Changing flora of Devil's Hole, Ravenmeols – 2022 update

Philip H. Smith, December 2022

Summary

The 'Devil's Hole' is a large active blowout that originated in the early 1940s at Ravenmeols Local Nature Reserve on the Sefton Coast dunes. Wind erosion produced two calcareous, seasonally-flooded, dune-slacks that are still growing. Their floristic development was studied between 2004 and 2022, annual changes being monitored from 2012. By 2022, a total of 179 vascular plants had been recorded, annual totals showing a tendency to level off after about 2015 and then start to decline, following a 'hump-back' model that describes a trend of species-richness during succession. Thirty-eight regionally or nationally notable taxa were listed (21% of the total), while only 8% of the plants were non-native, this low figure being attributed to the distance of the site from gardens. Particular features of the slacks include large populations of the Red-listed Grass-of-Parnassus *Parnassia palustris*, Early Marsh-orchid *Dactylorhiza incarnata* subsp. *coccinea* and Marsh Helleborine *Epipactis palustris*. Older parts of the blowouts were colonised by up to 15 taxa of willow *Salix*, including over 140 bushes of the nationally rare hybrid *Salix* ×*friesiana*. Analysis of fixed-point quadrats recorded in the larger slack in 2014 and 2019 were referable to rare UK National Vegetation Classification (NVC) communities of young calcareous dune-slacks. Between the two surveys, Creeping Willow *Salix repens* increased, while species associated with wetter slack habitat declined.

The site also supported breeding Natterjack Toads *Epidalea calamita* in wet years and a rich diversity of insects, including large populations of the Red-listed Northern Dune Tiger Beetle *Cicindela hybrida* and Early Colletes bee *Colletes cunicularius*.

Introduction

Devil's Hole (National Grid Reference SD278054) is an enormous active blow-out in the Ravenmeols Sandhills Local Nature Reserve on the Sefton Coast. Formerly owned by Sefton Metropolitan Borough Council, the land was transferred to the ownership of the National Trust on 15th September 2017. Initiated in the early 1940s by World War II military activity, the Devil's Hole is thought to be the largest dune blowout in Britain (Fig. 1) and has attracted international interest as a site for the study of the effects of wind flow on sand movement. It

consists of two steep-sided troughs, the northern being by far the larger, together with a depositional lobe to the east which is inundating a block of conifers planted between 1905 and 1910 (Gresswell, 1953). Previously a bare sand basin (Fig. 2; 3), by the early-1990s the northern blowout reached the water-table, producing a secondary dune-slack which floods in wet winters (Figs. 4; 5).

Fig. 1. Devil's Hole in 2010 (Bing 3D maps), showing an early stage in slack formation

Fig. 2. Monochrome photo of the Devil's Hole in about 1970

Fig. 3. Devil's Hole in 1984 before slack formation began

Fig. 4. Devil's Hole north basin flooded in 1995 after a wet winter

Fig. 5. Extensive flooding of the northern slack in March 2013

The structure and early evolution of the blowouts, before colonisation by slack vegetation, were described by Neal & Roberts (2001). Later studies based on aerial photographs and field survey (O'Keeffe, 2014) show that, by 2012, the northern basin was about 320 m long, having grown in length at a linear rate since 1945, and had a maximum width of 90 m, while the southern blowout measured about 125 x 50 m. The entire site covered an area of over 3.13 ha, though its annual rate of growth had declined linearly since 1960, due in part to landward expansion being slowed by the conifer plantation,.

During the 1970s, two small proto-dunes began to form around Marram *Ammophila arenaria* in what was then a sandy northern basin. These developed into sizeable features, a third one forming to the east in 2008.

The vegetated area in the floor of the blowouts has been increasing by about 10% per annum since the early 2000s and, by 2012, had an area of 1.05 ha (O'Keeffe, 2014). Further sand-blow and slack enlargement has continued. Studies of wind-flow dynamics measured about 4 tonnes of sand moving in the main blowout during a few days of moderate winds in October 2015 (Delgado-Fernandez *et al.*, 2018) (Fig. 6).

Fig. 6. Wind sculpturing, Devil's Hole north

Floristics to 2021

Following the breaching of the winter water-table, vegetation began to colonise the larger northern basin in 2003, while plants first appeared in the southern slack in 2008. Smith & Lockwood (2012) recorded only 16 vascular plants in 2004. Seventeen years later, in 2021, 110 taxa were present in the northern slack, while 60 were identified in the southern basin, the grand total since recording began being 177 vascular plants (Smith, 2021). The proportion of non-native taxa was particularly low at 8.5%, this being attributed to the site's distance from gardens (about 600 m). By 2021, as many as 38 regionally or nationally notable species had been recorded in the two slacks (21% of the total). The species count increased annually up to about 2015, when numbers levelled off and then began to fall. Deep flooding in years such as 2013 and 2021 seemed to kill off some plants, including the England Red-list 'Vulnerable' Grass-of-Parnassus *Parnassia palustris*, which declined to only 1125 individuals in 2013, compared with an estimated 10,000+ the previous summer (Smith & Lockwood, 2012).

Using UK NVC methodology, nineteen 2 m × 2 m quadrats were recorded in the northern slack in the summer of 2014. Keys and descriptions in Rodwell (2000) showed that the plant communities were referable to SD13: *Sagina nodosa-Bryum pseudotriquetrum* dune-slack and SD14: *Salix repens-Campylium stellatum* dune-slack. Both are relatively rare vegetation types associated with young calcareous dune-slacks. This survey was repeated in 2019, when it was evident that Creeping Willow *Salix repens* had increased in frequency, while species associated with wetter slack habitat, such as Common Spike-rush *Eleocharis palustris*, had declined.

The 2022 survey

As before, visits were made at not less than two-week intervals from spring to autumn to record vascular plants in the two slacks. The year total for the larger northern basin was 110, the same as the previous year, while the southern slack held 60 taxa, also unchanged. The combined total for both sites was 112 taxa (Appendix 1). Since 2015, the data show a decline in species-richness for both slacks, especially the southern one, following a 'hump-back' model that describes a trend of species richness during succession (Isermann, 2011) (Fig. 7). Twenty-eight regionally or national notable plants were recorded in 2022, 27 (24.5% of the year total) in the northern slack and 18 (29.5%) in the southern. Two new plants were added to the site species list: Daisy *Bellis perennis* and Reed Canary-grass *Phalaris arundinacea*, both being in the northern basin. This

brings the total of higher plants identified in the Devil's Hole slacks since recording began in 2004 to 179, 38 (21%) of these being notable, of which 14 are Red-listed (Appendix 1). The proportion of non-native taxa remained low at 8.3%. As usual, Grass-of-Parnassus was a feature of the vegetation during the late summer with several thousand plants in flower, noticeably concentrated on the drier fringes of the slacks. There was also a fine display of thousands of the 'Near Threatened' Marsh Helleborine *Epipactis palustris* in June/July. The 'Nationally Scarce' Round-leaved Wintergreen *Pyrola rotundifolia* was, again, mostly associated with patches of Creeping Willow. Worryingly, *Phragmites australis* Common Reed, found for the first time at the eastern end of the northern slack in 2021, began to spread rapidly. This species has a tendency to become invasive over time (Smith, 2020).

