

# Community Ecology of Spiders and Hoverflies within Newham Fen

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## Introduction

In the UK many diverse habitats have been lost due to agricultural intensification, largely affecting fens. Fens are wetlands, often fed by ground-water and are mainly dominated by sedges and reeds.

Due to drainage and land reclamation fens are rare in southern England and even rarer in the North East.

Newham Fen (Figure 1, 2) is a National Nature Reserve (NNR) in Northumberland managed by Natural England. Despite being an NNR, the invertebrate fauna of Newham fen is understudied. Furthermore, it is unknown how the isolation impacts its species composition and biodiversity. Newham Fen is rare, calcareous (mainly calcium carbonate) and isolated. It has significant research value as many other fens are larger and southern, with more opportunities for animals to move between areas.



Figure 1: Map of British Isles with green dot indicating Newham Fen location in the North-east England.



Figure 2: Aerial view of Newham Fen with scale bar.

## Methods

### Sites and sampling

The 13 sites consisted of distinct vegetation types, subjected to different management regimes. Pitfall traps and yellow pans (to attract insects) filled with washing detergent and water were used to capture invertebrates. Each site contained 5 pitfall traps (at 1 m intervals) and 1 yellow pan, these were sampled fortnightly within Newham Fen from the 20.06.16 – 29.08.16.

Sweep-netting was undertaken to collect hoverflies and spiders on visits to empty and replenish pitfall traps. Malaise traps (large, tent-like structures to capture flying insects) were used on suitable days in June, July and August.

Collected samples were labelled, stored in 70 % alcohol and later identified. Identification required insect keys to determine specimens to species level (Figure 3, 4).

### Environmental variables

Vegetation cover and height in each site was assessed using 2m square quadrats, this was completed on the 06.09.16 and records were later used for analysis.

### Data Analysis

Using R (a statistical computing programme), a combination of multivariate ordination and generalised linear modelling techniques were used to independently analyse hoverfly and spider diversity trends. Analyses used were Redundancy analyses (RDA) and Canonical correspondence analyses (CCA). RDA summarises trends in observed variables, for example, spider species across the sites. CCA attempts to explain the spider species variation in terms of vegetation.

## Aims

- Analyse spider and hoverfly community structures on Newham Fen to assess how vegetation structure and site isolation impacts the communities.
- Develop techniques for assessing sites based on conservation value.
- Identify communities with highest conservation values and reserve aid management.
- The alternative hypothesis is that the isolation and size of the reserve contribute to different and smaller communities than more connected sites elsewhere.

## Results

Due to a small dataset, hoverfly recordings were not included in the analyses.

Figure 5, 6, 7 shows spider species composition was largely determined by vegetation management, which ranged from managed grassland, to heathland and finally to marsh habitats along the x axis.

Disturbed, managed vegetation provided better habitats for *Oedothorax retusus* and *Pardosa amentata*, whilst *Phragmites australis*, a tall marsh species was favoured by *Clubionid* species. The second axis represented a trend in site moistness whereby *Hypomma bituberculatum* (Figure 8) was found in wetter and *Antistea elegans* (Figure 9) was more prominent on drier sites.

The major trend in vegetation species composition was strongly related to the cover of herbaceous species including *Scabious spp.* and *Galium uliginosum*. The second was related to a trend from open grassland associated with *Agrostis capillaris* to dense marshland vegetation dominated by *Phragmites spp* (Figure 8). Species with high scores on this axis represented marsh or bog land.

