

Variability in harbour seal counts during consecutive aerial surveys



Louise Cunningham & Callan Duck

Sea Mammal Research Unit, Gatty Marine Laboratory, University of St Andrews, Fife, KY16 8LB, Scotland



Introduction

European legislation requires the status of harbour seals (*Phoca vitulina*) to be monitored. Counting methods are designed to reduce the potential effects that date, time of day, tide and weather might have on population estimates.

The Sea Mammal Research Unit (SMRU) surveys harbour seals from the air. For consistency, these counts are only carried out during a three-week survey window within the annual moult when, in most areas, greatest numbers of seals are hauled ashore (Thompson & Harwood, 1990; Boveng *et al.*, 2003; Harris, Lelli & Gupta, 2003).

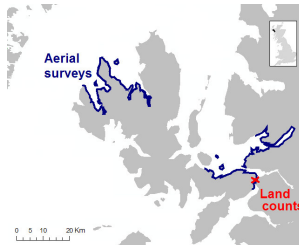
In order for long-term trends to be determined from these counts, it is assumed that numbers of seals reach a plateau during this survey window and that the timing of this plateau does not vary with location or between years.

Methods

Harbour seals on the southeast and northwest coasts of Skye were counted on five consecutive days during the 2004 summer moult using a thermal imaging camera mounted in a helicopter. Surveys were conducted within a four-hour window, two hours either side of low tide, in order to coincide with highest numbers of seals hauled out.

In addition, harbour seals hauled out in southeast Skye were repeatedly counted from the land between May and September 2004. We assumed that haul-out patterns were representative of the broader region and used a generalised additive model (GAM) with a log link function and a Poisson distribution, to analyse the factors that may affect these patterns and thus predict the number of seals hauled out during the survey window.

Figure 1: Location map of the Isle of Skye, northwest Scotland. Blue represents the path of the aerial surveys and the red cross the haul-out where land-based counts were conducted.



Aims

- To examine whether numbers of harbour seals reach a plateau during the survey window.
- To determine a generic coefficient of variation to allow comparison between future counts.

Results

Highest counts from the land were obtained during the pupping season in May and then declined before a second peak during the August moult. This second peak occurred within the SMRU aerial survey window but predicted numbers of seals at the start and end of the survey window were lower than at the peak's zenith on 15th August.

As predicted by the GAM, seal abundance did not remain stable during the five repeat aerial surveys conducted at the beginning of the survey window. Counts increased significantly between the start and finish of the study period (2nd - 6th August, Wilcoxon $Z = -1.99$, $p = 0.046$), and there was also a significant increase between 3rd - 4th and 4th - 5th August ($Z = -1.99$, $p = 0.046$ and $Z = -2.20$, $p = 0.028$ respectively).

The coefficient of variation (CV) of the repeat aerial counts was around 15% of the mean count and ranged widely among sub-regions from less than 5% to over 26%.

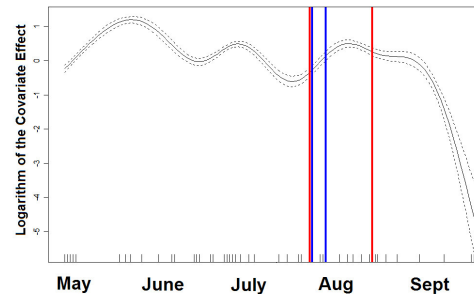


Figure 2: The effect of date, a smooth term component of the GAM, for land-based counts of harbour seals in southeast Skye. Upper and lower curves represent approximate 95% confidence intervals. Red lines represent the start and finish of the SMRU survey window and blue lines show the start and finish of the five consecutive repeat aerial counts.

Conclusions

One of the main assumptions in estimating harbour seal numbers during the moult is that the survey window fits a period when variation is minimised with no significant trend in abundance. This study showed that numbers of seals hauled out around the Isle of Skye may still be increasing at the start of the SMRU survey window. This may be caused by spatial variation in the timing of the moult plateau but in order to improve the 15% error on either side of the mean, this survey window may need to be redefined or the consequences of not doing so re-examined. Further work will examine the daily variation in land-based counts during consecutive repeat counts conducted during the three-week survey window in 2005.

References

- Boveng, P.L., Bengtson, J.L., Withrow, D.E., Cesarone, J.C., Simpkins, M.A., Frost, K.J., & Burns, J.J. (2003) The abundance of harbor seals in the Gulf of Alaska. *Marine Mammal Science*, **19**, 111-127.
- Harris, D.E., Lelli, B., & Gupta, S. (2003) Long-term observations of a harbor seal haul-out site in a protected cove in Casco Bay, Gulf of Maine. *Northeastern Naturalist*, **10**, 141-148.
- Thompson, P.M. & Harwood, J. (1990) Methods for estimating the population size of common seals (*Phoca vitulina*). *Journal of Applied Ecology*, **27**, 924-938.

Acknowledgements

Many thanks to all those who assisted with the fieldwork and to Mike Lonergan for his patient statistical advice. Thanks also to Scottish Natural Heritage and the Wester Ross Fisheries Trust for funding.