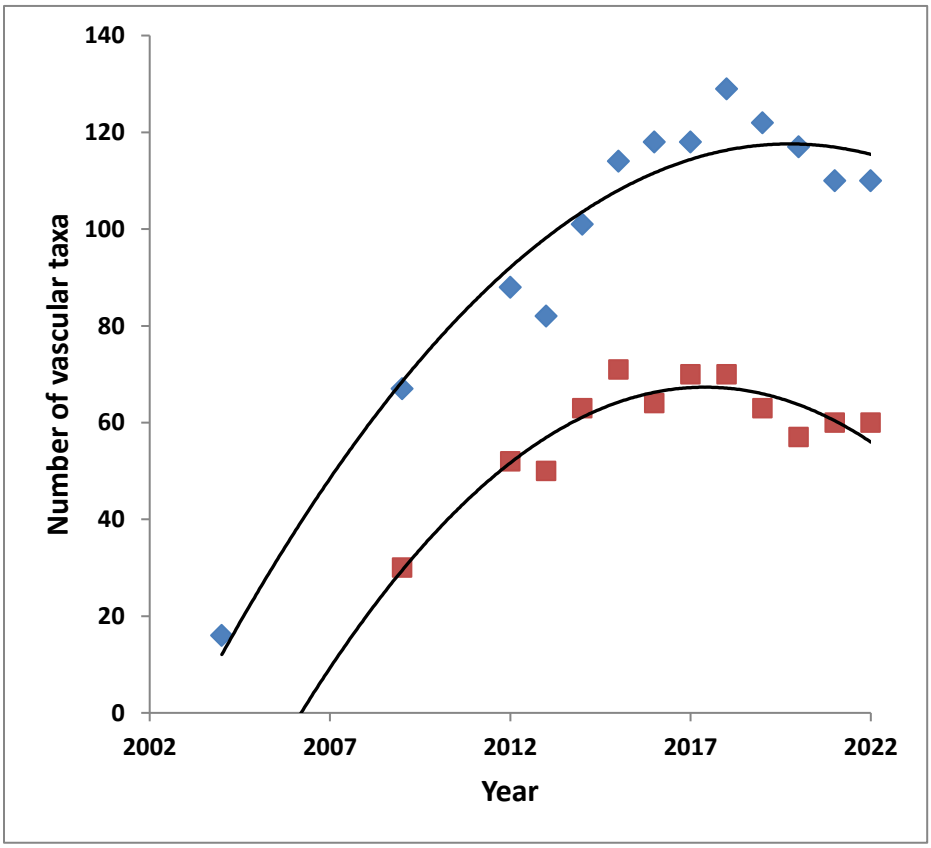

Fig. 7. Number of vascular taxa recorded in northern (blue) and southern (red) basins, 2004-2022

Willows continued their general dominance of the slack vegetation with 12 taxa identified, one more than in 2021. The largest bushes, mainly of Goat *Salix caprea* and Grey Willow *S. cinerea*, are now well over 2 m tall (Fig. 8). An ongoing survey of the nationally rare hybrid

Salix×*friesiana* (Creeping Willow × Osier *S. viminalis*) recorded, measured and labelled 143 bushes, six more than the previous year. Some were attacked by the chrysomelid beetle *Galerucella lineola*, though the damage was less than in 2021. Overall, the number of bushes recorded annually since 2012 (Fig. 9) is levelling off, probably due to competition from other willow taxa and a reduction of bare ground in which to seed. The growth trends for mean area and mean height of bushes since 2012 are shown in Figs. 10 and 11. This hybrid is known from only sixteen 10 km National Grid squares (hectads) in Britain & Ireland (BSBI Maps project) but is relatively frequent on the Sefton Coast with over 400 bushes recorded up to 2014 (Smith, 2015b) and more since. The Devil's Hole also supports four specimens of the even rarer Don's Willow *Salix* ×*doniana*, one new young bush being found this year. Only about 43 bushes are known in Britain, most being on the Sefton dunes (Smith, 2014). Although there was evidence of Rabbit *Oryctolagus cuniculus* grazing, it was insufficient to prevent the growth of dense willow scrub in the older slack areas, this being dominated by Creeping Willow (Fig. 12). Rapid successional changes since 2007 are illustrated by the contrast between Fig. 13 and Fig. 14. As in previous years, any seedlings or young bushes of the invasive Sea Buckthorn *Hippophae rhamnoides* were removed when seen.