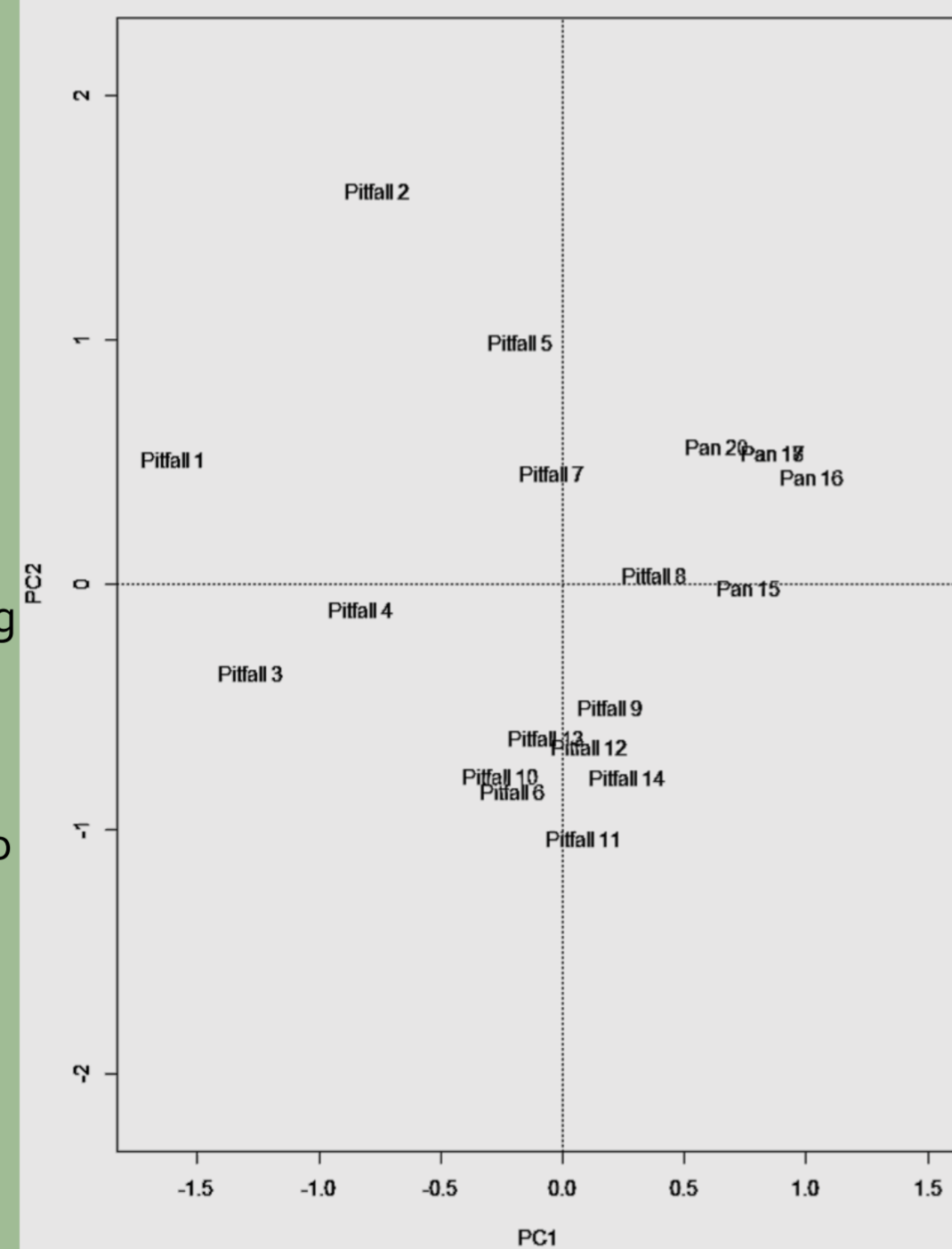


Figure 5: Redundancy analysis of site data obtained from Newham fen by combining data from the 20.06.16 to the 15.08.16. Pitfalls were placed in within 15 sites and pans were present in 20. Sites at Pitfall 1 and Pan 16 are different due to the large distance between points on the graph.

