

# **Moon Carrot Survey 2023**

**(Version PD 25/08/23)**

## **Background**

Moon Carrots (*Seseli libanotis*) are white flowered umbellifers that are quite widely distributed across continental Europe, but are only found in a handful of sites in Britain. Since at least 1845 they have been recorded on Seaford Head, where they currently grow close to Hope Gap. The vast majority are on the north facing slope to the west of the Gap (shown in Figure 1). Most of the others have been recorded up the hill to the east of the Gap, near the coast path in the areas shown in Figure 2.

Most Moon Carrots are biennial and die after two growing seasons (normally two years), so the number of plants can vary considerably between years. The numbers will be influenced by the success of seed-production and dispersion two years previously, and the quality of subsequent growing conditions. All these factors can be highly variable, especially given the current weather perturbations and the exposed nature of the Hope Gap site.

In order to monitor changes in both the numbers and location of the plants, members of the Seaford Natural History Society started a series of annual surveys in 2013. These continued until 2019, but stopped due to Covid proximity restrictions in 2020. They restarted in 2021.

The surveys take place during what is hopefully the peak flowering season for the Moon Carrots – typically the second half of August. The dates of the 2021, 2022 and 2023 surveys were August 18<sup>th</sup>, 15<sup>th</sup> and 14<sup>th</sup>.

## **Survey methods and results**

Two different approaches are used in the surveying. (1) Plants on the main slope are counted in strips and the strip totals are combined to give estimates for three larger blocks. (2) The smaller numbers in Hope Bottom, and on the cliff tops to the east, are recorded individually.

### **Surveying on the main slope**

Seven people from the Natural History Society and Sussex Wildlife Trust carried out the main slope survey in 2023. We started at the far eastern end of the slope – by the fence that goes to the Hope Gap steps – and continued for approximately 140 metres up the coast path to 10m beyond a “cliff edge” sign.

For the first 80m (or so), corresponding to the Main East and Centre Blocks of the main slope (see Figure 1), we counted the number of flowering plants in a series of N-S strips. These were approximately 2-3m wide and went from the coast path up to the cliff edge. For safety reasons, plants within 10m of the edge were counted at a distance. The grid references of each strip were recorded for use in aggregating the results. Although most of Main East and

Centre could be surveyed in this way, on some of the strips surveyors had to divert around patches of scrub.

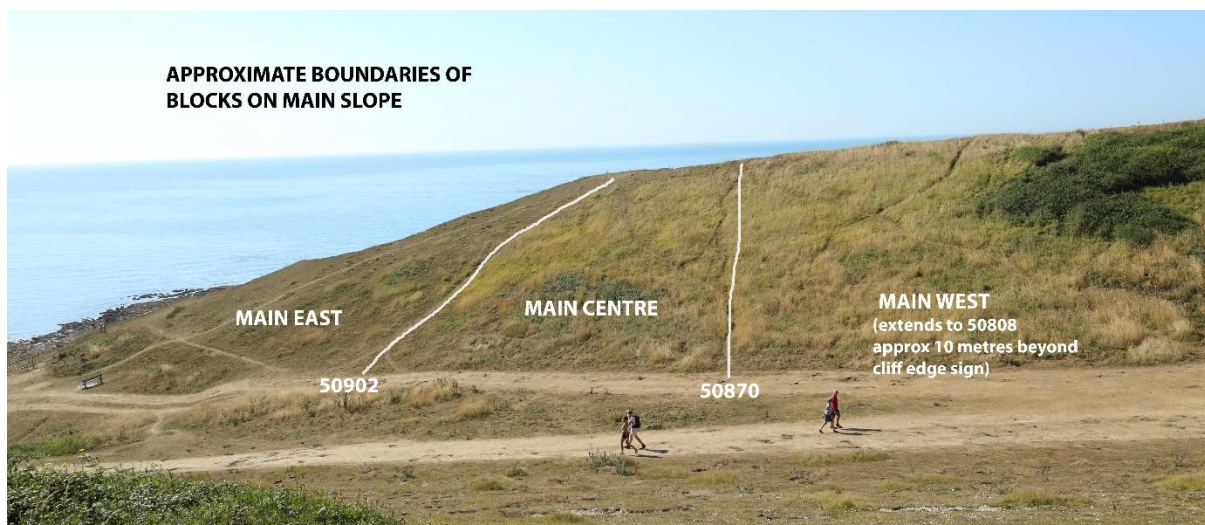
The increasing density of scrub meant it was difficult to continue using full length strips to survey the Main West block (west of easting 50870) and this part of the main slope was done on an ad hoc basis – with several surveyors covering any ground not obscured by scrub.