Fig. 8. Willow scrub in the northern slack, June 2022

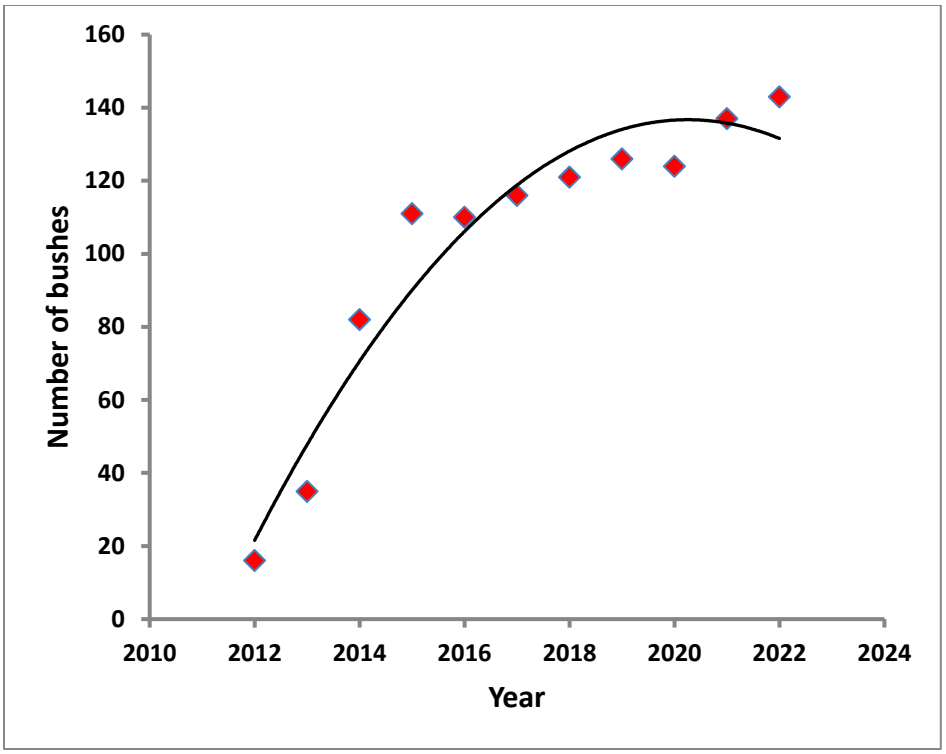

Fig. 9. Annual number of *Salix* ×*friesiana* bushes found in the Devil's Hole, 2012-22

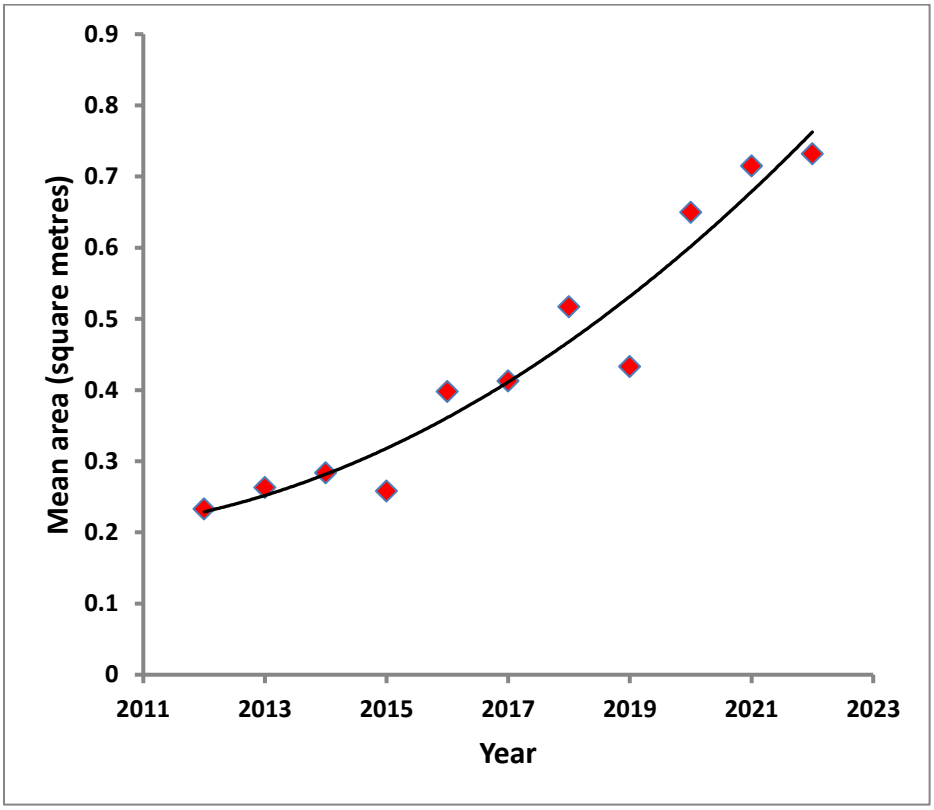

Fig. 10. Mean area (m^2) of *Salix* ×*friesiana* bushes in the Devil's Hole, 2012-22

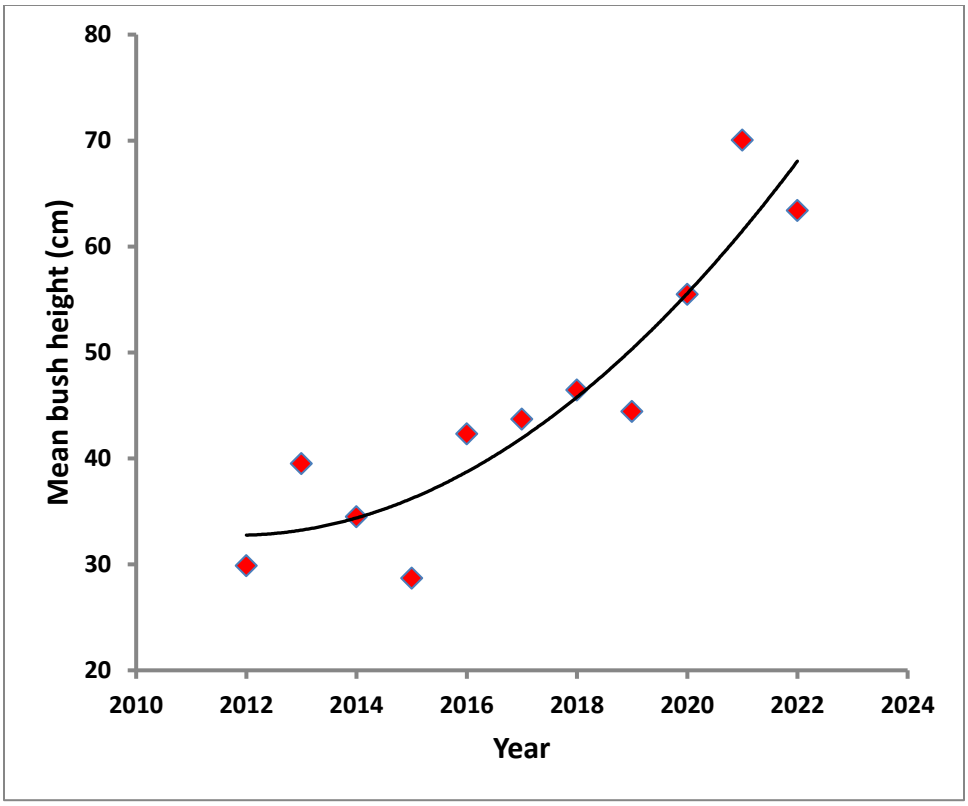

Fig. 11. Mean height (cm) of *Salix* ×*friesiana* bushes in the Devil's Hole, 2012-22

Fig. 12. Devil's Hole in January 2022, showing abundance of Creeping Willow

Fig. 13. Devil's Hole in September 2007 showing an early stage in vegetation development,