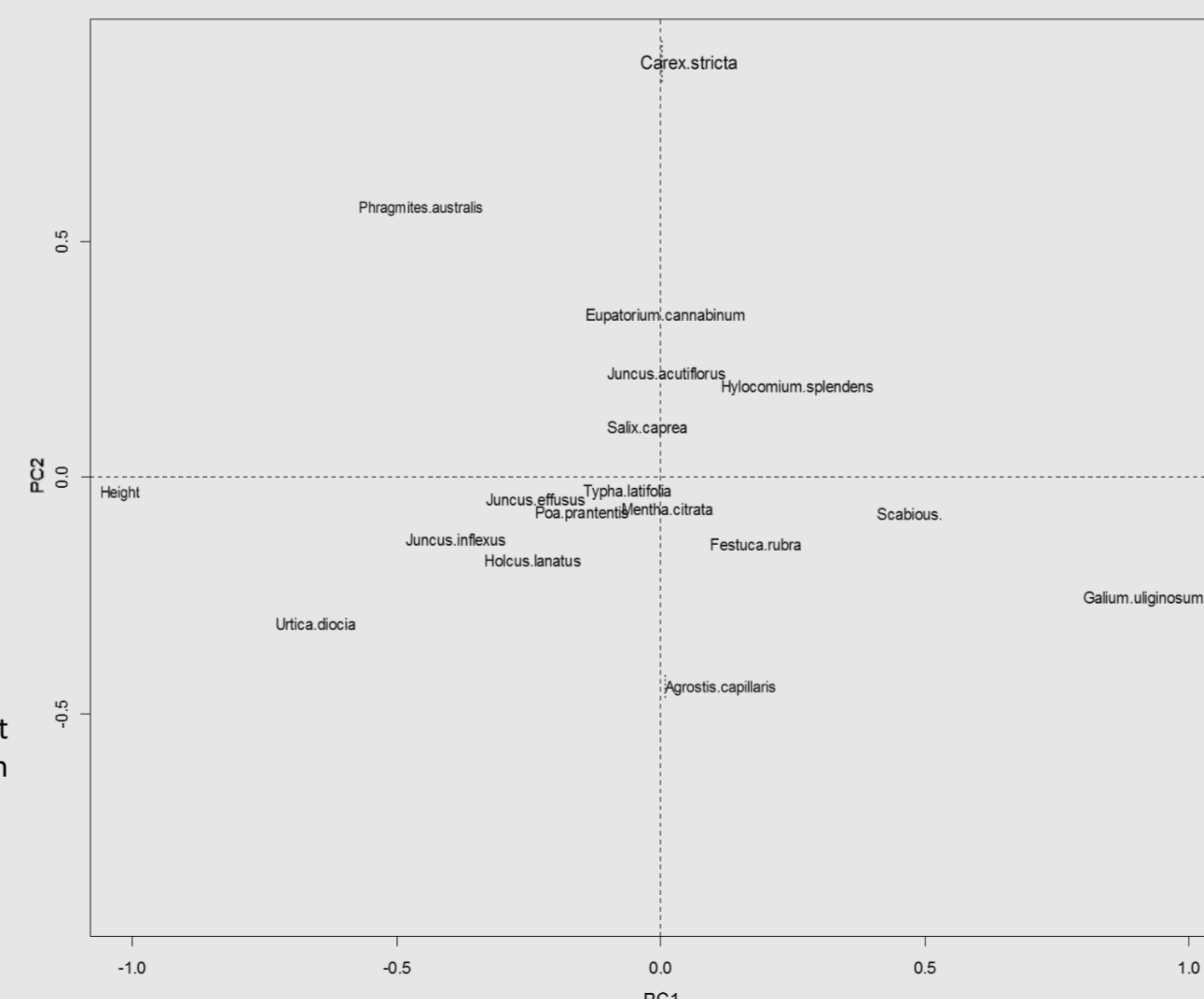


Figure 6: Redundancy analysis of vegetation species composition, percentage cover and height within the focal sites at Newham fen. Vegetation species composition and height was measured at each site on the 06.09.16. Species were identified in the field, using an identification key. Species which could not be identified immediately were brought back to the laboratory. *Carex stricta* and *Juncus usitatus* are dissimilar, as are *Urtica dioica* and *Galium uliginosum*.



Figure 3: Microscope image using Dinoscope of a female *Gnathorium dentatum*, magnification x 100.



Figure 4: Microscope image using Dinoscope of female epigyne, magnification x 100.

