of the whole flock
- Bacteriological examination of any available abscess material
- Serological testing of blood samples (ELITEST CLA, Hyphen Biomed, France)
  - Commercially availabe ELISA test kit
  - Based on recombinant PLD antigen





Eradication trial

- Change in ectoparasite control (although dipping of ewe lambs continued for tick control), good hygiene at shearing
- Separate management of seropositive animals and their offspring – eventually culled
- Separate management of clinically suspicious animals (with “lumps”)
- Clinical inspection and blood sampling scheduled with other management tasks (scanning / after lambing / clipping / pre-tupping)
- Ewe lambs tested from 6 months of age
- Buy replacement rams early, keep in isolation and test twice for CLA

Results - clinical

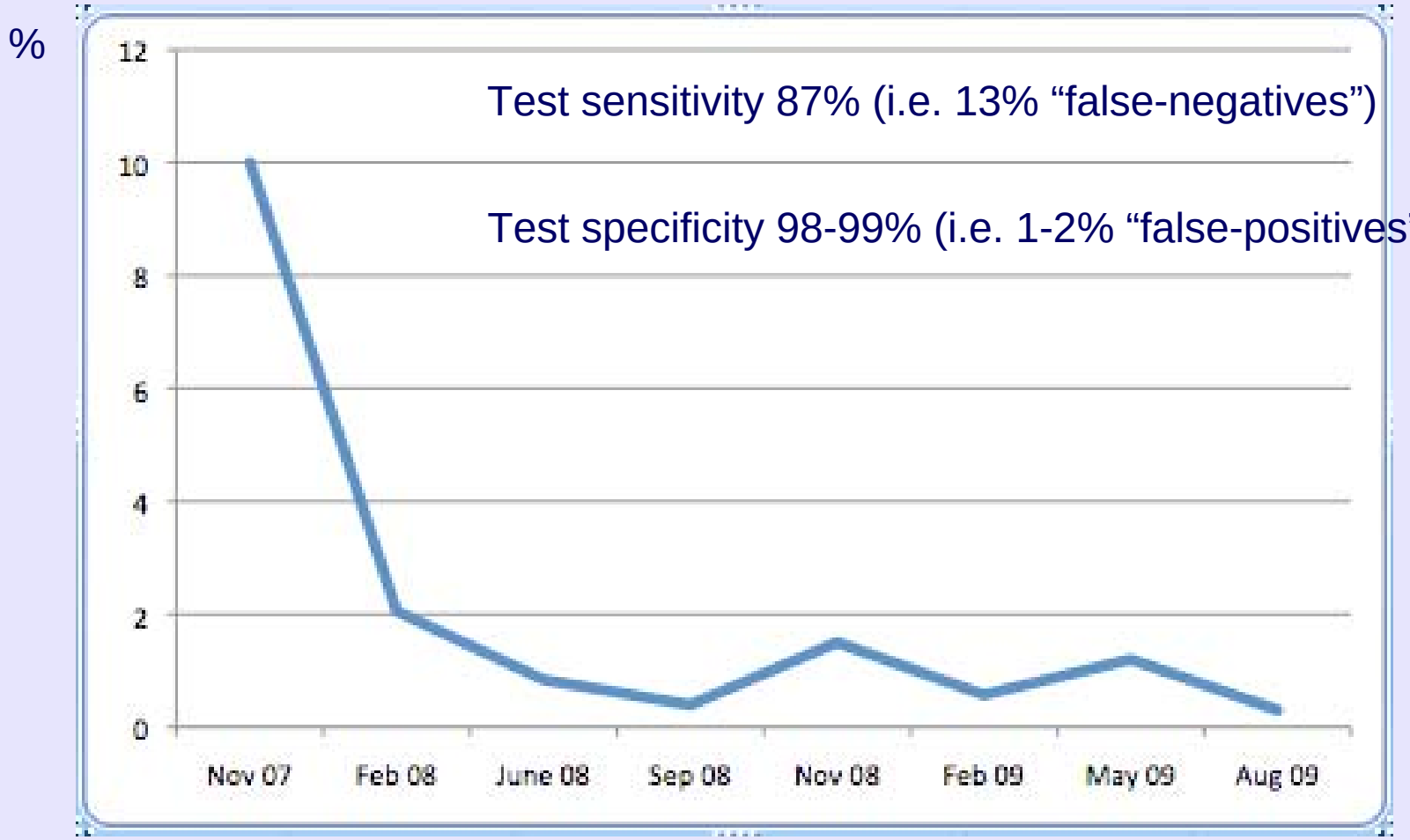
- No confirmed clinical cases since July 2008 (i.e. no external lymph node abscesses confirmed as CLA by bacteriology)

