



THE UNIVERSITY of EDINBURGH  
The Royal (Dick) School  
of Veterinary Studies



# Assessing the use of cardiac biomarkers as a health management tool for early diagnostic of cardiomyopathy syndrome (CMS) in Atlantic salmon

J. del-Pozo, J.Z. Costa, C.C. Chadwick, P. Sourd, A. Bordeianu & K.D. Thompson



Cooke



Moredun

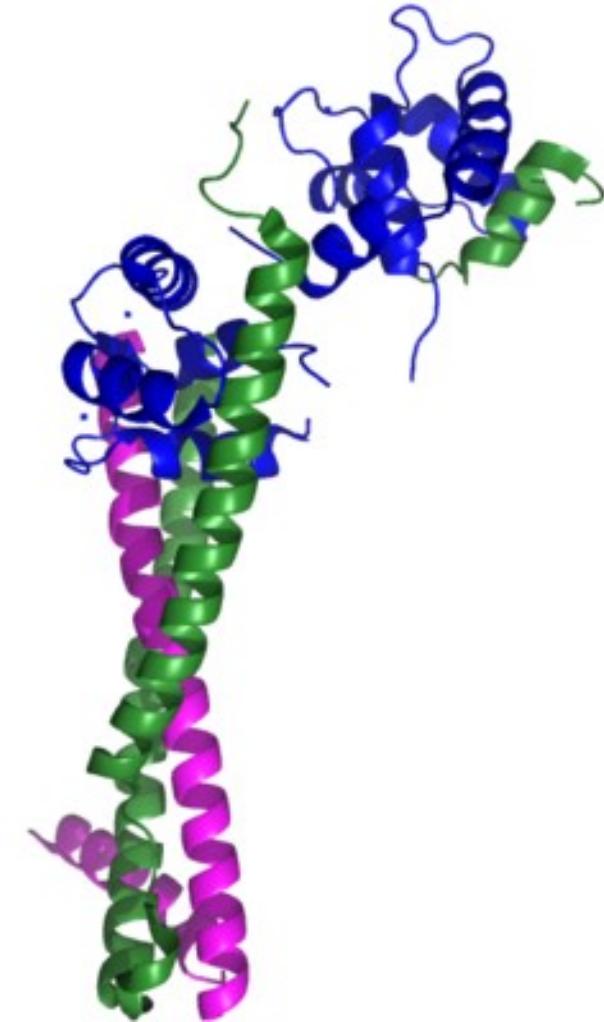


THE UNIVERSITY of EDINBURGH  
The Royal (Dick) School  
of Veterinary Studies



# The targets: Troponins

- **Troponins**
  - “Leakage” biomarkers
  - Regulate muscle contraction
  - Complex of 3 proteins: C, I, T
  - Tissue specific isoforms
    - Cardiac muscle
    - Skeletal muscle
      - Fast
      - Slow
- **Study targets (in salmon)**
  - Skeletal troponin C - skTnC
  - Cardiac muscle troponin C - cTnC



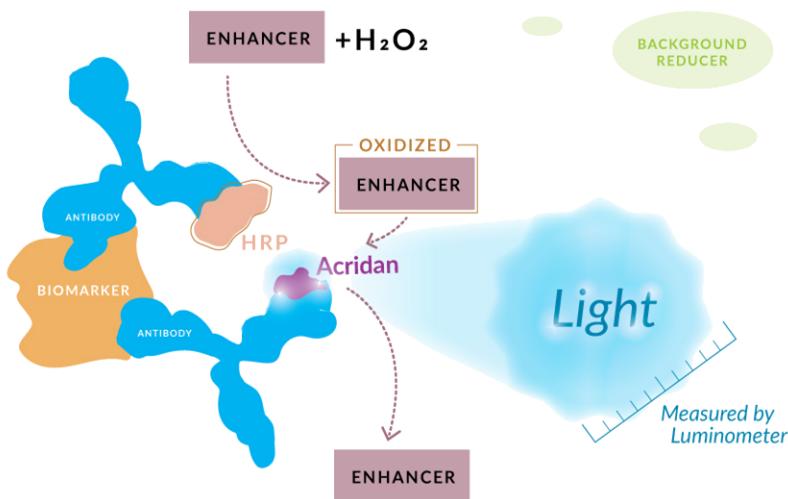
<https://www.wikipedia.org/>



# Measurement tool: SPARCL™

(Spatial Proximity Analyte Reagent Capture Luminescence)

*Antibodies Bound to Biomarker:*



Life Diagnostics, Ltd.

