Non-invasive methods for monitoring parasite infections in free-range livestock

CPH cattle seminar 2022

Amalie Camilla Pedersen
PhD student,
Veterinary Parasitology
IVH, KU-SUND
acp@sund.ku.dk

KØBENHAVNS UNIVERSITET

Background

Nature preservation with livestock (rewilding)

- Parasites are a common problem

Large pasturelands

- Mustering and sampling are difficult or impossible

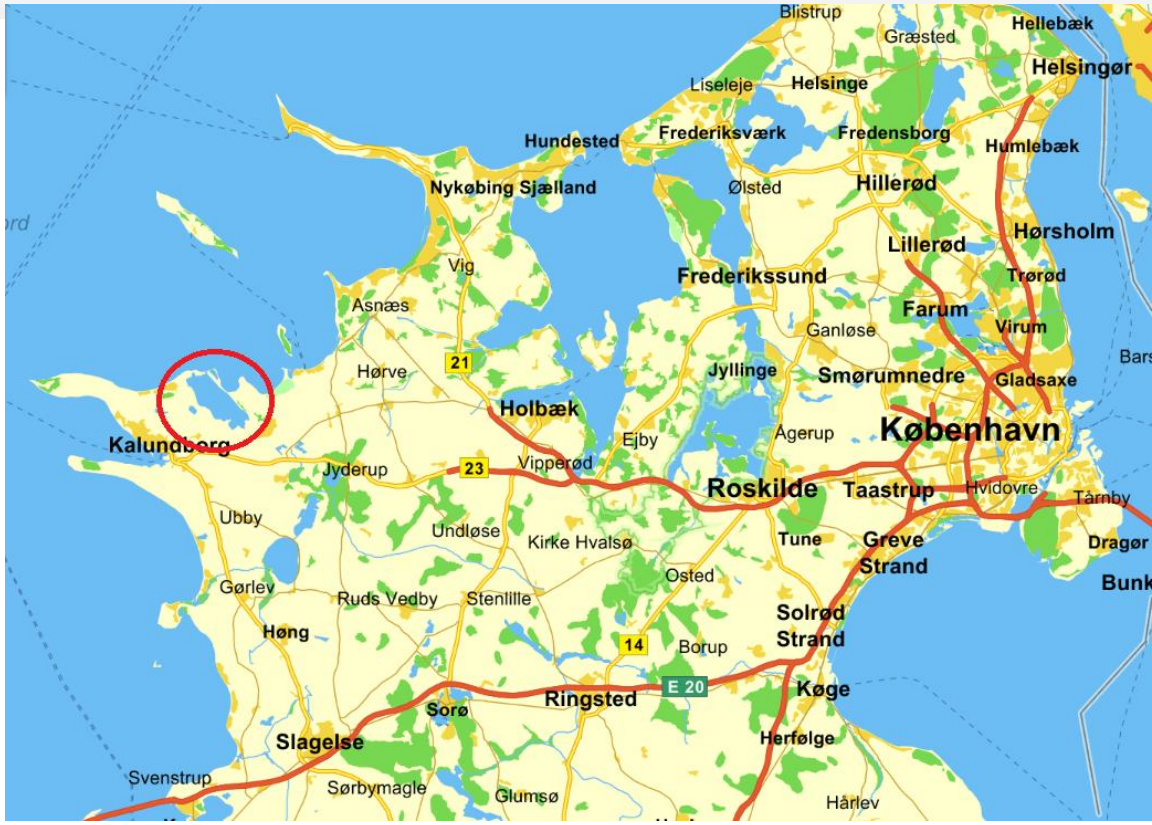
Certain interventions may be regulated

- Use of supplementary feed and use of anti-parasitic drugs may be restricted

Objective

- To develop methods of monitoring parasite infections in livestock in large pasturelands, in a non-invasive manner
- And at same time, to diagnose individual infections in order to treat potential parasitic problems

