ISSN 2755-3531

Vol. 45, no. 3 **Journal of Conchology** 25 June 2025

Published by the Conchological Society of Great Britain and Ireland, established 1874

Snails in the strip lynchets at Worth Matravers, Dorset: a fauna in calcareous grassland

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Abstract. The snail fauna of the strip lynchets on grazed calcareous grassland at Worth Matravers was studied by quantitative extraction of shells from the flatter treads and steeper risers of the lynchets, distinguishing between fresh and long dead specimens. Treads held a poor fauna dominated by just three "xerophile" species. The fresh and long dead samples differed little. On the risers, the fauna was richer and held more shells overall, while the long-dead assemblages differed slightly from the fresh ones. Comparison with other studies of present and prehistoric assemblages on calcareous grassland shows that we are far from a complete understanding of differences in faunas from what appear to be similar habitats.

ZooBank identifier. urn:lsid:zoobank.org:pub:C643489D-7D37-498F-884D-1A8F1459876C

DOI. https://doi.org/10.61733/jconch/4551

Introduction

Strip lynchets are a form of terracing caused by the cultivation of sloping ground, giving rise to flat or nearly flat strips (treads) supported by steep slopes between them (risers) (Wood 1961). Most are believed to be of Mediaeval origin (some are much older), and there is some debate about whether they were deliberately constructed, or a consequence of ploughing along contours. Over time, those sited on gentle slopes or on fertile soil were destroyed by modern ploughing, but many have been preserved when the land has been given over to pasture. They are especially common on calcareous soils formed from chalk or the softer limestones.

As with chalk and limestone grassland generally, changes in agricultural practice have resulted in the growth of coarse grasses and scrub (Smith 1980; Gibson & Brown 1991), reducing the biodiversity of the sites, and threatening a number of species adapted to that habitat. While some grassland was present earlier (Allen & Gardiner 2009), the habitat is mostly anthropogenic in origin, albeit from the Neolithic onwards (Evans 1968, 1972). Many of the larger snail species associated with the habitat are introduced, but some of them, as noted in the Conchological Society website, are very rare and restricted in distribution (https://conchsoc.org/index.php/habitats/calcareous-grassland-habitat.php, accessed 15 May 2025).

Even before Boycott's (1934) classic review, it was known that such grassland held a very distinctive snail fauna, identified by Boycott as "xerophilic", but with some more tolerant species in addition. In addition to Boycott (1934), Kerney (1968), and Evans (1968), later work has sought to explore variation in faunal composition and the effects of declining sheep and rabbit grazing on faunal succession (Chappell *et al*. 1971; Cameron & Morgan-Huws 1975; Ruesink 1995). In part, these studies have aimed at making the interpretation of fossil faunas from the Neolithic onwards more precise.

When the National Trust acquired the strip lynchets at Worth Matravers, Dorset (National Grid SY9777), they commissioned a number of surveys, conscious that parts of the system were being colonised by coarse grasses, especially tor grass *Brachypodium pinnatum* (L.) P.Beauv. I therefore carried out a small survey of the snail fauna of an area least affected by this change in the lynchet system, submitting an unpublished report (Cameron 2001). Aware that this habitat is still threatened, and of the fact that the treads and risers mimic, on a larger and more easily sampled scale, the terracettes formed by long-term sheep grazing on steeper slopes, my survey, aimed to examine the differences between the two microhabitats, can be used to examine some of the variation among sites detailed in the references given above.

Study Area and Site Selection

Many of the hillsides around Worth Matravers have strip lynchets (McOmish 2002). The area chosen for study, within National Trust property, lies on the west-facing side of Winspit Bottom, south of the village (Fig. 1). The underlying rock is Oolitic Limestone. The treads between each riser varied in width from 15 to 30 m; the risers were much narrower (c. 5 m). Eight samples, four each for risers and treads, were made in a line in the mid part of the area; four more samples were made on risers at the northern and southern ends of the area (Fig. 1), and two further, non-quantitative samples were made along old walls nearer the valley bottom. The sites within the lynchets were chosen to avoid areas dominated by tor grass *Brachypodium pinnatum.* These were searched briefly by eye.