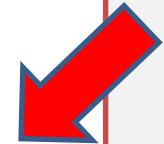


THE UNIVERSITY of EDINBURGH  
The Royal (Dick) School  
of Veterinary Studies

- “ELISA” in solution
- **45m for reaction**
  - Single 30m incubation
  - At room temperature
- No wash required
- High sensitivity

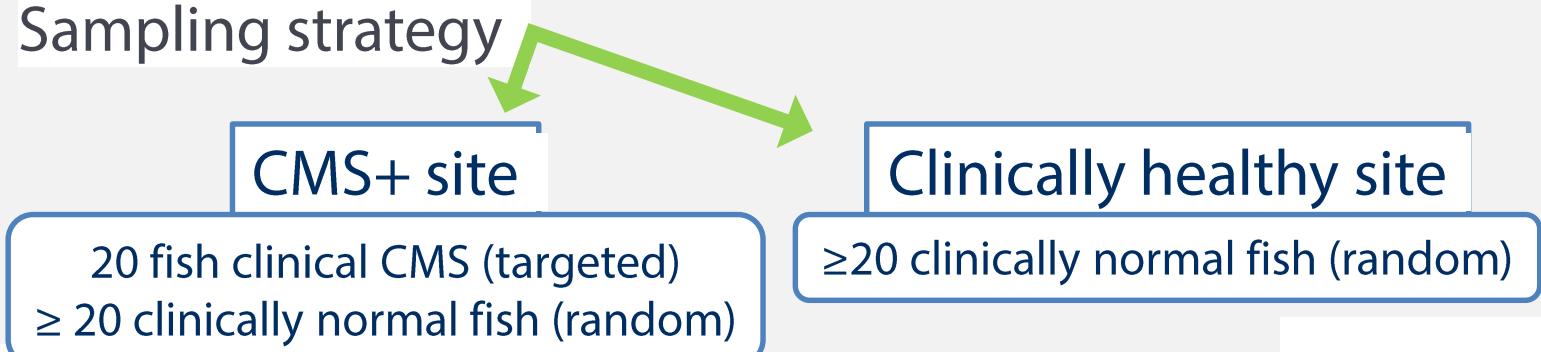
## **MEASUREMENT**

96-well plate version  
OR  
Single tube assay  
(Vet-Bio1 portable luminometer)



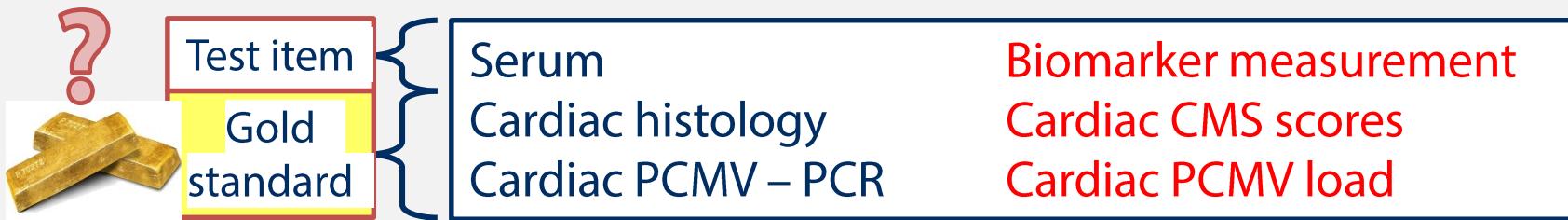
# Study design

- Cross sectional cases and controls field study (n=129)
- Samples from CMS+ and CMS- sites
  - 4 sites included (aka cohorts)
    - **Cohort A** –during CMS outbreak (harvest)
    - **Cohort B** – during CMS outbreak (pre-harvest)
    - **Cohort C** – no disease detected clinically (harvest)
    - **Cohort M** – negative control cohort (experimental unit)
  - Sampling strategy