Saltbæk Vig – field study



Protected nature area

- 1200 ha land (plus 1400 ha lake)
- Grazed by beef cattle (Red Angus)
  - Approx. 90 cows,
  - 115 heifers, some calves and bulls.
    - Housed during winter, grazing May-November
    - Calves born outside on pasture during late spring
    - Daily supervision of the cattle
    - Low stocking density

- 1.2 m below sea level
- Low pasture quality
- Large population of red deer, rare birds and plants

http://www.saltbaek-vig.dk/

Grazing cattle = Parasites (Nematodes)

Gastrointestinal nematodes (GIN)

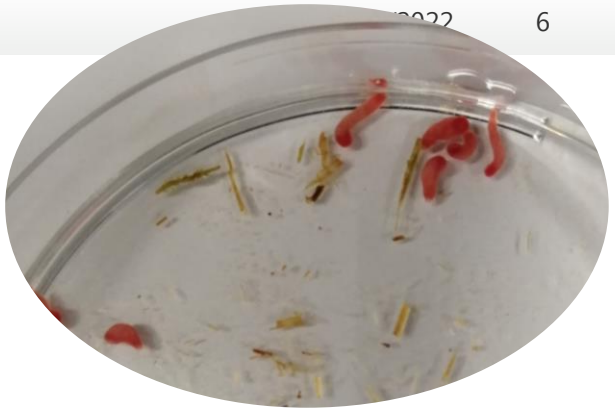
- *Ostertagia ostertagi* (abomasum) and *Cooperia oncophora* (small intestine)
  - Clinical and subclinical disease (reduced productivity)

Lungworm (*Dictyocaulus viviparus)*

- Adult stages localized in bronchi of the cattle
  - Coughing

Taylor et al., 2016

Grazing cattle = Parasites (Flukes)



- Liver flukes (*Fasciola hepatica*):
  - Intermediate host – mud snail ("lille pytsnegl")(*Galba truncatula*)
  - Adult flukes localized in bile ducts → eggs excreted with faeces of the host.
- Rumen flukes (probably *Calicophoron daubneyi*)
  - Juvenile flukes excyst and feed in the duodenum until migration into the rumen and reticulum, where the adult flukes are localized
  - Same intermediate host
  - Impact: debated

Diagnostics:

- Faecal egg count by sedimentation
  - Liver flukes: yellow eggs
  - Rumen flukes: grey or colourless eggs

Taylor et al., 2016

What we have done so far (2022) …

Monitoring of infections:

Two groups of animals:

- 2nd year heifers from summer 2020
- 1st year heifers from summer 2021

1st sampling: 12.05.2022 (INVASIVE) – at turn out

- Blood and rectal faecal samples
- 45x 1st year, 14x 2nd year

Monthly sampling after turnout

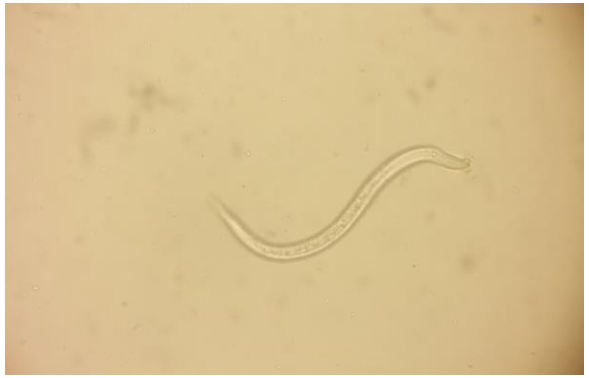
- Faecal samples collected from ground
- 20x 1st year, 20x 2nd year
- Fresh faeces = warm, moist