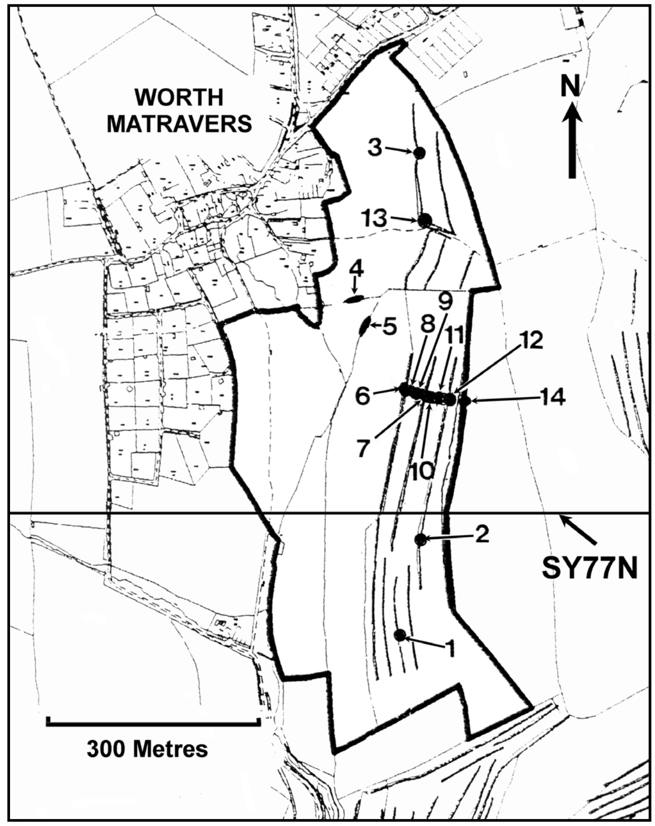

Figure 1. A map of the study area, showing the position of sample sites. The whole area of the map, based on one provided by the National Trust, lies within OS 1 km grid squares SY 97 76 and SY 97 77.

Sampling and Processing

Each site on the risers and treads was marked out as a rectangle 5 × 10 m, the long side running parallel to the risers. Following Cameron & Morgan-Huws (1975), two turves, each 15 × 15 cm were cut to a depth of 5 cm within each site and bagged for processing. The site was also searched by eye for 30 minutes, and slugs and snails found collected. The two sites from walls were searched in the same way. No measurements of sward height were made, but it was much shorter on the treads than on the risers, and the soil was more compacted.

In the laboratory, turves were broken down gently in water, and washed through a graded series of soil sieves. Material passing through a 0.5 mm mesh was discarded. The remainder was dried and sorted, using a binocular microscope for the finest fractions. Results from the two turves at each site were pooled, the aim being to smooth out very local differences in composition. Following Cameron & Morgan-Huws (1975) and Ruesink (1995), shells were classified as fresh (with body visible inside, or a complete periostracum) or long dead (periostracum missing or eroded). Nomenclature follows Anderson & Rowson (2020), except where noted.

Results

Fresh shells in the quantitative samples

No species, apart from slugs, were found in the visual search that were missing from the quantitative samples at any site. Table 1 shows the numbers of each species found in the turves at each site. While the variation among sites in the same category is sometimes great, there are clear differences in the faunas of treads and risers. Treads hold fewer species and have a lower overall density than risers; there is no overlap in either (Mann–Whitney test, $p < 0.05$). The tread fauna is dominated by just three species, *Vallonia* cf. *excentrica, Cochlicella acuta* and *Cernuella virgata*, which held 93 of the 99 shells recovered. They account for only 43% in the risers, which held six species present at all sites, with *Vertigo pygmaea* and *Pupilla muscorum* much more abundant than on the treads. Given that the three least common species, *Vallonia costata*, *Vitrea contracta*, and *Cecilioides acicula* were each recorded from only one site, out of eight in the risers, their absence from the treads is not meaningful.

