

A Survey of Kidney Vetch along the Angus Coastline

The Small Blue butterfly's foodplant and sole site of oviposition is the flower of the Kidney Vetch¹. Due to a decline in the numbers of this butterfly, efforts are being conducted by Butterfly Conservation Scotland to preserve the species. This survey aimed to inform these efforts by tracking changes in the numbers of Kidney Vetch along the Angus coastline throughout the years, and observing any fluctuation in the numbers of Small Blue corresponding to this. It has been concluded that while Kidney Vetch numbers have fluctuated, there is no net increase in the numbers of Small Blue.

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Introduction

The Kidney Vetch (KV) is a wildflower mostly found in coastal habitats². As the sole caterpillar foodplant and site of oviposition for the Small Blue butterfly (SB), its presence constitutes a potential habitat for the endangered butterfly. Therefore, tracking it provides an approximation of the amount of habitat available for SB.



Image 1. SB on a KV, photograph taken in Seaton Cliffs 2021
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KV and SB have been tracked over a number of years by Butterfly Conservation Scotland, showing that the numbers of SB have significantly declined in the past 20 years¹. The butterfly (*Cupido minimus*) is Scotland's smallest butterfly, requires sheltered grassland to brood, and is unlikely to fly long distances, meaning that work to increase the number of and connectivity of areas of KV is vital to increase its population³. Therefore, volunteers have been mobilised to plant KV at sites such as Seahills Farm and Elliot Links⁴.

This survey aims to ascertain the effect of these efforts on KV density along the Angus coastline. This has been attempted by comparing numbers of KV in various Angus coastal transects with the data collated in Meg Mearns' 2017 Small Blue butterfly survey⁵. It is hoped that this data can inform the forthcoming Species on the Edge Project, which aims to work with landscape managers to increase the habitat for 40 species, including the Small Blue¹.

Methods

The Butterfly Conservation Scotland method for monitoring KV was used in these surveys of the Angus coastline. Six transects were monitored: between Monifieth and Carnoustie, East Haven, Elliot Links, between Arbroath cliffs and Auchmithie, Lunan Bay, and between Boddin Point and Fishtown of Usan. These were selected based on the

locations found to be potential SB habitats in Meg Mearns' survey, and on locations where KV has been planted in recent years by volunteers⁶.

The KV at each transect was recorded by counting the number of KV plants and the total number of flowerheads⁷. At each location where KV was seen, the grid reference of the location was taken using the Arthur Embleton Grid Reference app, and the numbers within an area with 3m diameter was taken. This produced a list of locations where KV was found in each transect, with the corresponding amount of KV and flowerheads at each location – the format of this record is shown below. Other volunteers also counted KV and submitted the data, but as this was qualitative rather than quantitative it could not be averaged with the data taken here so has been left out.

Grid reference (10 figures ideally)	Number of Kidney Vetch plants	Number of Kidney Vetch flowerheads	Exact count (C) or estimate (E)?	Notes
NS 12345 12345	14	27	C	on track edge

Table 1. An example of the format for recording KV numbers at each transect.

The numbers from this year were compared with those taken in 1994 to see changes in the KV density, and therefore the change in the levels of SB habitat present on the Angus coastline.

Results

Transect	Total # Flowers	Total # Flowerheads
Monifieth-Carnoustie	137	1193
East Haven	6	77
Elliot Links	319	6544
Arbroath-Auchmithie	86	3537
Lunan Bay	45	1083
Boddin-Usan	693	13431

Table 2. A net total of the number of KV plants and flowerheads on each of the transects in 2021.

Analysis

Transect	1994		2017		2021	
	# KV	# SB	# KV	# SB	# KV	# SB
Monifieth-Carnoustie	N/A	N/A	N/A	N/A	137	5
East Haven	N/A	N/A	N/A	N/A	6	N/A
Elliot Links	0	20	100	2	319	8
Arbroath-Auchmithie	175	19	1336	7	86	44
Lunan Bay	35	0	256	0	45	N/A
Boddin-Usan	500	35	1080	1	693	N/A

Table 3. A net total of the number of KV and SB on each of the transects in 1994, 2017, and 2021.