The three blocks used since 2019 to present the main slope results are as follows.

- Main East is the section of much shorter grass to the East of the obvious N-S track up the cliff. The area ends at easting 50902.
- Main Centre is the area of mostly Tor Grass, starting at the track where Main East finishes. It ends at a path that goes up from the main valley track, at easting 50870.
- Main West starts at the path at 50870 and continues west along the slope to 50808 east, 10m beyond the first “cliff edge” sign. Although a few plants were seen this far west in 2013, by 2016 much of this area was impenetrable due to scrub encroachment, and was not surveyed from 2016-2018. Following scrub clearance, limited surveying re-started in 2019.

The 2022 report gives more details of how these areas correspond to the transects used in the pre-2019 reporting. Because some of these earlier transects crossed the current boundaries, there could be some imprecision in assigning their counts to the three blocks used to present the results in Table 1. Moreover, the methodology for surveying the main slope, designed from the outset to be simple and easy to repeat, also runs the risk of introducing imprecision into the counts: not least by the miscounting of multiple flower heads. So, we need to be very cautious about drawing conclusions from small differences in the absolute numbers – and regard them more as orders of magnitude.

**Figure 1 The Main Slope and the three reporting areas**



<b>Table 1 Annual totals of plants in the three sections of the main recording block</b>										
<b>Section</b>	<b>Number of plants</b>									
	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
Main East	338	274	1113	835	1091	2330	3536	5353	3216	3952
Main Centre	470	261	1011	412	355	543	348	1691	416	227
Main West	94	59	48	22	6	1	0	23	8	33
<b>Total</b>	<b>902</b>	<b>594</b>	<b>2172</b>	<b>1269</b>	<b>1452</b>	<b>2874</b>	<b>3884</b>	<b>7067</b>	<b>3640</b>	<b>4212</b>
% in East	37	46	51	66	75	81	91	75.7	88.4	93.8
% in Centre	52	44	47	32	24	19	9	23.9	11.4	5.4
% in West	10	10	2	2	0	0	0	0.3	0.2	0.8

***Results from the main slope (Table 1):***

- Since the start of the surveys, the total number of plants recorded on the main slope has varied from 600 to 7000, but trying to identify any trend is complicated by the lack of data for 2020 and the sudden increase in numbers in 2021. The peak in 2021 might lead us to expect high numbers in 2023, but there is an argument that growing conditions in 2021 were exceptional, and we should only expect similar numbers if these conditions were repeated. But, with the exception of 2021, there does seem to be some recent stability, as both the 2023 and 2022 counts are not dissimilar to those in 2019 (all are in the range 3600-4200) suggesting this could now be a typical total for the slope, except in years with very unusual growing conditions.
- Without wanting to over-interpret the figures, the percentage of the main slope total in the central block has been falling since the surveys started: from around 40-50% in 2013-5, to 20-30% in 2016-2021 (9% in 2019), and down to 11% in 2022 and 5% in 2023. This may be due to the increasing density of Tor Grass in the central area.
- The Western Block counts for 2021, 2022 and 2023 show that Moon Carrots are now nearly absent from this area. In the first 3 years of the survey (2013-2015) the western counts were 98, 59, 48. And although there have been some subsequent sightings of 20-30 plants, these have all been at the eastern end of the western block. The boundary path between the two blocks has not always been clear, so some of these could have been assigned to the centre block rather than the west, further reducing the western numbers.

**Surveying the Satellite sites**

Because of their smaller numbers, the Moon Carrots in the satellite sites east of Hope Gap (and a few in Hope Bottom) can be surveyed more precisely than those on the main slope. In these areas, individual plants and their locations (grid references) are recorded.

**Surveying the cliff top satellites**

The areas in which most of the “satellite” plants have been seen begin at the top of the slope going east from Hope Gap. They are shown in Figure 2 (taken from Chris Brewer's 2019 report). In his 2018 report he noted that Satellite 1 had been present since the start of the surveys and that a second area further east (Satellite 2) was first seen in 2017 and had expanded by 2018. By 2019, Satellite 2 had extended eastwards into Satellite 3 and many more plants were recorded. There were also 3 isolated plants north of the main coast path in satellite 4. In 2021 we found a similar distribution of plants on the cliff top sites, including 16 plants in Sat 4. In 2021 we also saw a single plant further east and inland at TV51192 97517. The counts for all these Satellites are in Table 2.