Old shells in the quantitative samples

The composition of samples of old shells is generally similar to that of fresh shells (Table 2), but while the contribution of the three abundant species listed above was similar (95%) on the treads, it was greatly increased on the risers (73%), mainly due to the large numbers of old *C. virgata* shells. Cor-

Table 1. The numbers of fresh shells found in each of the quantitative samples from treads and risers, the percentage of the fauna represented by each, and the notional density (m^{-2}). The presence of slugs is also noted. *Vallonia* cf. *excentrica* is a synonym of *V. pulchella* (Nekola *et al.* in review). The name is retained for ease of comparison with earlier work.

Species	**Treads**							**Risers**										
	8	**9**	**10**	**11**	**Total**	**%**	**m^{-2}**	**3**	**13**	**6**	**7**	**12**	**14**	**2**	**1**	**Total**	**%**	**m^{-2}**
Vertigo pygmaea (Draparnaud, 1801)	1	0	0	0	**1**	1.0	5.6	30	14	15	28	22	5	21	22	**157**	36.4	436.1
Pupilla muscorum (Linnaeus, 1758)	4	1	0	0	**5**	5.1	27.8	16	15	8	8	5	2	3	1	**58**	13.5	161.1
Vallonia costata (O.F. Müller, 1774)	0	0	0	0	**0**	0.0	0.0	3	0	0	0	0	0	0	0	**3**	0.7	8.3
Vallonia cf. *excentrica* Sterki, 1893	17	15	7	9	**48**	48.5	266.7	16	13	3	7	8	11	7	4	**69**	16.0	191.7
Vitrea contracta (Westerlund, 1871)	0	0	0	0	**0**	0.0	0.0	0	1	0	0	0	0	0	0	**1**	0.2	2.8
Cecilioides acicula (O.F. Müller, 1774)	0	0	0	0	**0**	0.0	0.0	0	2	0	0	0	0	0	0	**2**	0.5	5.6
Cochlicella acuta (O.F. Müller, 1774)	7	10	6	8	**31**	31.3	172.2	4	12	14	4	5	14	12	9	**74**	17.2	205.6
Cernuella virgata (O.F. Müller, 1774)	5	6	1	2	**14**	14.1	77.8	5	4	6	6	4	8	6	4	**43**	10.0	119.4
Trochulus hispidus (Linnaeus, 1758)	0	0	0	0	**0**	0.0	0.0	2	2	5	2	2	1	4	6	**24**	5.6	66.7
Total	**34**	**32**	**14**	**19**	**99**		550.0	**76**	**63**	**51**	**55**	**46**	**41**	**53**	**46**	**431**		1197.2
Species	**5**	**4**	**3**	**3**	**5**			**7**	**8**	**6**	**6**	**6**	**6**	**6**	**6**	**9**		
Arion ater (agg.)								*										
Arion intermedius Normand, 1852	*	*		*						*	*	*		*	*			
Deroceras reticulatum (O.F. Müller, 1774)											*		*					

Table 2. The numbers of old shells found in each of the quantitative samples from treads and risers, and the percentage of the fauna represented by each.