Fig. 14. Devil's Hole in May 2022, 15 years on from Fig. 13

Other observations in 2022

As usual, measurements of the water-table continued fortnightly throughout the year. In contrast to 2020/21, the autumn and winter were relatively dry, so that the maximum water-level reached in March 2022 was 46 cm lower than in 2021. Over the seven years of observations, there was an upward trend in water-table height (Fig. 15). The slacks were dry by early June 2022, so that dragonflies were unable to breed, although in May a Four-spotted Chaser *Libellula quadrimaculata* was attracted to the last of the surface water. Conditions for Natterjack Toad *Epidalea calamita* spawning were hostile, with dry, cold nights throughout April inhibiting activity, though some limited spawning took place. About 1000 tadpoles were noted in early May but these succumbed to the drought by the end of the month. During the same period 10,000s of competitive Common Toad *Bufo bufo* and 100s of Common Frog *Rana temporaria* tadpoles were noted but these suffered the same fate. Slender Groundhopper *Tetrix subulata* was recorded twice on the edges of slacks (Fig. 16). An unexpected sighting was the locally distributed Heath Assassin Bug *Coranus subapterus* (Fig. 17). Dune Robberfly *Philonicus albiceps,* Dune Villa *Villa modesta* and Coastal Silver Stiletto *Acrosathe annulata* were occasional on bare sand while Broad Centurion *Chloromyia formosa* and the Four-banded Bee-grabber *Conops quadrifasciatus* were also seen. The nationally rare Northern Dune Tiger Beetle *Cicindela hybrida* was present on south-facing sandy slopes, though less numerous than in recent years., Early Colletes *Colletes cunicularius,* a Red-listed solitary bee, was again abundant in spring on the two older proto-dunes and in the northwest corner of the main blowout. As usual, Six-spot Burnets *Zygaena filipendulae* were numerous in August. Amongst the butterflies were abundant Common Blue *Lycaena phlaeas* and occasional Grayling *Hipparchia semele*, Meadow Brown *Maniola jurtina* and Small Tortoiseshell *Aglais urticae*. Birds included Whitethroat *Sylvia communis*, Willow Warbler *Phylloscopus trochilus* and Reed Bunting *Emberiza schoeniclus*, while a pair of Stonechats *Saxicola torquatus* also took up residence.

Recreational use of the site was often considerable, including children sliding down the slopes of the blowout. Although potentially damaging to wildlife, this probably helped to maintain the dynamism of the feature. As usual, dogs were allowed or encouraged to enter what little surface water was present, despite signs erected by the National Trust in 2021 explaining the presence of breeding Natterjack Toads and requesting cooperation.

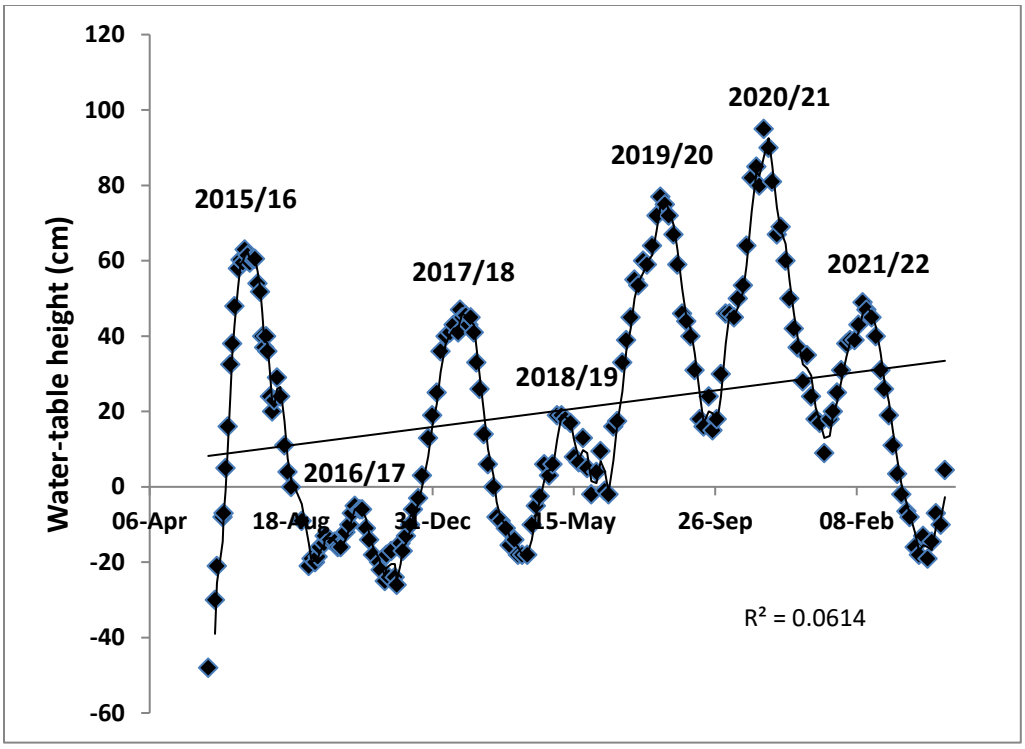

Fig. 15. Fortnightly measurements of the Devil's Hole water-table from October 2015 to December 2022 ($r = 0.248$; $p \leq 0.001$). Zero on the y-axis indicates ground level

Fig. 16. Slender Groundhopper, Devil's Hole, August 2022

Fig. 17. Heath Assassin Bug Devil's Hole, August 2022

References

Delgado-Fernandez, I., Smyth, T.A.G., Jackson, D.W.T., Smith, A.B. & Davidson-Arnott, R.G.D. 2018. Event-scale dynamics of a parabolic dune and its relevance to mesoscale evolution. *Journal of Geophysical Research*: *Earth Surface* 123: 3084-3100.

Gresswell, R.K. 1953. *Sandy shores in south Lancashire*. Liverpool University Press, Liverpool.

Isermann, M. 2011. Patterns in species diversity during succession of coastal dunes. *Journal of Coastal Research* 27: 661-671.

Neal, A. & Roberts, C.L. 2001. Internal structure of a trough blow-out determined from migrated ground-penetrating radar profiles. *Sedimentology* 48: 791-810.

O'Keeffe, N. 2014. *Factors controlling geomorphological change in a coastal blowout*:

a case study of the Devil's Hole, Formby (*1945 to present*). B.Sc. dissertation, Edge Hill University, Ormskirk.

