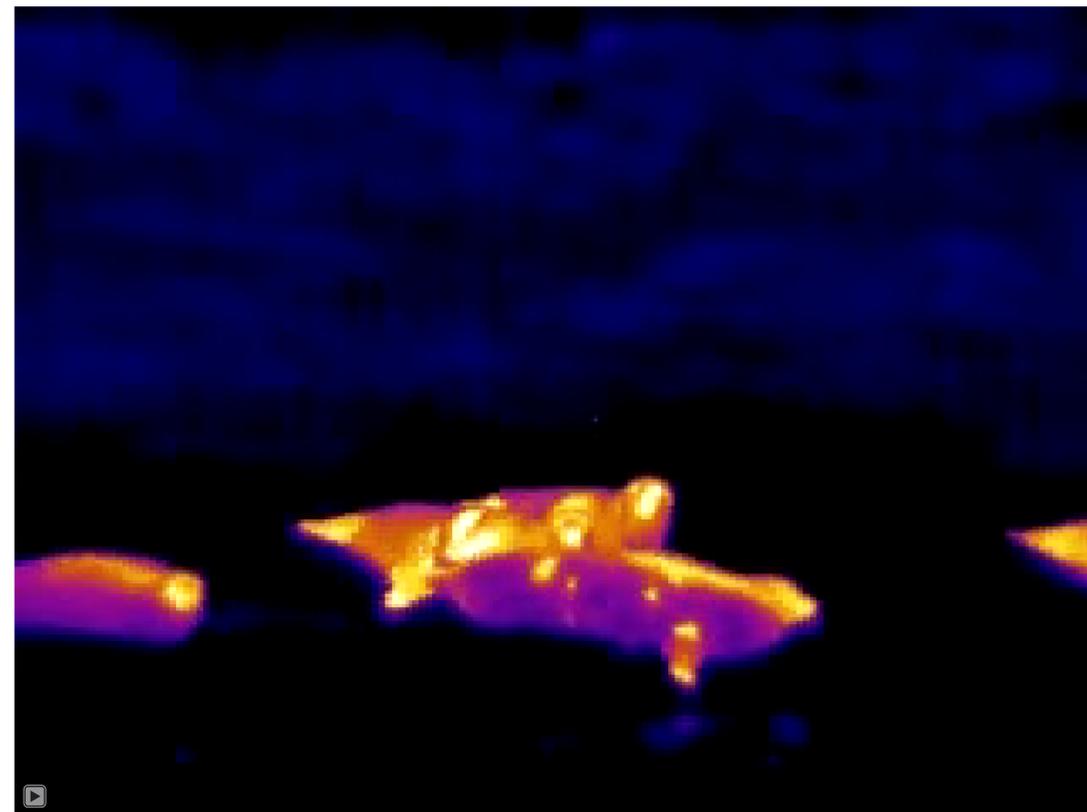


# Comparison of visual and thermal counts of seals at haulout in SW Scotland

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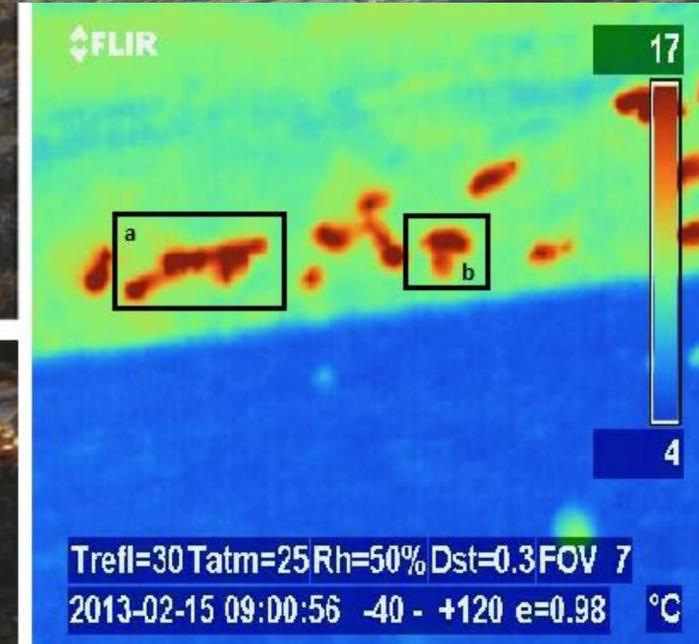
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## Aims