Species	**Treads**						**Risers**									
	8	**9**	**10**	**11**	**Total**	**%**	**3**	**13**	**6**	**7**	**12**	**14**	**2**	**1**	**Total**	**%**
Vertigo pygmaea	3	1	0	0	**4**	0.8	42	8	16	23	21	3	10	8	**131**	10.9
Pupilla muscorum	10	4	2	0	**16**	3.4	60	21	10	5	9	9	8	2	**124**	10.3
Vallonia costata	0	0	0	0	**0**	0.0	2	0	0	0	0	0	0	0	**2**	0.2
Vallonia cf. *excentrica*	53	62	33	51	**199**	41.7	98	47	18	43	32	29	28	4	**299**	24.8
Vitrea contracta	0	0	0	0	**0**	0.0	0	0	0	0	0	0	0	0	**0**	0.0
Cecilioides acicula	0	0	0	0	**0**	0.0	0	1	0	0	0	0	0	0	**1**	0.1
Cochlicella acuta	53	42	57	28	**180**	37.7	46	10	14	18	9	23	12	124	**256**	21.3
Cernuella virgata	37	23	8	8	**76**	15.9	26	21	20	65	23	54	50	64	**323**	26.8
Helicella itala (Linnaeus, 1758)	0	0	0	0	**0**	0.0	1	0	2	0	0	0	0	0	**3**	0.2
Xeroplexa intersecta (Linnaeus, 1758)	0	0	0	0	**0**	0.0	0	1	2	0	0	0	0	0	**3**	0.2
Trochulus hispidus	0	1	1	0	**2**	0.4	20	4	16	1	6	3	6	6	**62**	5.1
Total	**156**	**133**	**101**	**87**	**477**		**295**	**113**	**98**	**155**	**100**	**121**	**114**	**208**	**1204**	
Species	**5**	**6**	**5**	**3**	**6**		**8**	**8**	**8**	**6**	**6**	**6**	**6**	**6**	**10**	

Table 3. Correlations between the numbers of fresh and old shells for the six commonest species in the treads and risers, and for each species separately in the risers. Values for *V. pygmaea* and *P. muscorum* fall just short of P = 0.05. ns, not significant. There are four degrees of freedom in each case.

Test	r	P
Treads	0.975	=0.001
Risers	−0.028	ns
Vertigo pygmaea	0.779	<0.1
Pupilla muscorum	0.780	<0.1
Vallonia cf. *excentrica*	0.854	<0.05
Cochlicella acuta	−0.141	ns
Cernuella virgata	0.348	ns
Trochulus hispidus	0.230	ns

respondingly, while numbers of fresh and old shells among the six species universal on the risers were strongly correlated on the treads in each sample, those in the risers were not (Table 3). On the risers, *V. pygmaea* was much less represented in old shells. One species, *V. contracta*, was missing among the old shells, and two, *Helicella itala* and *Xeroplecta intersecta,* were absent from the fresh assemblages; all these species were represented by very few shells. Inspection of individual species, site by site, in the risers shows that there are positive correlations in the three tiny species, *V. pygmaea*, *P. muscorum*, and *V.* cf. *excentrica,* but not in the three larger species (Table 3).

Slugs and the qualitative samples away from the lynchets

Slugs were not found in all sites, and given the dry weather, the records will not be complete. As with snails, however, more species were found in the risers. Sites 4 and 5, alongside walls in an area previously ploughed, and with more cover, also had *C. virgata*, *C. acuta*, and *Trochulus hispidus* but none of the smaller xerophiles. They also held other species not present on the lynchets: *Lauria cylindracea* (Da Costa, 1778), *Aegopinella nitidula* (Draparnaud, 1805), *Gonyodiscus rotundatus* (O.F. Müller, 1774)[1], *Trochulus striolatus* (C. Pfeiffer, 1828), and *Cornu aspersum* (O.F. Müller, 1774). A brief examination of areas dominated by tor grass suggested that they held very few of the larger species.

[1] In the U.K. and Ireland checklist as *Discus rotundatus* (Anderson & Rowson 2020) but now placed in *Gonyodiscus* following Salvador *et al.* (2023).

Discussion

This study was small in scale; samples were not randomly distributed within the site, and were selected to represent those areas showing least succession to taller grasses and shrubs. The distinction between fresh and old shells is necessarily blurred (see below). Being close to the sea, these strip lynchets held large numbers of *C. acuta*, which, while not absolutely confined to the coast, is an unusual species on inland calcareous grassland (Kerney 1999). Nevertheless, it demonstrates a sharp distinction between the flatter, more trampled treads and the steeper slopes of the risers: certainly grazed, but with looser soil and taller vegetation. The minor differences between fresh and long-dead shells suggests relative habitat stability over a considerable period, perhaps centuries (Gibson & Brown 1991); the increase in the proportion of some of Boycott's "xerophiles" among old shells on the risers might be attributed to differential destruction over time.