Methods

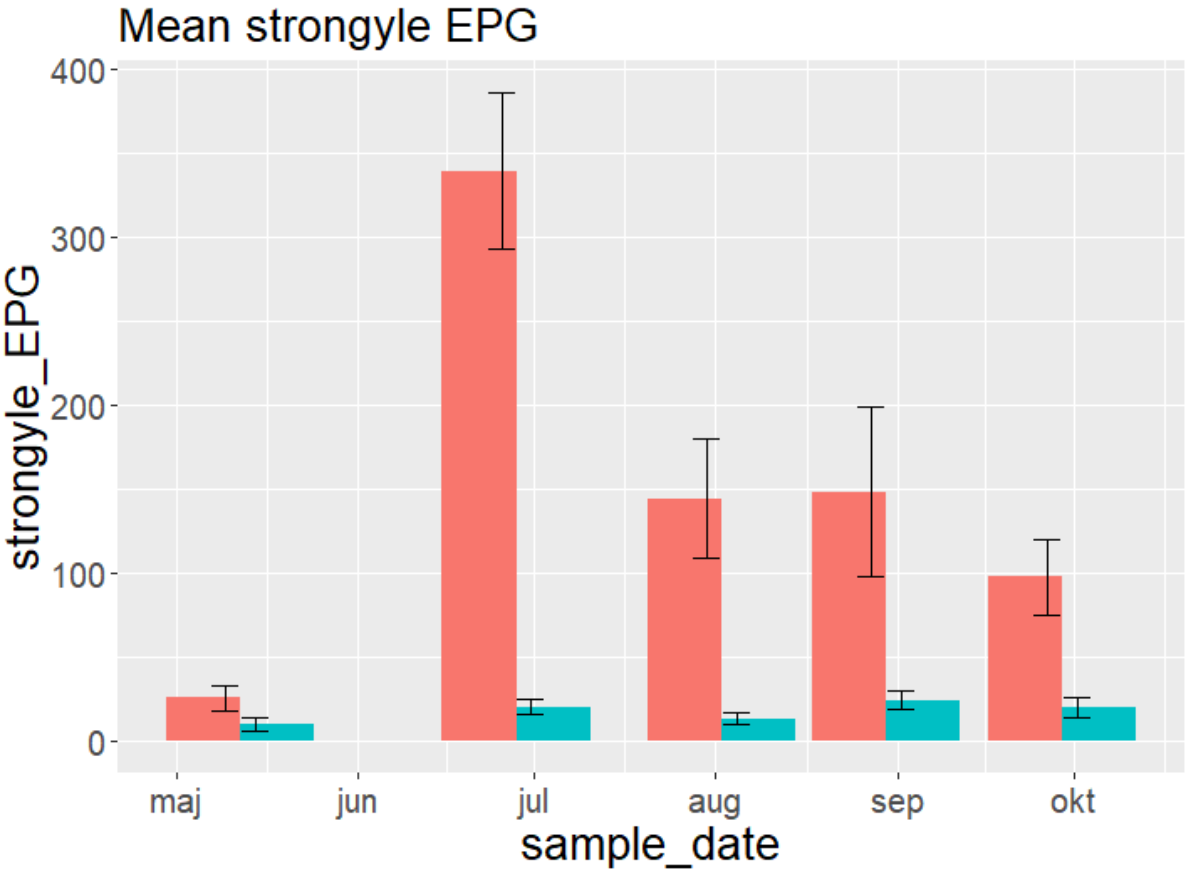
- Blood (only 1st sampling)
  - Diagnostic of *Babesia* (blood smear, PCR)
- Faeces
  - McMaster (GIN)
  - Baerman (lungworm)
  - Sedimentation (flukes)
  - Stored for Nemabiome (larvae culture) and barcoding (fresh faeces at -80°C)