- Still occasional sheep with abscesses, but all pus samples negative for CLA (other pathogens)



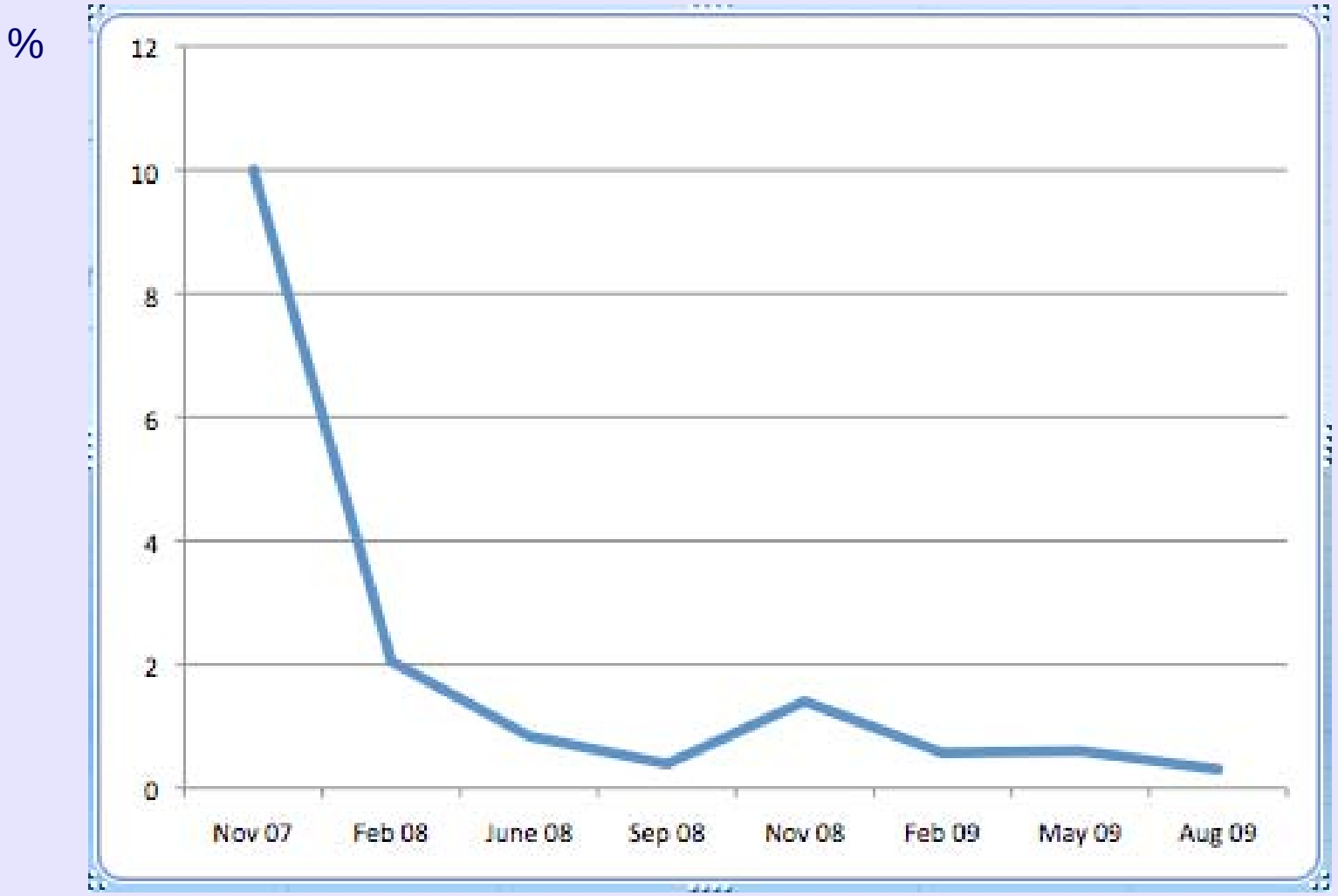
Results - serology

CLA seroprevalence (ELISA)