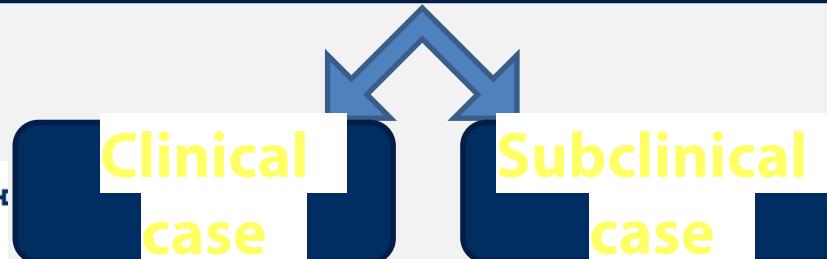


# Study design

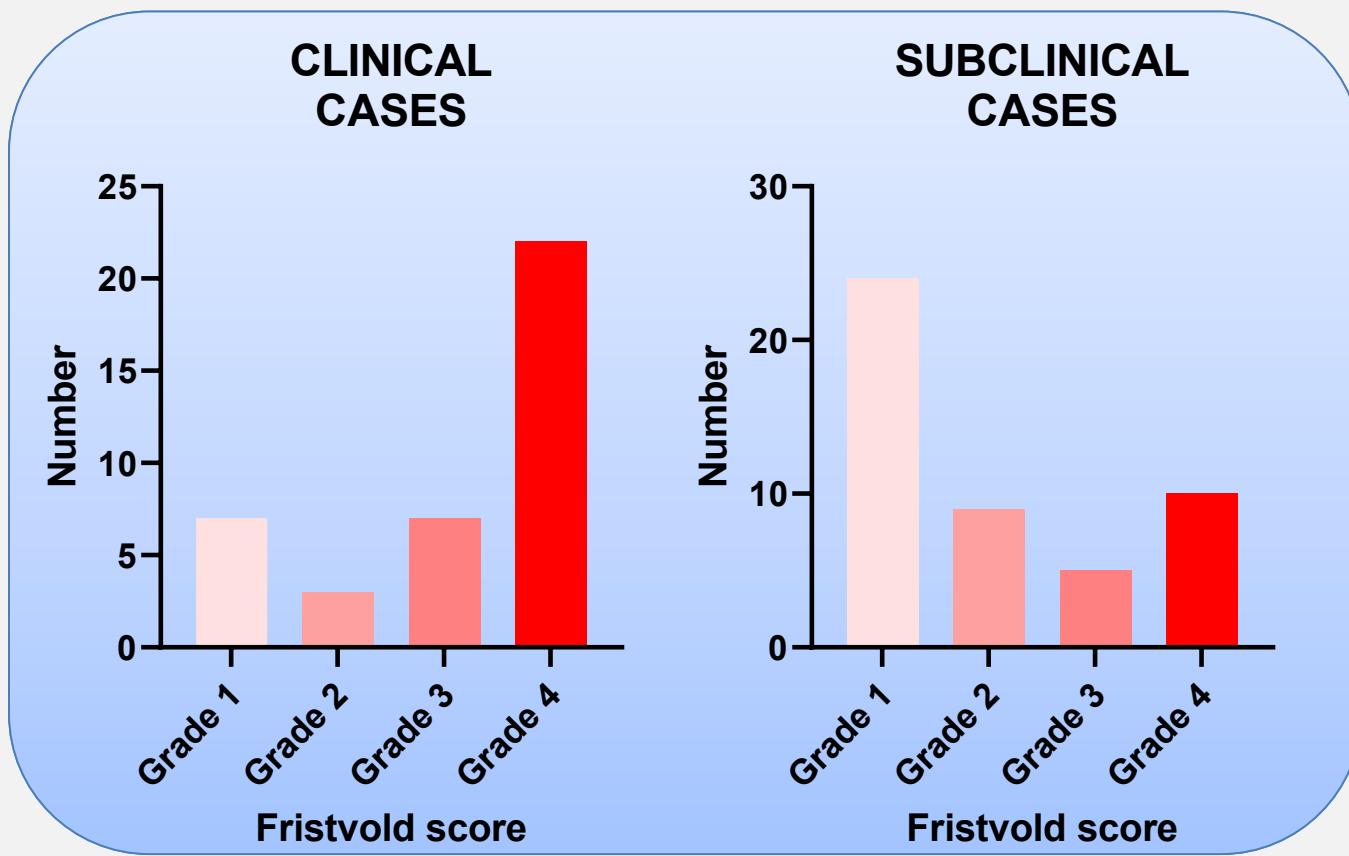
- Aim: Evaluate serum troponin concentrations vs CMS case/control status