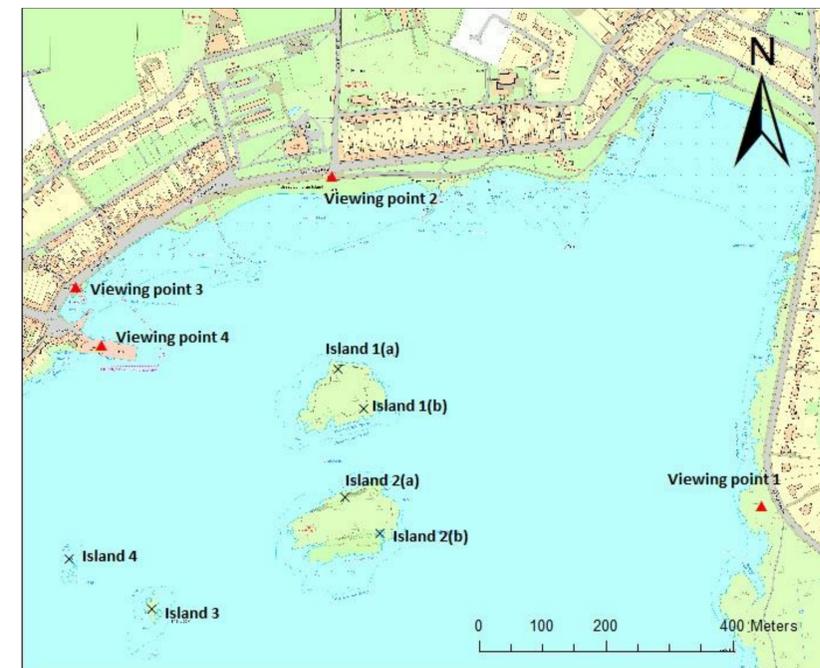
To compare visual and thermal survey methods of recording seal haulout and to examine the influence of time of day, tidal state and weather on haulout numbers.



Visual and thermal images showing four seals (a) closely huddled and (b) two seals spread out. Individuals were difficult to distinguish in thermal images when seals were closely huddled.

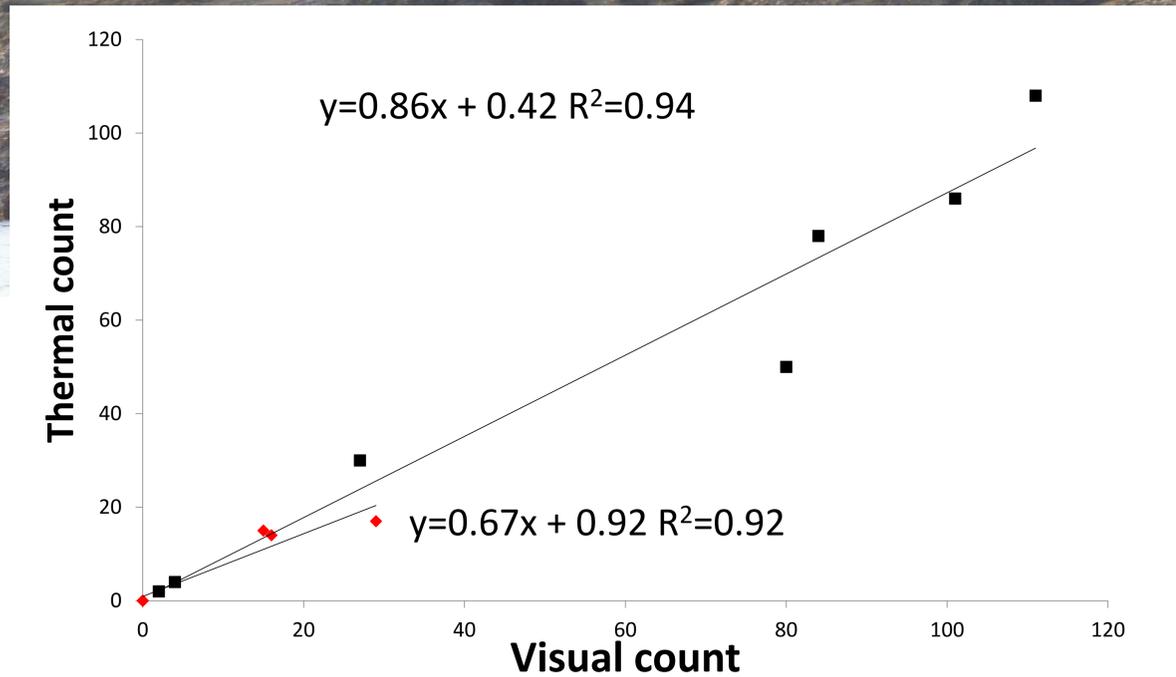
## Methods

The study was undertaken at a mixed haul out site of grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) in Millport Bay, Isle of Cumbrae, SW Scotland ( $55^{\circ}45'02.52''N$   $4^{\circ}55'31.83''W$ ) from November to February 2012. Visual (telescope) and thermal (hand held P65 FLIR camera) counts were made simultaneously during daylight and thermal counts only during the night.