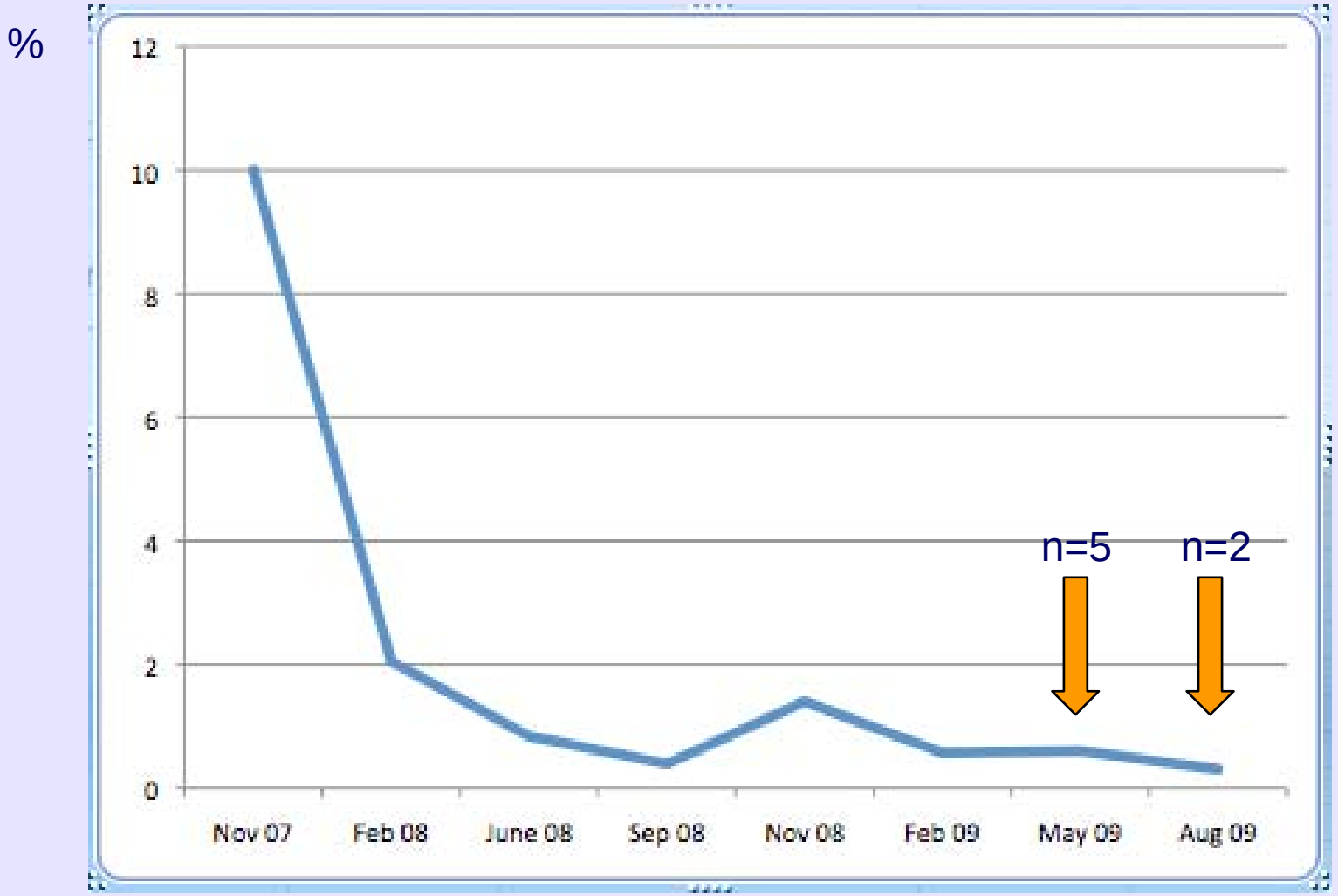
Results - serology

CLA seroprevalence (ELISA plus Western Blot)