- Case definition:

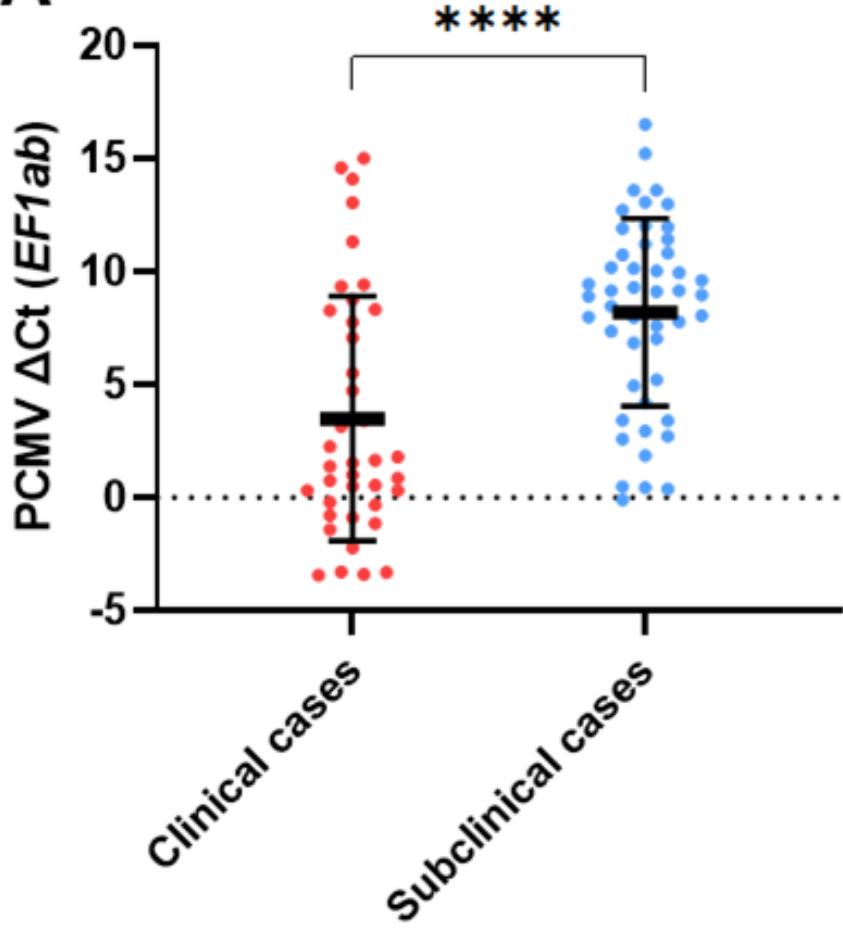


# Sample set features (CMS+ n=87)

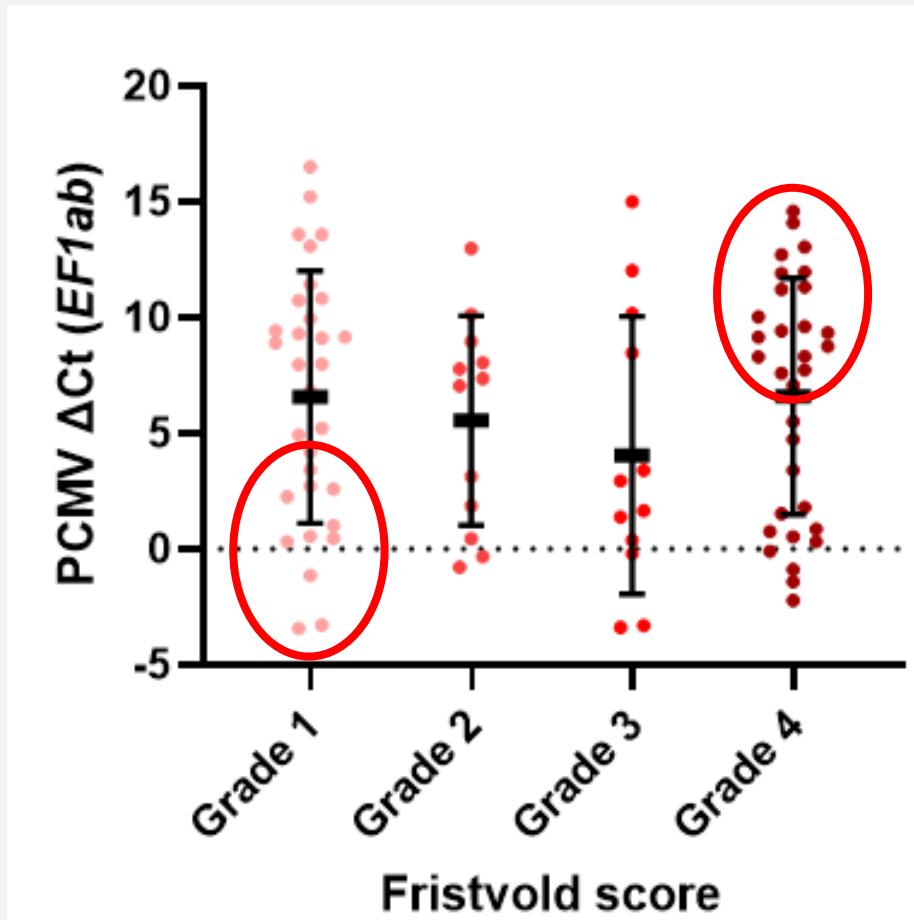