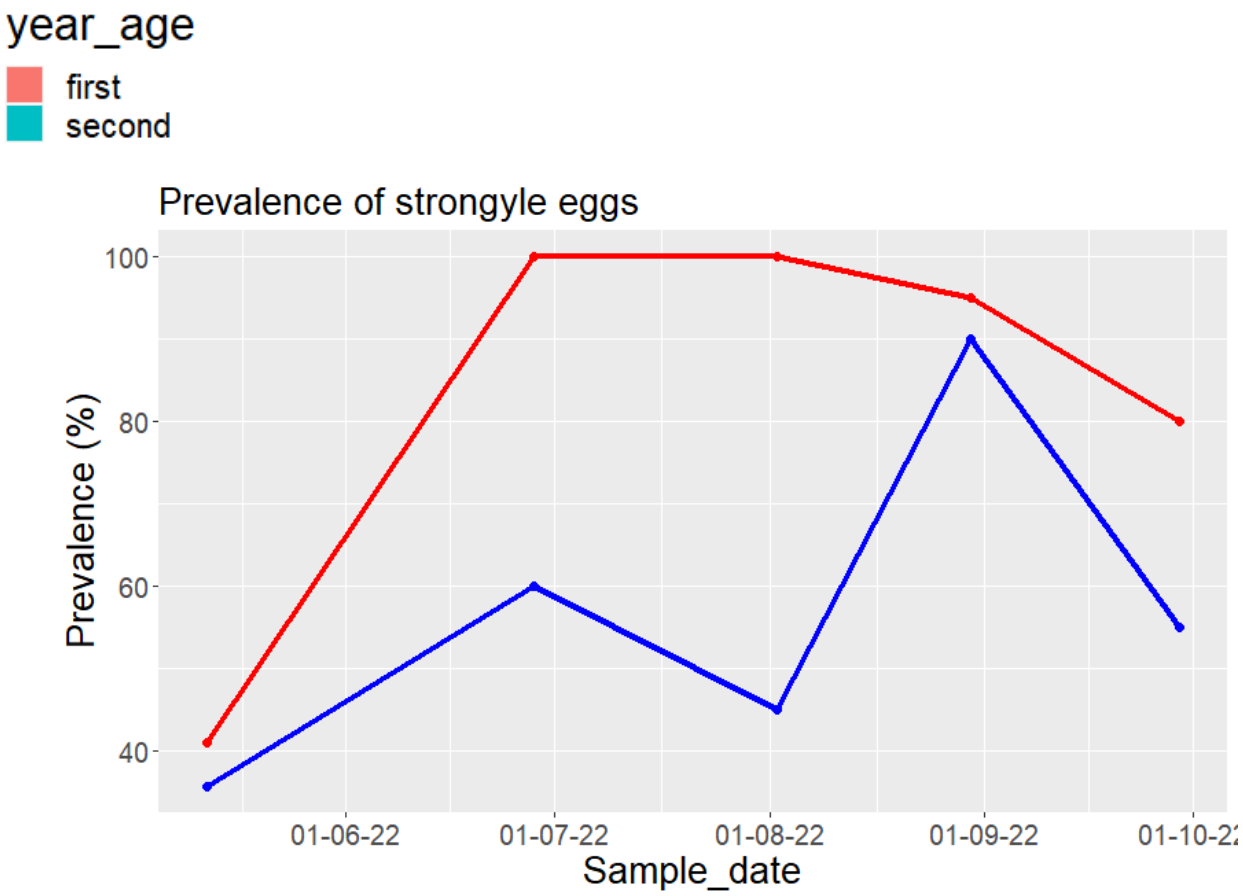
Challenges in non-invasive sampling:

- Diagnostic of individual – which sample is from which animal
- Contamination – soil nematodes
- Not always fresh samples – hatched eggs