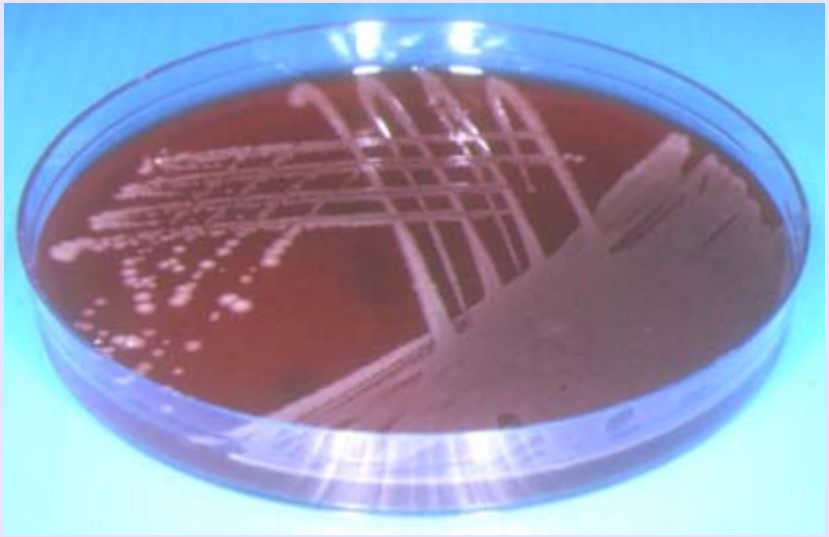
Results – post mortems Aug / Sept 09

CLA seroprevalence (ELISA plus Western Blot)



Results - post mortems Aug 09

- 5 animals submitted for post mortem – tested positive in May 2009
  all ELISA-positive, 2 WB positive, 3 WB inconclusive (very weak band)
  - All clinically healthy, no palpable lymph node swelling
  - Full post mortem, lymph node cultures (external and internal body and visceral lymph nodes)
  - 4 animals: no CLA infection identified
  - 1 animal: tiny purulent lesion in pre-scap. LN, culture positive!



Results - post mortems Sept 09

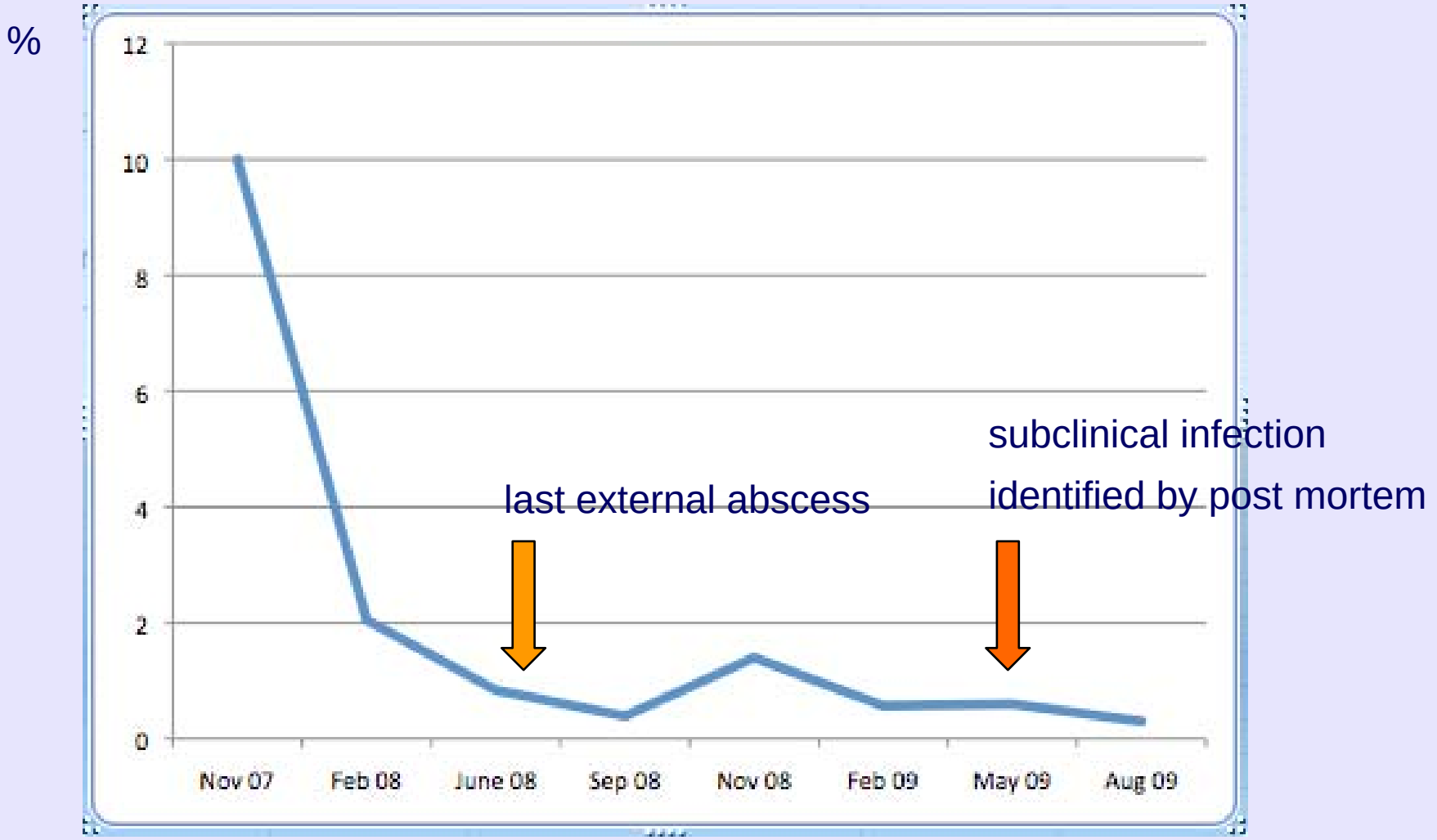
- 1 animal submitted for post mortem – (2 tested positive in August 2009)