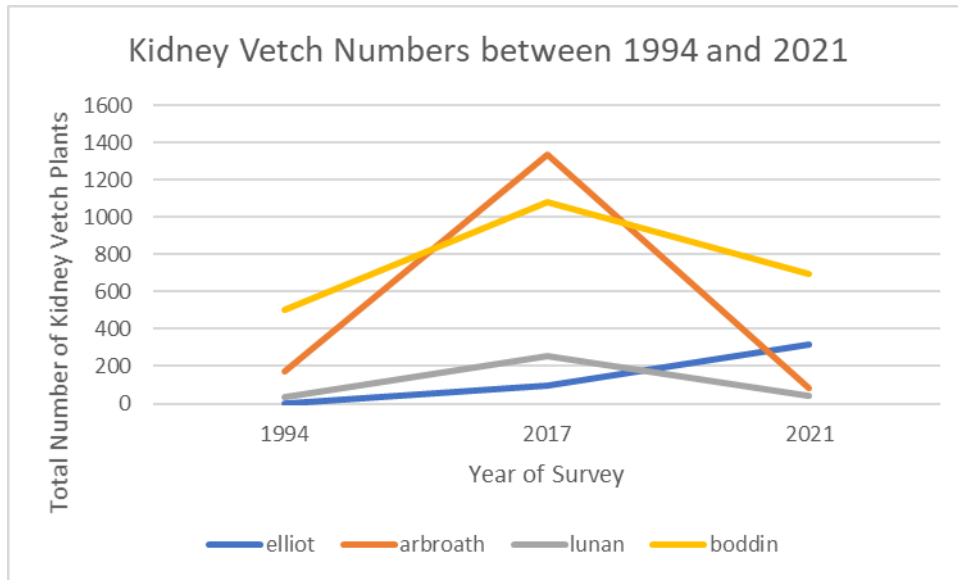


Figure 1. Line graph showing fluctuations in KV numbers at the Elliot Links, Arbroath, Lunan Bay and Boddin-Usan transects between the three surveys.

As seen in Table 2, there has been a fluctuation in the total number of KV throughout the years, with numbers increasing in Elliot Links from previous years, but decreasing from previous years in Arbroath, Lunan Bay, and between Boddin and Usan. This fluctuation was evaluated as significant ($P < 0.001$) by a generalised linear model comparing the number of KV counted in each year (coefficients seen in appendix). While this is counter-intuitive due to the increase in volunteer planting sessions in recent years⁴, there are potential explanations for this decrease. It may be due to coastal erosion and rising sea levels making some locations inaccessible to surveying that were previously surveyed, and may also be because of the extensive late-spring frosts in April of 2021⁸. Additionally, plants may die due to varying soil conditions, animals such as rabbits digging up newly planted KV, or long dry periods affecting seedling.



Image 2. Large numbers of KV planted by a volunteer at Lunan Bay, photograph taken 2021. © Isabel Grainger

Table 3 shows fluctuations in SB number alongside that of KV. While an increase in SB numbers at Arbroath back to 1994 levels is encouraging, more data needs to be collected to evaluate its reliability and see if it reflects a real increase in SB population. Regardless, the overall number of SB has still not increased to the level it was at in 1994. Therefore, the Species on the Edge project is needed to conserve this endangered butterfly, with hopes that the next planting sessions will yield more living plants than last year. To improve this survey in the future, each transect should be repeated for reproducibility, and the potential of using drones to visualise inaccessible areas of the coast should be considered to get a more comprehensive appraisal of KV numbers on the Angus coastline. Additionally, more extensive cataloguing of the SB itself is needed to better understand its status, including egg and larval searches on the KV plants in the transects.

Bibliography

1. Species on the Edge Small Blue workshop, David Hill
2. Coastal Wildflowers workshop, Anthony McCluskey
3. Small Blue Priority Species Factsheet <https://butterfly-conservation.org/sites/default/files/1.small-blue-psf.pdf>
4. Small Blue 2020 Newsletter <https://www.taysidebiodiversity.co.uk/wp-content/uploads/2021/02/SMALL-BLUE-2020-002-GE-CL-FINAL-25-2-21-1.pdf>
5. Small Blue Butterfly Survey of Angus Coastline 2017, Meg Mearns
6. Small Blue Butterfly Survey: Angus 1994, Meg Mearns
7. Kidney Vetch monitoring for Small Blue, Butterfly Conservation Scotland
8. Lamichhane, J.R. Rising risks of late-spring frosts in a changing climate. Nat. Clim. Chang. 11, 554–555 (2021). <https://doi.org/10.1038/s41558-021-01090-x>

Appendix

Generalised linear model for count data (with poisson error distribution) to see the significance of the difference in KV between the three years:

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-58.07091	2.98154	-19.477	< 2e-16 ***
year	0.03131	0.00148	21.155	< 2e-16 ***
transectarbroath	1.33801	0.05489	24.377	< 2e-16 ***
transectlunan	-0.22076	0.07323	-3.015	0.00257 **
transectboddin	1.69098	0.05317	31.806	< 2e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for poisson family taken to be 1)

Null deviance: 5125.2 on 11 degrees of freedom
Residual deviance: 2185.9 on 7 degrees of freedom
AIC: 2276

Number of Fisher Scoring iterations: 5