Preliminary results

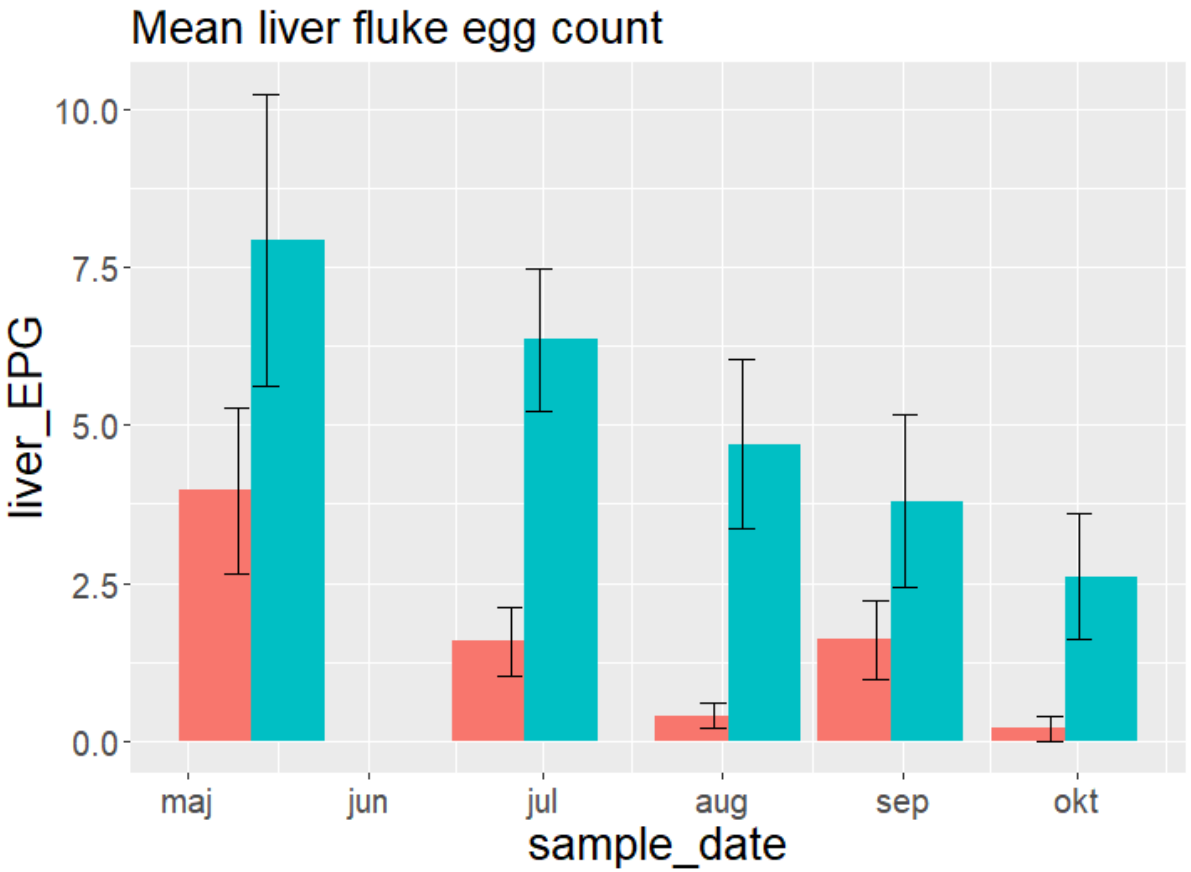