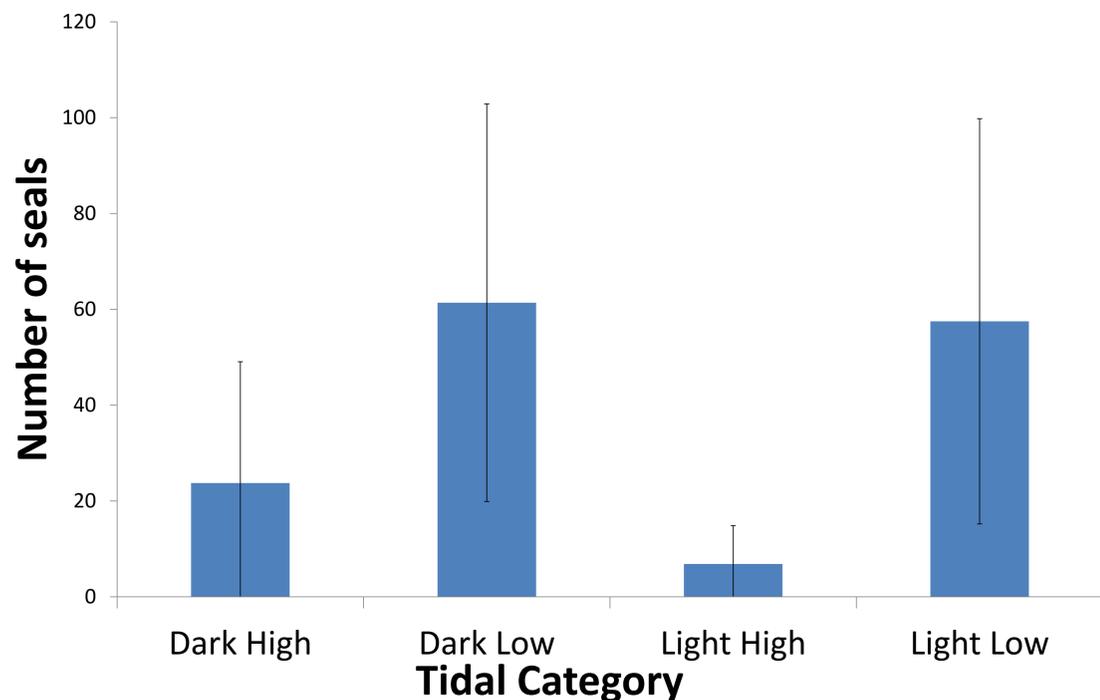


Locations of survey sites and islands for seal counts.

# Results



Relationship between thermal and visual counts during high tide (red) and low tide (black).



Number of seals (mean  $\pm$  95% CI) hauled out during the four tidal categories.

- Visual and thermal counts were highly correlated but thermal counts underestimated numbers by 10-15%.
- Variation in thermal counts was explained by tidal state, time of day, air temperature, wind speed and direction (GLM  $p=0.011$   $R^2=0.47$  )
- There was no significant difference in the number of seals hauled out between day and at night ( $p>0.05$ ).
- Significantly more seals were seen to haul out during low tide than high tide ( $p=0.003$ ) and higher wind speeds reduced haulout numbers ( $p=0.034$ ).
- Mean ( $\pm$  SE) thermal contrast of seals was  $9.5 \pm 3.3$  °C and groups of animals ( $10.4 \pm 3.1$  °C) were warmer than individuals ( $7.1 \pm 2.5$  °C, GLM  $p<0.0001$ ).

## Conclusions

Thermal imaging provided an effective method of detecting seals hauled out during day and night in winter but underestimated numbers from nearby shore counts. Similar numbers of seals were counted during day and night and therefore current daytime survey methods do not appear to bias population estimates. Weather influenced haulout numbers but tidal state was the predominate factor determining maximum number of seals recorded.

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