Rodwell, J.S. (ed.) 2000. *British plant communities Volume 5. Maritime communities and vegetation of open habitats*. Cambridge University Press, Cambridge.

Smith, P.H. 2014. History, status and habitat of the rare hybrid willow *Salix ×doniana*. *BSBI News* 125: 6-11.

Smith, P.H. 2015. The occurrence of *Salix ×friesiana* on the Sefton Coast sand-dunes, north Merseyside (v.c.59: South Lancashire). *BSBI News* 129: 41-46.

Smith, P.H. 2017. The natural history of a sand-dune blowout. *British Wildlife* 28: 329-334.

Smith, P.H. 2020. Increasing status of non-native vascular plants in the Sefton Coast sand-dune system, north Merseyside, UK. *British & Irish Botany* 3: 232-262.

Smith, P.H. & Lockwood, P.A. 2012. *Vascular Flora of Devil's Hole, Ravenmeols, 2012 update*. Unpublished report.

Smith, P.H. 2021. *Changing flora of Devil's Hole, Ravenmeols – 2021 update*. Unpublished report.

Appendix 1. Devil's Hole vascular plants recorded annually from 2015 to 2022
Nomenclature follows C.A. Stace's *New Flora* fourth edition (2019) and later amendments.

KEY: * = non-native or introduced native taxon; d = dominant; a = abundant; f = frequent; o = occasional; r = rare; l = locally; v = very. Stat. = conservation status; NR = Nationally Rare; NS = Nationally Scarce; VU = GB Vulnerable; NT = Near Threatened (italics = threat status in England Red List); S41 = listed as a species of principal importance under Section 41 of NERC Act 2006; SCI = Species of Conservation Importance in North West England; JS = record by Joshua Styles.

Northern basin

Taxon	**English name**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**Stat.**
Agrostis capillaris	Common Bent			r			r			
Agrostis stolonifera	Creeping Bent	la	la	la	la	la	la	la	la	
Aira praecox	Early Hair-grass		lo			vla		lo		
Ammophila arenaria	Marram	la	la	la	la	la	la	la	la	
Anacamptis pyramidalis	Pyramidal Orchid	vlo	o	r	o	lo	lo	lo	lo	SCI
Anthoxanthum	Sweet Vernal-							lo		

odoratum	grass									
Arenaria serpyllifolia	Thyme-leaved Sandwort	r	lf	r	lo	lo	lo	lo		
*Asparagus officinalis**	Garden Asparagus	lo	r	r	r	r	r	r	r	
Bellis perennis	Daisy								r	
Betula pendula	Silver Birch	r	r	r	r	o	o		r	
Betula pubescens	Downy Birch	r	r	r	r	r	r			
Blackstonia perfoliata	Yellow-wort	o	o	o	o	o	o	o	o	
Blysmus compressus	Flat-sedge	vlf	vlo	vlo	vlo	r	r	r	r	VU *VU* SCI S41
Bromus hordeaceus	Soft Brome									
Campanula rotundifolia	Hare-bell	r	o	vlf	vlf	vlf	vlf	lf	lf	*NT*
Cardamine hirsuta	Hairy Bitter-cress	o	o	o	o	o	o		vlf	
Cardamine pratensis	Cuckooflower	lo	lo	lf	o	lo	r	r	lo	
Carex arenaria	Sand Sedge	la	la	la	la	la	la	la	la	
Carex flacca	Glaucous Sedge	la	la	la	la	la	la	la	la	
Carex hirta	Hairy Sedge	lf	r	o	r	lo		r	lo	
Carex nigra	Common Sedge								vlf	
Carex viridula	Small-fruited Yellow-sedge	lf	lf	lf	o	lf	lf	lf	lf	SCI
Carlina vulgaris	Carline Thistle		r	lo	lo	lo	lo	lo	lo	SCI
Centaurea nigra	Common Knapweed									
Centaurium intermedium	Intermediate Centaury	o	r	r	r	r	lo	lo	r	EN
Centaurium erythraea	Common Centaury	lf	lo	lf	lf	lf	o	lf	o	
Centaurium littorale	Seaside Centaury	o	r	vlo	r	r	r	lo	lo	NS SCI
Centaurium pulchellum	Lesser Centaury	vlf	r							SCI
Cerastium diffusum	Sea Mouse-ear	lf	lf	lo	lf	vlf	o	lo	lo	
Cerastium semidecandrum	Little Mouse-ear			lo	lo				lo	
Cerastium fontanum	Common Mouse-ear	o	o	o	o	o	o	o	r	
Chamaenerion angustifolium	Rosebay Willowherb	lo	lo	lf	lf	lo	lo	lo	lo	

Cirsium × *celakovskianum*	Hybrid Thistle									
Cirsium arvense	Creeping Thistle	lf	lf	lf	lf	o	o	o	o	
Cirsium vulgare	Spear Thistle	r	r	r						
Crepis capillaris	Smooth Hawk's-beard	o	o	r	o	r	o	o	o	
Cynoglossum officinale	Hound's-tongue	r		r	r					*NT* SCI
Dactylorhiza × *grandis*	Hybrid Marsh-orchid	r	o	r	r	r				
Dactylorhiza fuchsii	Common Spotted-orchid		r	r						
Dactylorhiza incarnata subsp. *coccinea*	Early Marsh-orchid	lf	lf	lf	lf	lf	lf	lo	lo	NT SCI
Dactylorhiza incarnata subsp. *incarnata*	Early Marsh-orchid	r				r			r	SCI
Dactylorhiza praetermissa	Southern Marsh-orchid	o	o	o	o	o	o	o	o	
Dactylorhiza purpurella	Northern Marsh-orchid	r	r		r	r			r	SCI
Daucus carota	Wild Carrot			r	r			r		
Eleocharis palustris	Common Spike-rush	la	la	la	la	la	la	la	la	
Eleocharis quinqueflora	Few-flowered Spike-rush				vlf	vla	la	la	la	SCI
Elymus juncea	Sand Couch				r					
Elymus repens	Common Couch					JS				
*Epilobium ciliatum**	American Willowherb							r	r	
Epilobium hirsutum	Great Willowherb	r	r	r	r	lo	lo	lf	lf	
Epilobium obscurum	Short-fruited Willowherb	r			r					
Epilobium parviflorum	Hoary Willowherb	f		lo	lo	lo	r		r	
Epipactis dunensis	Dune Helleborine				r					NR
Epipactis palustris	Marsh Helleborine	la	la	la	lf	lf	lf	lo	lf	*NT* SCI
Erigeron acris	Blue Fleabane	o	o	o	lo	lo	o	o	r	
*Erigeron canadensis**	Canadian Fleabane	r	r	r	r				o	
*Erigeron sumatrensis**	Guernsey Fleabane				vlo	vlo	vlo	r		