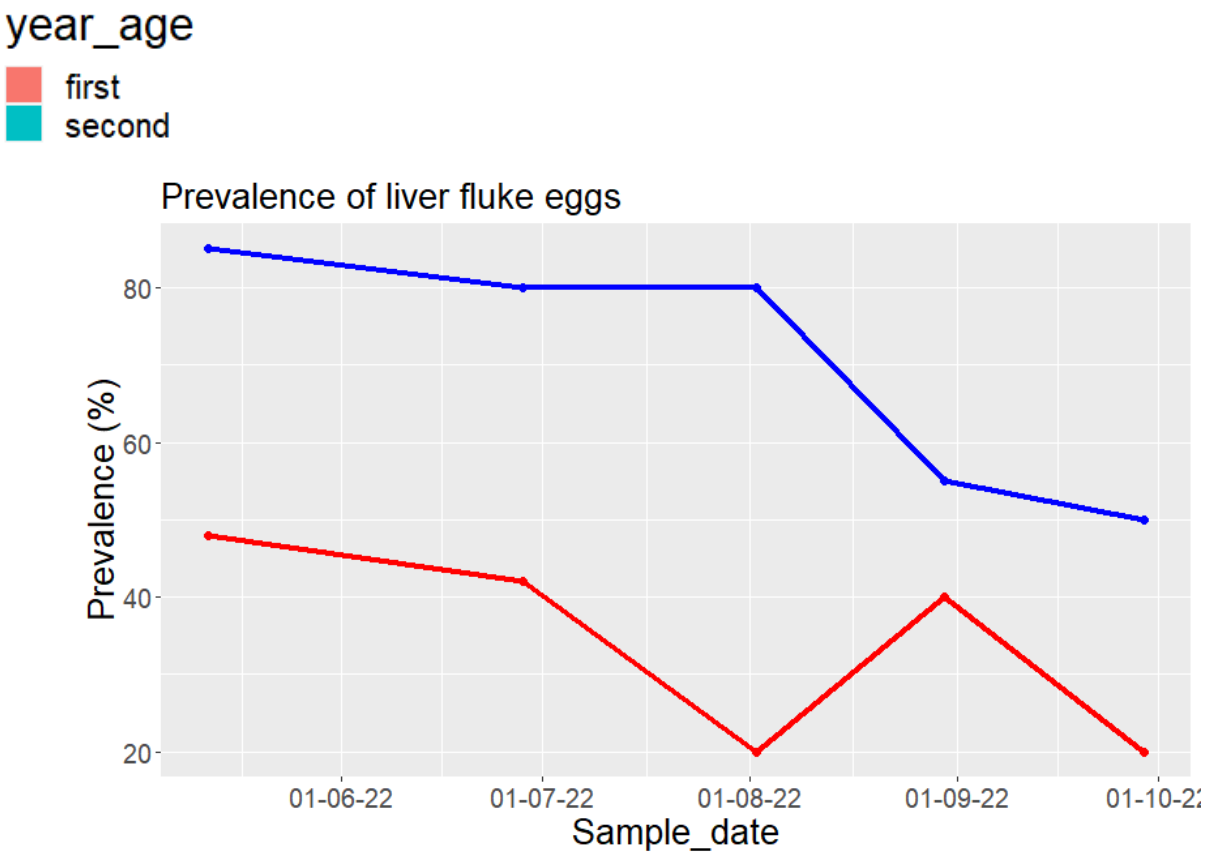


GIN count:

- 1st year: development of immunity
- 2nd year: resistent towards reinfection

Preliminary results

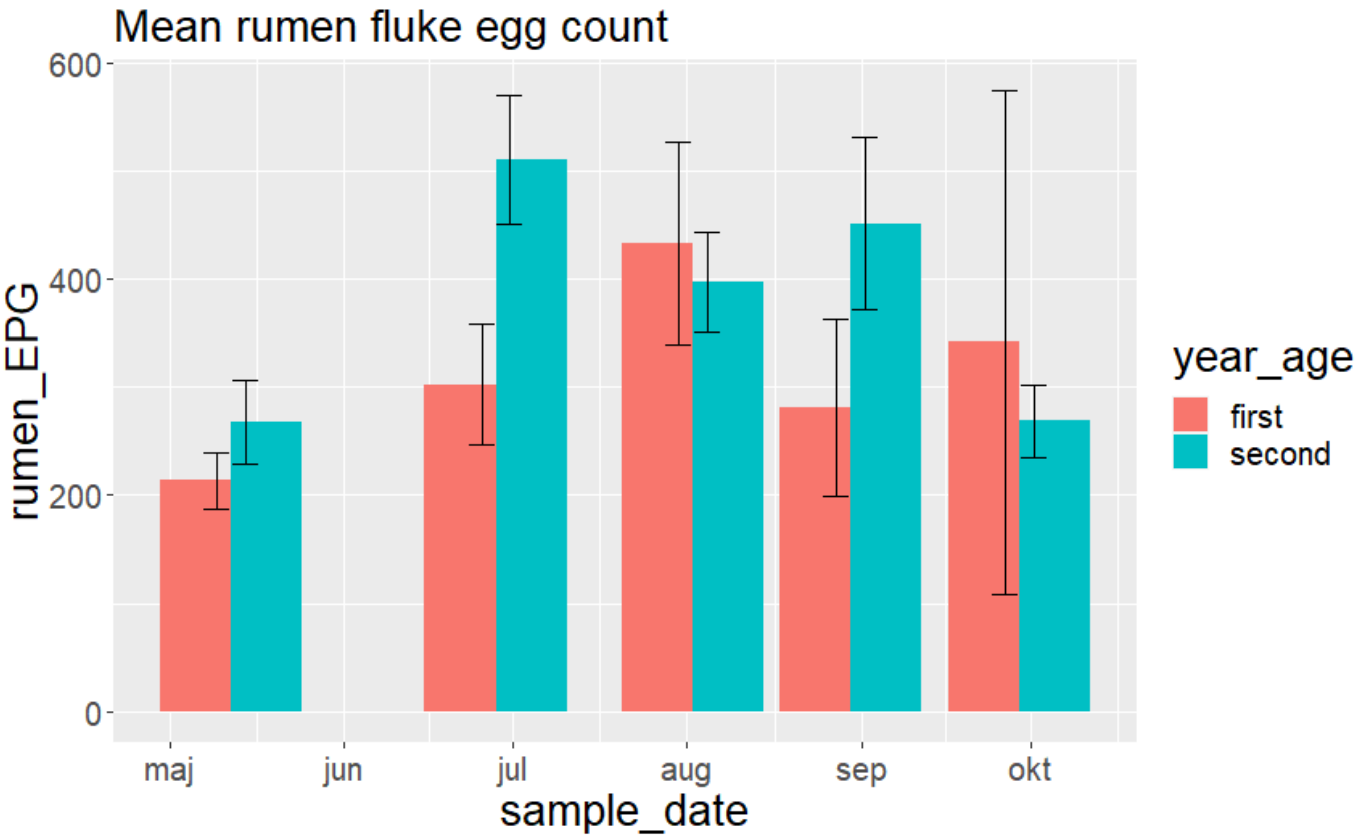




Liver fluke egg count:

- Levels decreasing throughout the season
- 2nd year: higher levels

Preliminary results



Rumen fluke egg count:

- Similar between age groups
- Prevalence of 100%

Conclusions

- We have described the parasite occurrence and dynamic of one grazing season in the area
  - Development of resistance toward GIN infection
  - Decreasing levels of liver fluke egg counts
  - High prevalence of rumen fluke and a need to look more into this infection

What is the further plan

Non-invasive sampling

- Nemabiome – which GIN are found in the samples
  - Deep amplicon sequencing (or metabarcoding), targeting the internal transcribed spacer 2 (ITS-2) rDNA locus, for describing the exact composition of the nematode population (https://www.nemabiome.ca/, Avramenko et al., 2015, Avramenko et al., 2017).
- Barcoding
  - Are the samples from different animals
  - Which sample is from which animal
    - Which individual have the highest egg excretion
    - Which individuals have the highest level of infection
  - How to: DNA database of all animals in the group
    - Each faecal sample contains DNA → match in database

What is the further plan

- Environmental monitoring of flukes (eDNA on water or snails)
- *Babesia* – infections
- Rumen flukes and their impact

- Sampling plan for next season
  - Should we proceed with only one group
    - Then which age group


Questions (or Suggestions) ?
acp@sund.ku.dk