**Figure 2 Plan of the 4 cliff top satellite areas in 2019**



We do not know the numbers in 2020 because there was no survey, but two years later we could only find 3 plants in this entire area, despite revisiting the site on several occasions. All 3 were in Sat 3.

<b>Table 2 Numbers of Plants in cliff top satellites east of Hope Gap</b>										
	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023
Sat 1	4	8	8	9	6	13	30	77	0	26
Sat 2					25	64	164		0	8
Sat 3							145	129	3	10(a)
Sat 4							3			2(b)
<b>Total</b>	<b>4</b>	<b>8</b>	<b>8</b>	<b>9</b>	<b>31</b>	<b>77</b>	<b>342</b>	<b>206</b>	<b>3</b>	<b>46</b>

Notes: (a) One of these 10 was much further east – beyond the second bench. (b) these 2 were at the top of the slope, inland of the main path.

In advance of the 2023 survey, we were hoping that the collapse in 2022 would not be repeated and that the offspring of the 206 plants seen in 2021 would revive the numbers. In the event, we recorded 46 this year. More than half of these (26) were in area Sat 1 – on the seaward side of the fence towards the top of the climb out of Hope Gap. Most of the remainder were in Sats 3 and 4. One was much further east – beyond the second bench. And 2 were just inland from the coast path, near the scrub, at the western end of Sat.4.

### *Results from the cliff top satellite areas*

- As can be seen from Table 2, the numbers recorded along the cliff top to the east of the Gap increased from the 4 recorded in 2013 to several hundred in 2019 and 2021.
- The apparent reversal from 2019 to 2021 (a drop from 300 to 200) may be due to environmental factors impinging on propagation and growth, but could also be due to a more rigorous recording regime in 2021: to ensure that plants with multiple flower heads were counted as single plants.
- The collapse in 2022, with only 3 plants recorded on August 15<sup>th</sup> – and no more present on August 25<sup>th</sup> - is hard to explain without data from 2020. The vegetation in the cliff top satellite areas does not appear to have changed radically from 2019 and 2021; and Wild Carrot still grows widely across these areas.
- Commenting on the 2022 figures for the cliff top satellite zones, Chris Brewer notes: “Given that the main site is vulnerable to erosion, and that the satellite site(s) appeared to represent an encouraging counter to this, I would suggest that this should be flagged and maybe further investigated”.
- The 2023 counts show that Moon Carrots may still have a future in these cliff top areas: 46 were recorded this year. But this is well below the 342 in 2019, 206 in 2021 and even the 77 recorded in 2018. Again, it is very hard to explain these variations, given that growing conditions seem relatively unchanged in these cliff top areas. So, it may be necessary to look for specific events to explain the fluctuations, such as strong northerly winds during seed dispersal.

### *Surveying the Hope Bottom/Hope Gap satellites*

Two areas of Hope Bottom are surveyed: (1) The flat ground on the seaward side of the fence between the Hope Gap steps and the first recording strip of the main slope; and (2) the flattish area where the paths converge in the centre of Hope Bottom.

- **In area 1**, the 2021 survey recorded 22 plants, which fell to 4 in 2023. For the past 2 years, recording has become difficult in this area, which, due to erosion is now less than 10m from the cliff edge – and surveying has to be done at a distance, increasing the risk of under-counting. Plants were almost certainly found here in previous years, but we have been unable to find separate records and assume they were included in the counts for the most easterly main slope transect.
- **In area 2 (the central part of Hope bottom)**, the 2021 survey found 58 plants around the grass and scrub margins where several paths converge. Small numbers had

previously been recorded in some areas of Hope Bottom: there are certainly sightings from 2018 and 2019, but we could not find specific details when compiling the 2021 report, and had to assume that they had also been included in the main slope totals. In 2022 we found no plants in any of these areas. Four plants were recorded in 2023: one at TV 50918 97387 and three at TV 50901 97401.

## **Summary and Conclusions**

It is worth repeating that the survey method was designed to be relatively easy to implement, but not intended to give meaningful quantitative data, only at orders of magnitude. Factors likely to introduce imprecision into the counts – especially on the main slope – include: the layout of the strips/transects, the accuracy and consistency of recording grid references, and the experience of the surveyors (including the extent to which they can identify Moon Carrots and ensure they are counting plants not flower heads).

The timing of the surveys could also be important. We tend to fix a date well in advance and currently do not systematically check whether this coincides with peak flowering.