Erodium cicutarium	Stork's-bill		o							
Erodium aethiopicum	Sticky Stork's-bill		r							NS SCI
Erophila verna	Common Whitlow-grass		lo	o	o				r	
Euphrasia confusa	Confused Eyebright	lf	lf	lf	lf	lf	lf	lo	lo	VU *VU*
Euphrasia nemorosa	Common Eyebright	la	lf	lf	lo	lf	o	lf	o	NT
Festuca rubra	Red Fescue	la	la	la	la	la	la	la	la	
Galium palustre	Marsh Bedstraw									
Lysimachia maritima	Sea Milkwort	r								
Helosciadium nodiflorus	Fool's Water-cress	r	r				r		vla	
Hieracium umbellatum	Umbellate Hawkweed	o	o	lo	lo	lo	o	o	o	
*Hippophae rhamnoides**	Sea Buckthorn	r	r	r	r	r	r	r	r	
Holcus lanatus	Yorkshire-fog	lf	lf	lf	lf	lf	lf	lf	lf	
Hydrocotyle vulgaris	Marsh Pennywort	la	la	la	la	la	la	la	la	*NT*
Hypericum perforatum	Perforate St John's-wort									
Hypericum tetrapterum	Square-stalked St John's-wort	lf	r	r	lo	lo	lo	r		
Hypochaeris radicata	Cat's-ear	o	o	o	lf	lf	lf	lf	lf	
Isolepis setacea	Bristle Club-rush									
Jacobaea vulgaris	Common Ragwort	o	o	o	o	o	o	o	o	
Juncus articulatus	Jointed Rush	lf	lf	lf	lf	lf	lf	la	la	
Juncus bufonius	Toad Rush		o		la		lf	lf	lo	
Juncus inflexus	Hard Rush	r	r	r	r	r	r	vlf	vlf	
Juncus subnodulosus	Blunt-flowered Rush	vla	vla	vla	vla	vla	vla	la	la	SCI
Lathyrus pratensis	Meadow Vetchling		vlo		vlo		lo	lo		
Leontodon saxatilis	Lesser Hawkbit	o	o	o	o	o	o	o	o	
Linum catharticum	Fairy Flax	vlf	vlf	r	r	vlf	vlf	vlf	lf	
Lolium perenne	Perennial Rye-grass	o			r					
Lotus corniculatus	Common Bird's-foot-trefoil	la	la	la	la	la	lf	lf	lf	
Luzula campestris	Field Wood-rush		lo	o	o	lf	o	o	lo	

Lysimachia tenella	Bog Pimpernel	la	la	la	a	lf	vlo	lo	vlf	SCI
Lythrum salicaria	Purple Loosestrife						r			
Mentha aquatica	Water Mint	lf	lf	lf	o	o	o	o	o	
Myosotis laxa	Tufted Forget-me-not	lf	o	o	o	lo	lo	lo	o	
Myosotis ramosissima	Early Forget-me-not	lo	lf	lo	lo		o	o		SCI
Nasturtium officinale	Water-cress	lo				r			r	
*Oenothera × fallax**	Intermediate Evening-primrose	o	o	lo	lo	o	o	o	o	
*Oenothera glazioviana**	Large-flowered Evening-primrose		r		lo	lo	lo	lo	lo	
Ononis repens	Common Restharrow	o	lf	la	la	la	la	la	la	
Ophrys apifera	Bee Orchid	r	o		lo	lo	lo	vlo	lo	
Parentucellia viscosa	Yellow Bartsia	vlo		r						SCI
Parnassia palustris	Grass-of-Parnassus	la	lf	lf	lf	lf	o	lf	lf	*VU* SCI
Pastinaca sativa	Wild Parsnip	o	o	o	o	r	o	o	o	
Phalaris arundinacea	Reed Canary-grass								r	
Phleum arenarium	Sand Cat's-tail	lo	lf	lo	lo	lo	lf	lf	la	*NT* SCI
Phleum pratense	Timothy									
Phragmites australis	Common Reed							lf	lf	
Pilosella officinarum	Mouse-ear-hawkweed	vlo	lf	lf	lf	lf	lf	lf	lo	
Pinus sp.*	Pine		r		r	JS				
Plantago coronopus	Buck's-horn Plantain									
Plantago lanceolata	Ribwort Plantain									
Plantago major	Greater Plantain			o	r		r	r	r	
Poa annua	Annual Meadow-grass	o	o	o	o					
Poa humilis	Spreading Meadow-grass				lo					
Poa pratensis	Smooth Meadow-grass		lo	r	lo	vlo	lo	lo		
Poa trivialis	Rough Meadow-	lo	r	r	r	r				

	grass									
Polygala vulgaris	Common Milkwort	o	lo	lo	lo	lo	lf	o	o	
Polypodium vulgare	Common Polypody			r	r	r	r	r	vlo	
*Populus × canescens**	Grey Poplar		r	r	r	r				
*Populus × jackii**	Balm-of-Gilead						r			
Populus tremula	Aspen		r	r	r	r				
Potentilla anserina	Silverweed	vlf		vlf	vlf	vlf	o		r	
Potentilla reptans	Creeping Cinquefoil	vlf				vlf	r			
Prunella vulgaris	Selfheal	o	lf	o	o	o	o	r		
Pulicaria dysenterica	Common Fleabane	lf	lf	lf	o	lo	lo	lo	lo	
Pyrola rotundifolia subsp. *maritima*	Round-leaved Wintergreen	lf	lf	lf	la	la	la	la	la	NS SCI
Ranunculus acris	Meadow Buttercup				r					
Ranunculus aquatilis	Common Water-crowfoot							r		
Ranunculus bulbosus	Bulbous Buttercup		vlf		vlf	lf	vlf	lo	vlf	
Ranunculus flammula	Lesser Spearwort	f	f	f	o	o	o	o	o	
Ranunculus repens	Creeping Buttercup	o	o	o	o	o	o	vla		
Rhinanthus minor	Yellow-rattle	vlo	lf	lf	la	la	lf	lf	lf	
Rubus caesius	Dewberry	o	o	o	o	o	o	o	o	
Rumex crispus	Curled Dock	r		vlo	r	lo	lo	lo	lo	
Rumex obtusifolius	Broad-leaved Dock		r		r	r	r		r	
Sagina apetala	Annual Pearlwort									
Sagina maritima	Sea Pearlwort		r	vlo		vlo	r	r		
Sagina nodosa	Knotted Pearlwort	lf	lf	lo	lf	lf	o	o	o	
Sagina procumbens	Procumbent Pearlwort									
Salix × doniana	Hybrid Willow	r	r	r	r	r	r	r	r	NR
Salix× forbyana	Fine Osier	o	o	o	o	o	r	o	o	
Salix × friesiana	Hybrid Willow	o	o	o	o	o	o	o	o	NR
*Salix × fragilis**	Hybrid Crack-willow	o	o	o	o	o	o	o	o	
Salix × reichardtii	Hybrid Willow					r	r	r	r	