While comparisons could range wider (Evans 1968, 1972), I have chosen three other studies of modern faunas on calcareous grassland (Table 4), including one in which trampling and compaction rather than grazing kept vegetation short (Chappell *et al.* 1971). In the others (Cameron & Morgan-Huws 1975; Ruesink 1995), only those sites with short vegetation maintained by grazing are listed; those subject to cutting or burning, or that have advanced through succession to longer vegetation have been excluded. It is evident from the great variation in notional density that not all studies have used the same criteria in determining the status of shells; since, in general, there are only modest differences in composition between the two states, I have used the proportional composition (%) in fresh shells in the same way for each.

There are few regularities. Four of the nine species regarded as typical for such grassland are confined to a single study, although some are present in very low numbers among old shells in others. *Helicella itala* is known to have declined over the last 100 years, while *C. acuta* is generally, but not completely, confined to places near the coast (Kerney 1999). *Abida secale* is unusual in the absence of exposed rocks, though bare patches on steep slopes may suffice; it has become less common over the last century (Kerney 1999). Among the others, there are considerable differences in relative proportions among sites and studies, most noticeable in the two *Vallonia* species, and as between *V. pygmaea* and *P. muscorum.* There are similar great contrasts in the representation of the two species frequently found alongside the xerophiles, *T. hispidus* and *Cochlicopa* sp.

Table 4. The proportions of fresh shells by species, all others representing the aggregate total of generalist and woodland species, together with numbers of shells involved and site characteristics. WMT, Worth Matravers treads; WMR, Worth Matravers risers CH I, CH II, CH III, the three zones, from less to more trampled in Chappell *et al.* (1971); C&M 9 and 10, the two sites in Cameron and Morgan-Huws (1975) retaining short, grazed grassland; RW, Wylye Down; RAR-S, Aston Rowant south; RAR-N, Aston Rowant north, all from Ruesink (1995). *Aspect was not given by Chappell *et al.* (1971).

	WMT	**WMR**	**CH I**	**CH II**	**CH III**	**C&M 9**	**C&M 10**	**RW**	**RAR-S**	**RAR-N**
Vertigo pygmaea	1.0	36.4	6.7	17.6	13.8	7.9	12.9	29.4	11.8	9.0
Pupilla muscorum	5.1	13.5	0.5	2.5	8.9	2.6	0.3	0.0	20.1	2.0
Vallonia costata	0.0	0.7	13.3	19.5	11.1	25.9	33.8	0.0	14.7	0.0
Vallonia **cf.** *excentrica*	48.5	16.0	55.8	36.8	39.4	21.6	7.9	41.5	12.0	0.0
Cernuella virgata	14.1	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicella itala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.0
Xeroplexa intersecta	0.0	0.0	0.3	3.5	8.9	12.3	15.8	1.8	11.0	9.0
Cochlicella acuta	31.3	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Abida secale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.6	0.0
Total "xerophile"	**100.0**	**93.8**	**76.6**	**79.9**	**82.1**	**70.3**	**70.7**	**72.7**	**94.4**	**20.0**
Coclicopa **sp.**	**0.0**	**0.0**	**9.3**	**11.8**	**11.1**	**16.6**	**25.1**	**0.0**	**0.0**	**26.0**
Trochulus hispidus	**0.0**	**5.6**	**1.6**	**0.4**	**3.3**	**0.0**	**0.0**	**27.3**	**0.6**	**0.0**
Total associated	**0.0**	**5.6**	**10.9**	**12.2**	**14.4**	**16.6**	**25.1**	**27.3**	**0.6**	**26.0**
All others	**0.0**	**0.6**	**12.5**	**7.9**	**3.5**	**13.1**	**4.2**	**0.0**	**5.0**	**54.0**
Number of species	**5**	**9**	**12**	**10**	**10**	**10**	**9**	**4**	**11**	**7**
Number of shells	**99**	**431**	**625**	**517**	**180**	**759**	**278**	**57**	**181**	**26**
Notional density m^{-2}	**559**	**1197**	**6250**	**5170**	**1800**	**3373**	**1235**	**507**	**1609**	**231**
Aspect	**W**	**W**	*	*	*	**S**	**SSW**	**W**	**SW**	**N**
Angle of slope (degrees)	**<10**	**>20**	**5**	**5**	**5**	**16**	**20**	**5–10**	**15–20**	**15**