# Sample set features (CMS+ n=87)

A



# Sample set features (CMS+ n=87)



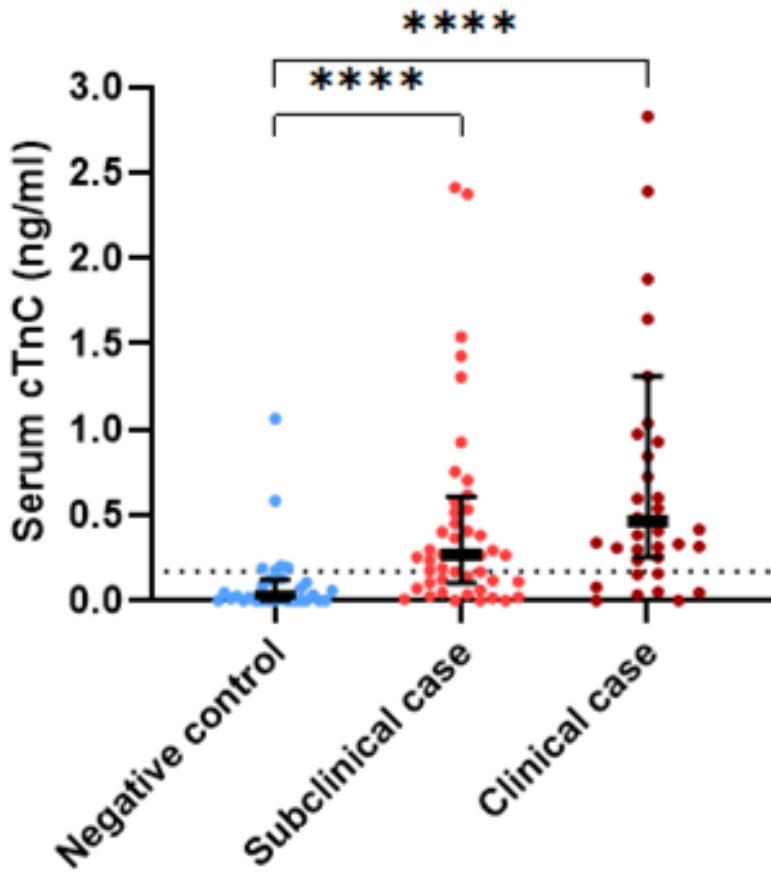
No correlation between virology/histology!!