  both low ELISA-positive, WB positive

  - clinically healthy, no palpable lymph node swelling
  - Other animal sold for slaughter
  - submitted animal: no CLA infection identified

Results – post mortems Aug / Sept 09

CLA seroprevalence (ELISA plus Western Blot)



Results – ongoing bacteriology

Serological testing stopped after August 2009 (lack of funding)

Continuing clinical inspections after August 2009

All external abscesses sampled and submitted for bacteriology

26 swabs submitted between 24.7.2009 and 15.10.2010

All CLA negative

Results – interpretation??



Results – serological “side-effects”

- Offspring of infected ewes:
  - 30 lambs kept with infected mothers on separate field between June and November 2007
  - Ewes culled in Nov 2007
  - Lambs managed as separate group
  - All lambs sero-negative in Nov 07
  - One develops CLA lesion in January 08 => culled
  - All others repeatedly sero-negative (at least 2 further tests 3 months apart)

Results - serological “side-effects”

- Serology versus clinical inspection (cull ewes, n=205)

History of “lumps” (n=83)	No history of “lumps” (n=122)
– Serology negative: n = 43	– Serology negative: n = 105
– Serology positive: n = 40	– Serology positive: n = 17

Results - serological “side-effects”

- Repeated testing of CLA-positive animals (n=11)
  - initial test in June 07, follow-up in November 07
  - All animals sero-positive in June 07 plus history of LN-associated abscesses, confirmed by culture in five
  - 4 / 12 animals sero-negative in November!
  - CLA lesions healed / hardly recognizable in 11 / 12

Results - post mortem (5 cull ewes)

- All five culture and ELISA positive in June 07, post mortem carried out in November 07
  - 1 ewe sero-positive but no lesions found, CLA not isolated from pm material
  - 1 ewe sero-negative and no external lesions, but CLA abscess in pulmonary lymph node
  - 1 ewe open abscess on previous site but sero-negative
  - 1 ewe slightly enlarged but not abscessed LN on previous site, sero-negative
  - 1 ewe thin, slightly enlarged but not abscessed LN on previous site, multiple pulmonary and mediastinal CLA lesions, sero-positive

Results - post mortem (5 cull ewes)





Discussion

- **Problems**
  - **Sensitivity / specificity** of the blood test
  - **Internal lesions** – “subclinical infection”
  - **Biosecurity** under extensive management conditions and at wintering
  - **Resistance** of *C. pseudotbc* in the environment
  - Dipping of lambs – risk factor
  - farmer compliance





Conclusions

- Eradication requires dual approach
  - Fluctuating antibody levels
  - Sero-negative / culture positive animals
- Elisa useful tool
- BUT expensive and difficult in large flocks under extensive management conditions
- Danger of re-introduction (neighbouring flocks / rams)

Acknowledgements

- Hyphen Biomed for the generous supply of ELISA test kits

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- SAC receives funding by the Scottish government

Thank you for your attention!