Salix × smithiana	Broad-leaved Osier	r	r?	r?	r?	r?	r			
Salix alba	White Willow	r	r	r	r	r	r	r	r	
Salix caprea	Goat Willow	o	o	o	o	o	o	o	o	
Salix cinerea subsp. *cinerea*	Grey Willow						r		r	
Salix cinerea subsp. *oleifolia*	Grey Willow	f	f	f	f	f	f	f	f	
Salix pentandra	Bay Willow		r	r	r	r	r			
Salix purpurea	Purple Willow		r	r	r	r	r	r	r	
Salix repens	Creeping Willow	a	a	a	a	a	a	a	a	*NT*
Salix viminalis	Osier	r	r	r	r	r	o	r	r	
Samolus valerandi	Brookweed	lf	lf	lf	lo	lo	r	o	o	SCI
Saxifraga tridactylites	Rue-leaved Saxifrage	vlf	lf	vlf	lf	vlo	lf	la	la	
Schedonorus arundinaceus	Tall Fescue									
Schoenoplectus tabernaemontani	Grey Club-rush	vlo	r		r		r	vlf	vlf	SCI
Scorzoneroides autumnalis	Autumn Hawkbit	r		r		lo				
Sedum acre	Biting Stonecrop	lo	lf	lf	lf	lf	lf	lf	lf	
*Senecio squalidus**	Oxford Ragwort				r	JS				
Senecio vulgaris subsp. *denticulatus*	Groundsel	r	r	o	o					NS
Senecio vulgaris subsp. *vulgaris*	Groundsel	r		r		r		r		
Solanum dulcamara	Bittersweet									
Sonchus asper	Prickly Sowthistle	r		o	r	r	r	r	r	
Sonchus oleraceus	Smooth Sowthistle		r		r	r	r	r	r	
Symphyotrichum sp.*	Michaelmas-daisy					r				
Taraxacum officinale	Dandelion	o	o	o	o	o	o	o	o	
Tragopogon pratensis	Goat's-beard	r					r	lo		
Trifolium dubium	Lesser Trefoil	r		r		vlf				
Trifolium pratense	Red Clover	lo	r	o	la	la	lo	r	vla	
Trifolium repens	White Clover	vlf			vla	vlf	lf	la	la	
*Triticum aestivum**	Bread Wheat	r		r						
Tussilago farfara	Colt's-foot	r		vlo	vlo	vlo	r	r	r	
Typha latifolia	Bulrush	r	r		r	lo	lo	lo	lo	
Valerianella locusta	Common Corn-	r	r	lo	r		r			

	salad									
Veronica scutellata	Marsh Speedwell		lo	r	lo	lo	r	lo	r	*NT*
Vicia lathyroides	Spring Vetch	r	lo	lo	r	r				SCI
Vicia sativa	Common Vetch	o	o	o	o	o	o	o		
Vicia sepium	Bush Vetch									
Viola canina	Heath Dog-violet	lf	lf	lf	lf	lo	lo	lo	lo	SCI NT *VU*
Vulpia fasciculata	Dune Fescue	lf	lf	lf	lf	lf	lf	la	la	NS
176 (2022) (14 alien)	Total	115	118	118	129	122	117	110	110	36

Southern basin (# = not in northern basin)

Taxon	**English name**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**Stat.**
Agrostis stolonifera	Creeping Bent	r	o	o	o	o	o	la	la	f	
Ammophila arenaria	Marram	o	o	o	o	o	o	o	o	lo	
Anacamptis pyramidalis	Pyramidal Orchid			r		r			lo	lo	SCI
Arenaria serpyllifolia	Thyme-leaved Sandwort		r	lo	lf		r				
*Asparagus officinalis**	Garden Asparagus			r			r		r	r	
Bellis perennis	Daisy				r						
Bromus hordeaceus	Soft Brome		r				r				
Carex arenaria	Sand Sedge	la	la	la	la	la	la	la	la	la	
Carex flacca	Glaucous Sedge	lf	lf	la	la	lf	lf	lf	la	o	
Carex nigra	Common Sedge							vlo		la	
Carex viridula	Small-fruited Yellow-sedge	f	f	o	o	o	lf	o	o	lf	SCI
Campanula rotundifolia	Hare-bell								vlo		*NT*
Centaurea nigra	Common Knapweed			o							
Centaurium intermedium	Intermediate Centaury	r			r	r		r	r	r	
Centaurium erythraea	Common Centaury	r	f	r	o	o	o	o	o	o	
Centaurium littorale	Seaside Centaury	o	o		o	o	o		o	o	NS SCI
Cerastium diffusum	Sea Mouse-ear		lf	lf	o	lf	r				
Cerastium fontanum	Common Mouse-ear	r	r	o	r	o	r	lo			
Cerastium	Little Mouse-ear					o					