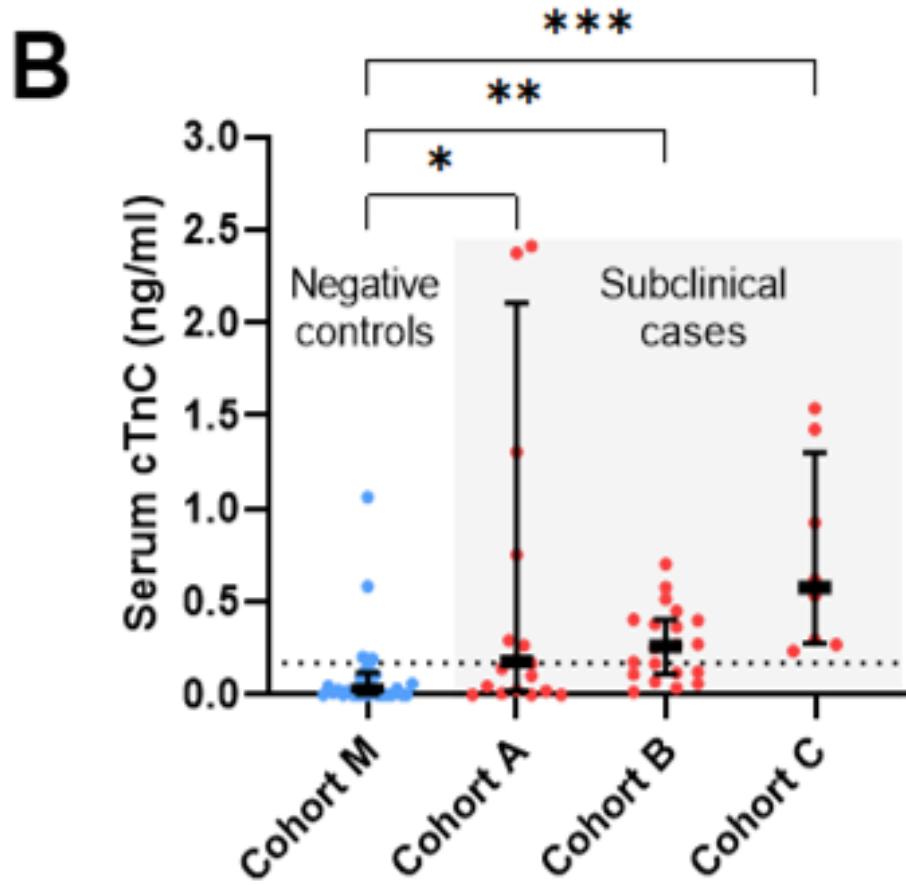
cTnC

# cTnC as a biomarker of CMS

A



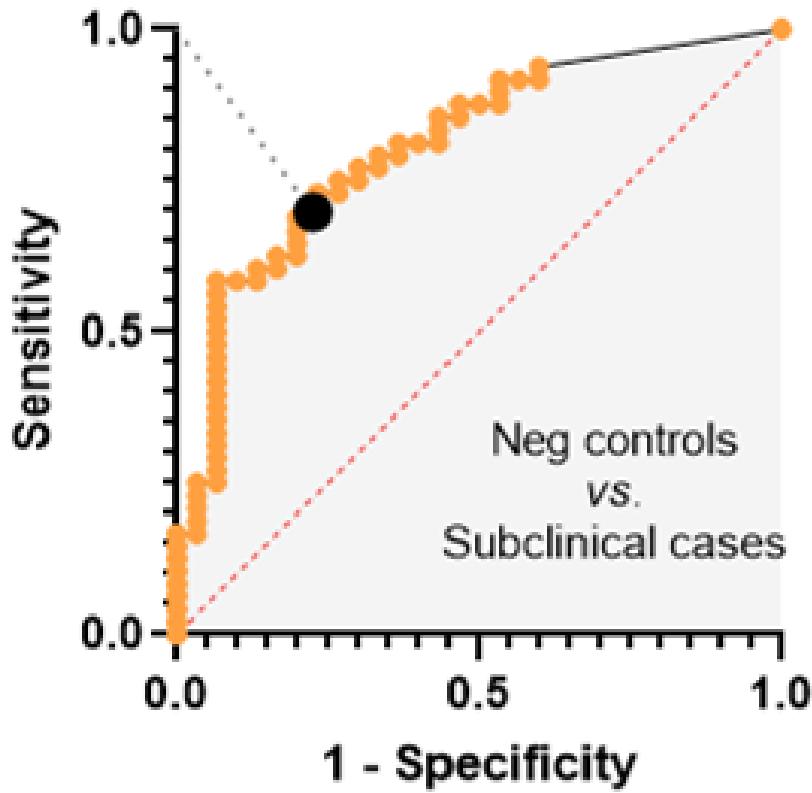