Interpretation of the resulting counts has to be very circumspect, as there are many short-term factors that may influence the number of plants. These include:

- Weather influences on Moon Carrot seed dispersion, germination and plant development. And it's effects on surrounding vegetation. coarse grasses, low scrub and plants such as Yarrow overwhelming the Moon Carrots, or hiding them so they are less likely to be recorded.
- Habitat management, both planned and unplanned – the latter being mainly the extent of rabbit grazing.
- Increasing visitor numbers in Hope Bottom and on the eastern end of the main slope.

The practical difficulties of the count, and the potentially limited information it provides on the ecology of the Moon Carrots, led Graeme Lyons to doubt the feasibility and value of this type of survey. In section 3.4 of his 2012 NVC survey of Seaford Head he comments:

*“Initially it was thought that it would be possible and worthwhile to count the plants of Moon Carrot at Seaford Head. However, there were far too many plants to make this worthwhile (a count of hundreds rather than thousands). Mapping the location of the plant and understanding its ecology on the site will have far more relevance to management than counting.”*

That said, because of recent variations in the counts, we hoped that the 2023 survey would give some at least some partial answers to questions including the following.

- ***Whether the high numbers on the main slope in 2021 would be replicated by their offspring in 2023?*** The main slope numbers in 2023 were only 60% of those in 2021, but they were still the second highest since the surveys started. And, arguably, with

the exception of 2021, there does seem to be some recent stability, as both the 2023 and 2022 counts are not dissimilar to those in 2019 (in the range 3600-4200), suggesting that this could currently be a typical annual total for the slope as whole. But there was further evidence of the plants becoming concentrated in the shorter grass in the east: approximately 94% of the 2023 total was in the eastern section of the main slope – the corresponding figure for 2021 was 76%.

- ***Whether the numbers in the central section of the main slope would continue to decline?*** Although there may be some inaccuracies in the pre-2019 assignments to the central block, the 2023 total for the central block was the lowest since the surveys started. The totals for 2021, 2022 and 2023 are: 1691, 416 and 227. As percentages of the slope total, these are 24%, 11% and 5%. The next smallest figure was 261, in 2014, when this was 44% of the overall slope total. The density of encroaching Tor Grass may well be responsible for this drop in numbers in the central section. But in 2012 Graeme Lyons argued that the Tor Grass might have at least one beneficial effect. *“In the Tor-grass community, the plants attain a more typical height where they are protected from rabbit grazing by the rank grass.”* (NVC Survey – p.20)
- ***Whether there is evidence of any increase in numbers in the western block of the main slope?*** Thirty-three plants were recorded in the west in 2023, slightly more than in the previous two years, but these were all at the eastern end of the block, where the boundary between the west and the centre becomes rather arbitrary, especially towards the top of the slope. So, some of these plants might have previously been assigned to the central section and we have to conclude that this year’s count provides no evidence of a revival of the Moon Carrots in the western area.
- ***What are the future chances of a revival in the western block?*** Although there is now some cleared ground in the west, the likelihood of seeds moving back naturally against the prevailing winds seems unlikely – and Moon Carrot seeds are not shaped to assist long-distance wind dispersal. That we found no plants on this cleared ground in 2023 underlines the difficulty of natural re-colonisation. For plants to be re-established in the west, the legality and logistics of seed collection and manual re-introduction might need to be explored and piloted?
- ***Whether the 206 plants seen on the cliff top satellites in 2021 would produce higher numbers in 2023 than the 3 recorded in 2022?*** The 2023 count of 46 was higher than the 2022 total (of 3), but, with the exception of 2022, we need to go back to 2017 to find a lower cliff top total than this year’s. (NB. We do not have figures for 2020). As previously noted, it is very hard to explain the fluctuations in the cliff-top numbers given that growing conditions seem relatively unchanged and Wild Carrots seem to be flourishing. So, it may be necessary to look for specific events to explain the fluctuations, such as strong northerly winds during seed dispersal. Because these cliff-top areas could provide a refuge for the Hope Gap population as the main slope

continues to erode, there is a case for continuing to monitor the numbers in these satellite locations. And for trying to find possible explanations for the very considerable variations.

- ***Are there any signs of an increase, or decline, in the numbers of Moon Carrots in the flat areas of Hope Bottom?*** There is simply insufficient data to address this question. The records prior to 2021 do not seem to give precise locations, or separate counts, for plants reported in this area. In 2021, 58 plants were recorded here, but none were seen in 2022, and only 4 in 2023. Following Covid, there is very high footfall and associated disturbance across this area, so a revival seems unlikely, but we do not have sufficient years of data to draw any conclusions.