

Understanding Carabidae population trends in the Allt a'Mharcaidh catchment.

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Introduction

Carabid ground beetles (Coleoptera, Carabidae L.) have been collected in the Allt a'Mharcaidh since 1999 as part of the Environmental Change Network (ECN) approach to monitoring changing climate and land use. Ground beetles are eminently suited to use as bioindicators as they are ubiquitous, varied (morphologically, behaviourally and ecologically), easily sampled and relatively simple to identify. Most importantly, they have tendency to shift their distribution as a response to climate change rather than undergoing physiological adaptation (Butterfield, 1996).

Trend analysis 1999-2006

- 98% decline in catch from 1999–2006 (Fig 1).
- No evidence that decline is related to changes in local climatic conditions (ECN Weather station).
- Broad decline in all species (Fig 2), with no single species displaying a favourable response.
- No changes in local land management have taken place in a considerable time

This analysis prompted an investigation into a more direct anthropogenic disturbance – over trapping.

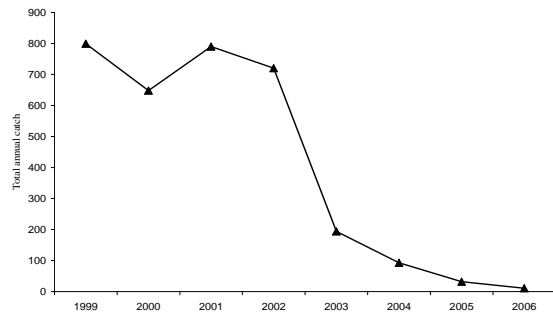


Figure 1. Total annual Carabidae catch in ECN transects, 1999-2006.

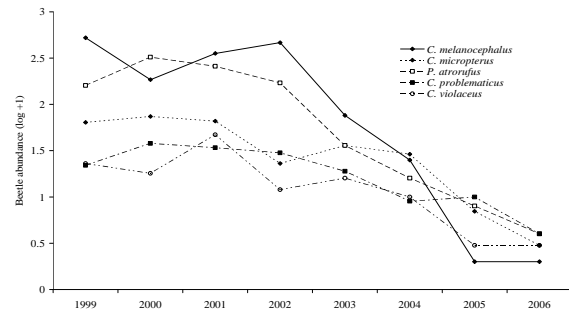


Figure 2. Targeted decline of five most commonly trapped species at the Cairngorms site.

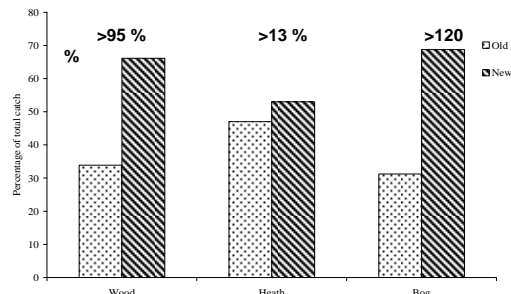


Figure 3. Number of beetles caught in old and new transects (2007), expressed as a percentage of the entire catch for each habitat. Percentage change from old to new transect is displayed above.

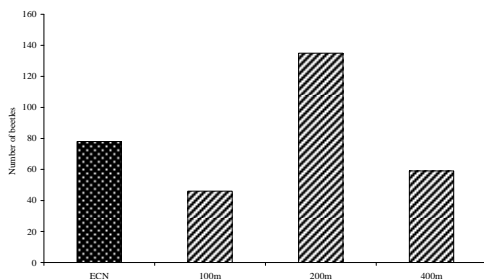


Figure 4. Number Carabidae caught in both the original ECN heathland transect, and at 100m, 200m and 400m from ECN line.

References

- Butterfield, J. (1996). Carabid life-cycle strategies and climate change: A study on an altitude transect. *Ecological Entomology*, 21(1): 9-16.
- Digweed, S.C., Currie, C.R., Cárcamo, H.A., Spence, J.R. (1995). Digging out the "digging-in effect" of pitfall traps: Influences depletion and disturbance on catches of ground beetles (Coleoptera: Carabidae). *Pedobiologia*, 39(6): 561-576

Experimental setup, 2007.

We tested for population depletion in 2007 by

- Addition of new comparable transects in each habitat type a minimum of 100m from ECN lines (Fig. 3).
- Addition of transects at increasing distances (100, 200 and 400m) in the wind-clipped heath habitat (Fig. 4), as this offered the largest area of monotonous habitat type.

Results

- New transects were found to have significantly higher ($p=0.001$) catches than the original ECN transects.
- No significant difference ($p=0.570$) existed with increasing distance from ECN transect.
- Analysis of species of varying morphological traits and life strategies provided no clear differences in the rates of decline.

Conclusions

We surmise that over-trapping seems a plausible factor for decline in beetles in the Allt a'Mharcaidh, however due to the lack of supporting evidence in the distance experiment it is difficult to ascertain with confidence if this is the primary driver. Spacing traps at 25m intervals as suggested by Digweed *et al* (1995) appears a logical choice in reducing depletion effects for those undertaking future long-term trapping experiments in upland habitats.