# cTnC as a biomarker of CMS



# cTnC as a biomarker of CMS

## Individual fish

C



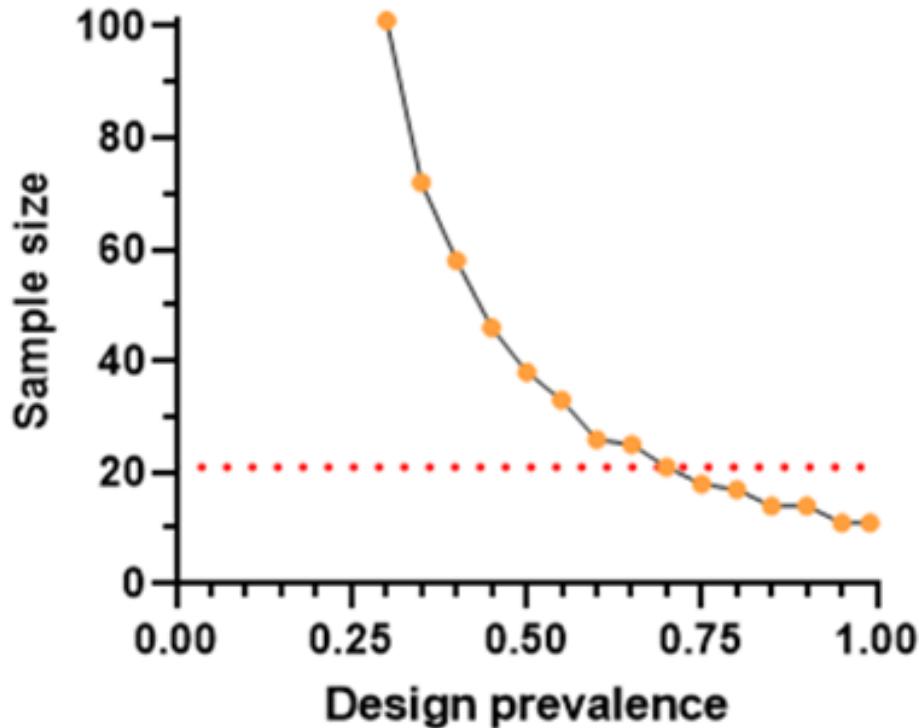
### Top-left threshold (ROC)