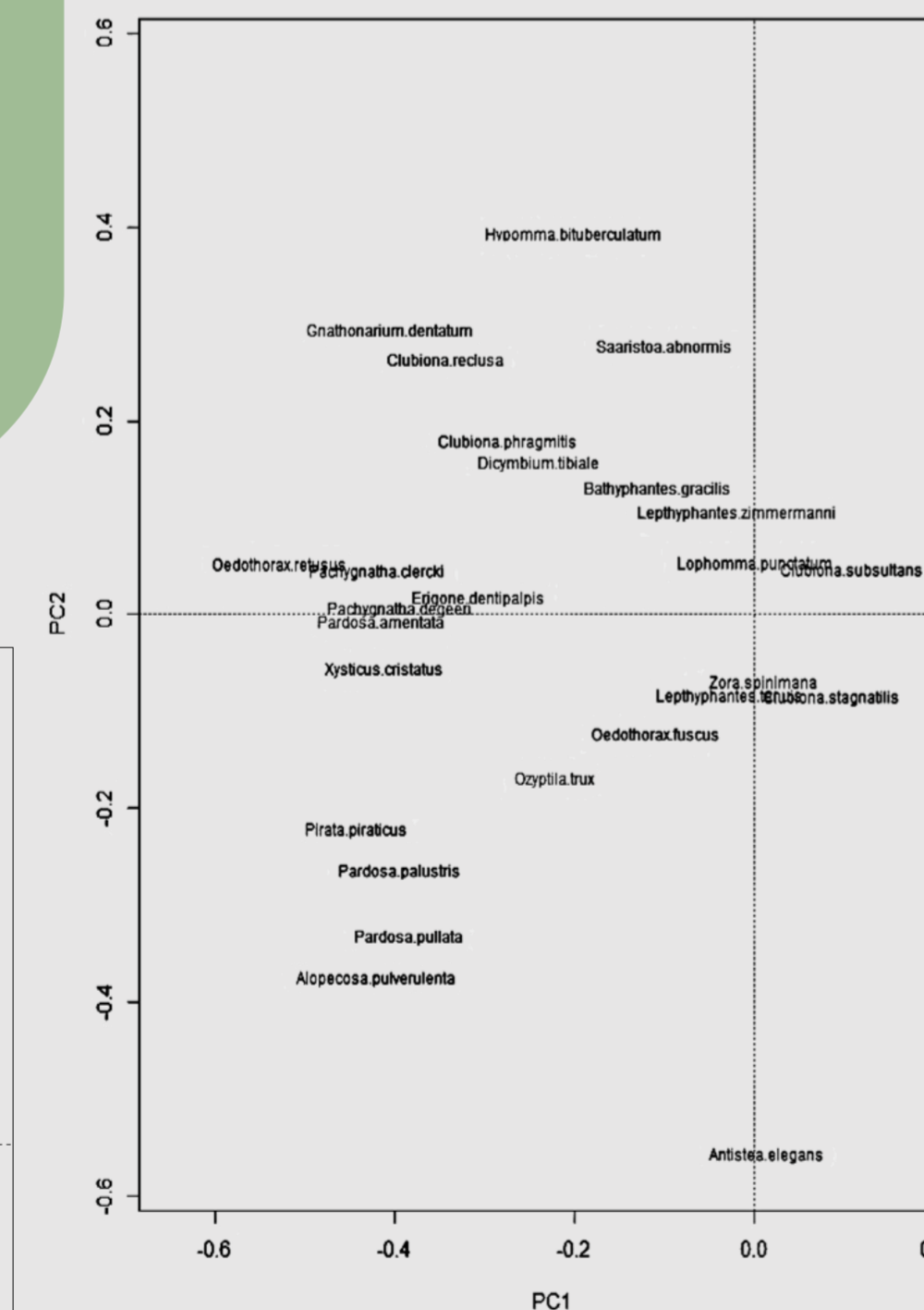


Figure 7: Redundancy analysis of the spider species obtained at Newham fen during the 20.06.16 to the 15.08.16. The extreme species are *Hypomma bituberculatum*, *Clubiona subsultans*, *Antistea elegans*, *Alopecosa pulverulenta* and *Oedothorax retusus*.



Figure 8: Front-facing view of a *Hypomma bituberculatum* (Marsh-knob head spider), showing the distinctive head structures.

## Discussion

The results demonstrate the close affinity of the spider community to the vegetation structure as the main trend and also the site wetness. Spiders are sit and wait predators, often utilising web structures that are highly dependent on the type of vegetation present.

- Despite their relatively large size, *Clubionids* are arboreal spiders, and are associated with *Phragmites* because they build nests in its folded stems.
- The smaller linyphiid species like *Hypomma spp* (Figure 8) are associated more with small dips in low level ground structures, reflecting their presence in wet areas.
- Pirata* are an abundant wolf spider species associated with moss in wet habitats where it builds a tube just above the water table (underground depth where ground is fully saturated with water).
- The biology of the spider species determines their presence within the sites.

## Acknowledgements

I would like to say a huge thank you to Stephen Rushton, Aileen Mill, Mike Eyre, Roy Sanderson and Andrew Craggs for helping me collect the data for the project. I would also like to thank Newcastle University for the funding which allowed me to carry out the research, I have thoroughly enjoyed the study and would have not been able to complete it without all the help.

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Figure 9: Rear view of *Antistea elegans* showing spinnerets in a row which is a distinguishing feature. Spinnerets are silk-spinning organs, often on the abdomen underside (contains stomach) or rear of spiders.