semidecandrum											
Chamaenerion angustifolium	Rosebay Willowherb		r	r							
Cirsium arvense	Creeping Thistle	r	lo	lf	lf	o	lf	o	o		
*Erigeron canadensis**	Canadian Fleabane	o	o		r						
Crepis capillaris	Smooth Hawk's-beard	o	o	o	lf		r		lo	lo	
Dactylorhiza incarnata subsp. *coccinea*	Early Marsh-orchid		r	r	o	r	o	r	o	o	NS *NT* SCI
Dactylorhiza praetermissa	Southern Marsh-orchid				r	o	o		r	lo	
Daucus carota	Wild Carrot	r	o		o	r		r	r	lo	
Eleocharis palustris	Common Spike-rush	la	la	la	la	la	la	la	la	la	
Eleocharis quinqueflora	Few-flowered Spike-rush	la	la	la	la	la	la	la	la	la	SCI
Eleocharis uniglumis#	Slender Spike-rush						la	lf		la	SCI
Epilobium hirsutum	Great Willowherb			o	o	lo	o				
Epilobium obscurum	Short-fruited Willowherb		r								
Epilobium parviflorum	Hoary Willowherb	r	r	r	r		lo			r	
Epipactis dunensis	Dune Helleborine						r				NR SCI
Epipactis palustris	Marsh Helleborine	o	lf	o	o	lf	lf	lf	lf	lf	*NT* SCI
Erigeron acris	Blue Fleabane	r	o		r			o	lo		
Erophila verna	Common Whitlow-grass					lo					
Euphrasia confusa	Confused Eyebright				o	lf	o		r		*VU*
Euphrasia nemorosa	Common Eye-bright	o	vlf	lf	lf	o		lf	lf	lf	
Festuca rubra	Red Fescue	lf	lf	lf	lf	lf	lf	lf	lf	lf	
Hieracium umbellatum	Umbellate Hawkweed	r	vlo	r	r	r	r	r	o	r	
*Hippophae rhamnoides**	Sea Buckthorn	r	r	r	o	r	r	r	r		
Holcus lanatus	Yorkshire-fog	r	o	lf	lf	lf	lf	lf	lf	lf	
Hydrocotyle vulgaris	Marsh Pennywort	lf	lf	lf	lf	lf	lf	lf	lf	la	*NT*

Hypericum tetrapterum	Square-stalked St John's-wort			r						r	
Hypochaeris radicata	Cat's-ear	o	o	o	o	o	o	o	o	o	
Jacobaea vulgaris	Common Ragwort	r	o	o	r	o	r		lo	r	
Juncus articulatus	Jointed Rush	a	f	f	f	f	f	f	f	lf	
Juncus bufonius	Toad Rush	o		o	r	lo		vlf	o	lf	
Lathyrus pratensis	Meadow Vetchling		r	lo	lo	lo	lo	o	lo	lo	
Leontodon saxatilis	Lesser Hawkbit	r	o		o	r	o	o	o	o	
Linum catharticum	Fairy Flax	r	vlf		vlo		lf			vlf	
Lotus corniculatus	Common Bird's-foot-trefoil	o	o	lf	lf	lf	lf	lf	lf	la	
Mentha aquatica	Water Mint	o	vlo	lf	lf	o	o	o	lf	o	
Myosotis laxa	Tufted Forget-me-not	o	o	lf	lf	lf	lo	o	o	o	
Myosotis ramosissima	Early Forget-me-not		r	r	r	r					SCI
*Oenothera × fallax**	Intermediate Evening-primrose	o	o	o	r	o		r	r	r	
*Oenothera glazioviana**	Large-flowered Evening-primrose			r	r	r					
Ononis repens	Common Restharrow	o	o	lf	lf	lf	lf	lf	lf	lf	
Ophrys apifera	Bee Orchid		r	o		o	o	o	o		
Parnassia palustris	Grass-of-Parnassus	o	o		lf	o	lf	lf	lf	la	*VU* SCI
Pastinaca sativa	Wild Parsnip	r	r	r	r	o		o	o	r	
Phleum arenarium	Sand Cat's-tail	r	o	vlf		vlf	r		r		*NT* SCI
Plantago coronopus	Buck's-horn Plantain	r	r	r	vlf	o					
Plantago lanceolata	Ribwort Plantain	r			r						
Plantago major	Greater Plantain	vlf	vlf	vlf	o	o	o	o	o	o	
Poa annua	Annual Meadow-grass	o	r	vlf	o		r		r		
Poa humilis	Spreading Meadow-grass	r	r			lo		r		vlf	
Polygala vulgaris	Common Milkwort			r		lo	lo	lo	r	o	
Prunella vulgaris	Selfheal	o									
Pulicaria	Common	r									

dysenterica	Fleabane										
Pyrola rotundifolia subsp. *maritima*	Round-leaved Wintergreen		o	lo	lo	lf	lf	lf	lf		NS SCI
Ranunculus bulbosus	Bulbous Buttercup			r							
Ranunculus flammula	Lesser Spearwort	o	o	o	o	o	o	o	o	lf	
Ranunculus repens	Creeping Buttercup	vlf	o		o	o					
Rubus caesius	Dewberry	o	r	r	r	o	r	r	lo	o	
Rumex crispus	Curled Dock	o	o	o	o	o	o	o	o	o	
Rumex sp.	Dock					r					
Sagina nodosa	Knotted Pearlwort	o	f		lf	lo	lo	lo	lo	lo	
Salix × *doniana*	Hybrid Willow	r	r	r	r	r	r	r	r	r	NR
Salix × *friesiana*	Hybrid Willow	r	r	o	o	o	o	o	o	o	NR
Salix × *fragilis**	Hybrid Crack-willow	r	r	r	r	r	r	r	r	r	
Salix ×*subsericea#*	Hybrid Willow							r			NS
Salix alba	White Willow										
Salix caprea	Goat Willow	o	o	o	o	o	o	o	o	o	
Salix cinerea	Grey Willow	o	o	o	o	o	o	o	o	o	
Salix repens	Creeping Willow	f	f	f	o	la	ld	ld	ld	ld	*NT*
Salix viminalis	Osier	r					r	r			
Samolus valerandi	Brookweed	lf	lo	o	o	lo	o	o	o	lf	SCI
Scorzoneroides autumnalis	Autumn Hawkbit	r				r					
Senecio vulgaris subsp. *denticulatus*	Groundsel		o	r	lf			r			NS
Senecio vulgaris subsp. *vulgaris*	Groundsel		r								
Sisyrinchium sp.*#	Blue-eyed-grass										
Sonchus arvensis	Perennial Sowthistle						r	r			
Sonchus asper	Prickly Sowthistle	r	o		r				r	r	
Sonchus oleraceus	Smooth Sowthistle		r			r				o	
Taraxacum officinale	Dandelion	o	o	o	o	o	r	r	r	r	
Tussilago farfara	Colt's-foot	r	r								
Veronica chamaedrys#	Germander Speedwell			vlo	vlf	vlf	vlf	vlo		lo	
Vicia lathyroides	Spring Vetch			r		r				vlf	SCI
Vicia sativa subsp. *nigra*	Common Vetch	r	o		o	o	r	r			

Viola canina	Heath Dog-violet									o	SCI NT *VU*
Vulpia fasciculata	Dune Fescue		o	o		o	r	lo	lo		NS SCI
103 (2022) (7 alien)	Total	63	71	64	70	70	63	57	60	60	25 not.

Aerial view of the Devil's Hole in about 2000