- 0.14ng/ml
- AUC: 80.8%
- Sensitivity: 69%
- Specificity: 80%



# cTnC as a biomarker of CMS

## Fish population



**Random sample size for freedom/presence of CMS**

- Assume n=50,000
- 95% confidence
- Population sensitivity = 95%
- Population specificity = 95%

**E.G : a sample of 20 fulfils the above for a prevalence of 70%**

Epitools - FreeCalc: Calculate sample size for freedom t ... (ausvet.com.au)

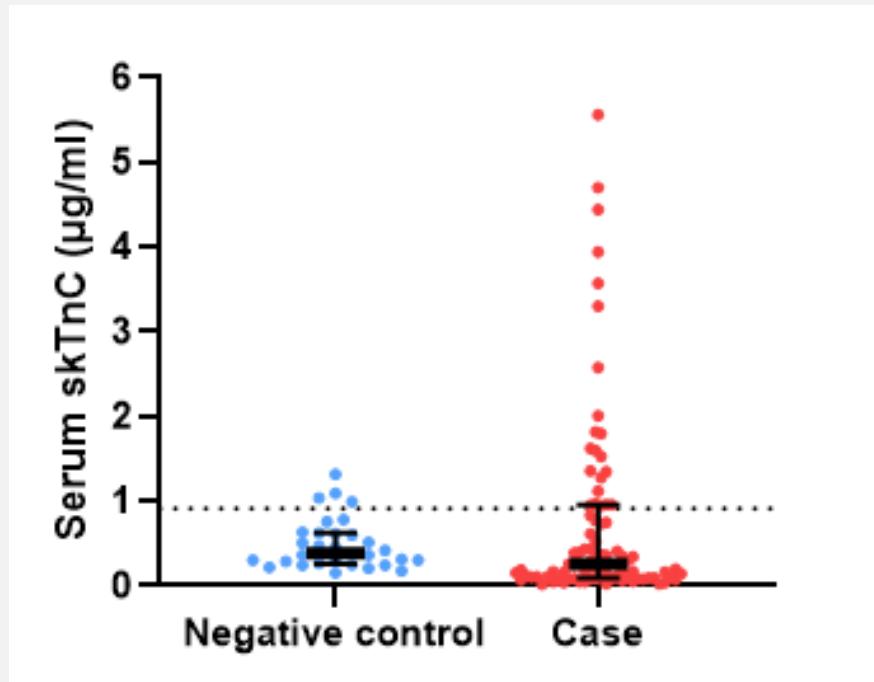


The Royal (Dick) School  
of Veterinary Studies



**skTnC**

# skTnC as a biomarker of CMS



# Conclusions

- **Portable, reliable, cheap assay for skTnC + cTnC**
  - Easy implementation in the field
- **cTnC is a biomarker of subclinical CMS**
  - Moderately good at the individual level
  - Very good at the population level
- **skTnC is not a biomarker of CMS**

## FOLLOW UP PROJECT

Additional biomarkers  
Expand to all cardiomyopathies  
Further characterization cTnC  
(longitudinal data + baseline values)



THE UNIVERSITY of EDINBURGH  
The Royal (Dick) School  
of Veterinary Studies



THE UNIVERSITY of EDINBURGH  
The Royal (Dick) School  
of Veterinary Studies



# Thank you!!!

Polly Douglas

Sarah Riddle

Lynsey Muir

Caroline Griffin

Daniel Carcajona

Philippe Sourd

Andrei Bordeianu

Chris Chadwick

Ben Perry

Alan Tinch

Borghild Hillestad

Hooman Moghadam

Kim Thompson

Janina Costa

Scott Maxwell

Ioannis Ioikonomidis



Cooke



Moredun



THE UNIVERSITY of EDINBURGH  
The Royal (Dick) School  
of Veterinary Studies