The faunas at Worth Matravers are remarkably "pure", a feature they share with Aston Rowant South. Low density overall seems to be associated with gentle slopes, as shown by the treads at Worth Matravers and Wylye Down; they are also species poor. All the sites in Chappell *et al.* (1971) were on gentle slopes, and density was lowest on the most trampled areas. Here, distinct terracettes are less likely than on the steeper slopes. Nevertheless, *V.* cf. *excentrica* was at its maximum in the least trampled zone, despite its nominally tighter restriction to open habitats relative to *V. costata* (Kerney 1999); this zone was partially dominated by tall grasses such as *Dactylis glomerata* L.

The one deviation from such faunas is seen at Aston Rowant North. Despite very short turf and a steep slope, only 20% of the admittedly very sparse fauna were xerophiles, and more than half the shells obtained belonged to generalist or woodland species. This remarkable result merits further studies on aspect on steep slopes. It is mirrored in the distribution of large helicids in the Derbyshire Dales (Cameron 1970).

Thus, there remain many unanswered questions about the snail faunas of open, calcareous grassland. Some species, such as *Vallonia* spp., *H. itala, A. secale, T. hispidus, P. muscorum, Cochlicopa* spp., and *V. pygmaea* were all present in the last stages of the Pleistocene, zones y and z as defined in Preece & Bridgland (1999) at Holywell Coombe, in open vegetation that also held hygrophilic species. Others, such as *X. intersecta, C. virgata*, and *C. acuta* are later introductions, as are many of the less common species listed in the Conchological Society website, cited earlier. It is clear that the term xerophile is not entirely appropriate, although intolerance of shade seems to be a factor.

Evans (1968 and 1972) was able to document the process of clearance in the Neolithic partly by noting the occurrence of typical calcareous grassland faunas. Abandonment, and the advance of scrub and looser, less compacted soils was characterised by the occurrence of other species, such as *Pomatias elegans*. As he noted, however, and illustrated here, even "pure" faunas typical of grazed calcareous grassland differed in the proportions of different species, especially *V. costata* and *V.* cf. *excentrica*, and *V. pygmaea*, and *P. muscorum. Cochlicopa* cf. *lubricella* and *T. hispidus* also vary greatly among sites. Data from Worth Matravers do little to explain this, but they show that micro-distribution within a site is significant; it may be reflected in varying proportions in death assemblages.

There are methodological difficulties in these and other studies. Apart from a potential lack of repeatable standards for distinguishing between fresh and old shells, there is often considerable variation in the fauna recovered from individual turves within a site. Ruesink (1995) was scrupulous in pointing out that the absence of some species from the fresh fauna might be down to chance, as they could be found in very small numbers among the more numerous old shells. In some cases, estimated density in fresh shells was less than 1 m^{-2}. For small species especially, this seems improbable as an even distribution, and may represent the chance sampling of very aggregated distributions. Site descriptions and botanical data generally refer to a whole site, and not to individual turves. The data from Worth Matravers indicates that within-site variation merits greater attention.

Acknowledgements

Thanks are due to Dr Annabel King of the National Trust, who introduced me to the site, and explained its history and background, also directing me to the areas least affected by succession to coarse grass and scrub. Michal Horsák made very useful comments in a review, and gave me additional references.

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Manuscript submitted: 22 May 2025
Revised manuscript accepted: 14 June 2025
Editor: Robert Forsyth