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SNAIL SHELLS UNDER STARLING ROOSTS

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The parish of Ravenstonedale lies on the watershed between the Eden and Lune valleys in east Westmorland and between 800 and 2,000 feet above sea level. The underlying rocks are the Silurian shales which make up most of the Howgill Fells to the south and the carboniferous limestone which extends down into the Eden valley on the north. Most of the more fertile enclosed land is in permanent grass on the limestone, on some of which over the past fifty years or so have been planted a number of small areas of coniferous woodland.

In January 1966 one of these, High Wood, was taken over as a startling roost and it quickly became obvious that irreparable damage would be done unless the starling were driven away. By March that had been effected by playing "frightened starling" noises on a tape recorder, though in the event much of the wood was found to have been killed by the droppings.

The starlings driven out of High Wood unfortunately settled in another wood, Wet Hill, in the same area and in two smaller plantings about a mile away, roosting in all until the end of the "roosting season". In that short period the small plantings were completely ruined and a number of trees in Wet Hill were killed. Subsequently a heavy gale blew down a number of trees in that wood, including some of those which had been killed by roosting starlings.

In May 1969 Wet Hill was investigated. This small wood was planted in 1912 and has a dense central portion of Sitka spruce and Douglas fir with a heavy canopy and a floor entirely covered with spruce and fir needles. Outside this the margins consist mainly of Scots pine, with a more open canopy admitting enough light to produce a floor largely covered with grass. No snails or snail shells could be found in the grass under the Scots pine but under the Sitka and Douglas the ground was peppered with white, bleached snail shells showing clearly on the needles. A closer examination showed that snail shells were present in enormous numbers throughout the 4–5 cms. or so of needles and decayed needles which lay on top of the underlying clay. In some places where trees had fallen grass had come in and no snail shells were visible on the surface but when the grass was removed an abundance of shells was seen.

Working from the centre of the shell strewn part of the wood outwards until there were no shells on or below the surface a cylindrical proprietary dog-food tin with a cross section 40 square centimetres in area was thrown down in 5 casually selected inter-tree spaces, turned up on end and pressed down through the needles etc. until its mouth was plugged by the underlying clay.

The shells thus found were sorted into three categories, (i) those 5–10 mm. in width (there were none exceeding 10 mm. obtained in this way), (ii) those wider than high, less than 5 mm. in width, (iii) elongated shells, longer than wide.

The numbers found in each of the samples taken were as follows:

Sample	A	B	C	total
	5–10 mm in width	less than 5 mm. in width	elongated	
1.	60	24	20	104
2.	57	68	35	160
3.	27	45	15	87
4.	15	51	12	78
5.	11	42	7	60
In 200 sq.cm.	170	230	89	489

In addition some 5,000 cc. of casually selected samples scooped up from the surface to the underlying clay were examined: all save one of the shells found by this method were less than 10 mm. in width (*Arianta arbustorum* (Linn.) 11·5 mm. in width).

A search through the whole shell strewn area produced 29 shells exceeding 10 mm. in diameter lying on the surface, the largest 12 mm.: one of these was *Cepaea* (?) *hortensis* (Müller) the remainder *Arianta arbustorum* or *Hygromia striolata* (Pfeiffer).

No living snails were found nor any fresh shells all, even those which had originally been transparent or translucent and including those found on the surface, being blanched white and opaque, with the periostracum eroded: I am very grateful to Dr. M. P. Kerney for their identification. The vast majority, many hundreds in the material examined, were *Hygromia hispida* (Linn.) which made up most of the categories A and B in the table above, though there was in category B, less than 5 mm. in width, a considerable number of *Retinella radiatula* (Alder) and *R. nitidula* (Draparnaud). A few other species were found in very small numbers as will be seen from the list set out below. Category C, elongated shells, consisted almost entirely of *Cochlicopa lubrica* (Müller) but in this category too were found a few other species in very small numbers.

High Wood and the two small plantings used as starling roosts were not examined in detail but snail shells were either obvious on the surface or apparent when the grass which had grown over them was removed. Three other coniferous plantations in the parish which had not been used as starling roosts were examined and no snail shells were seen on the surface of the ground nor to be found when the pine needle detrius was more closely examined. The owner tells me that he has seen no snail shells on the ground in his other plantations nor

does he remember seeing any in High Wood, Wet Hill and the other two affected plantings before the starling came. Few if any of the species identified there are likely to be found amongst the needles below a dense canopy of old coniferous woodland, some indeed, *Planorbis*, *Lymnaea* and *Succinea*, are normally found in freshwater or marshy areas.

I have not been able to find any references to snail shells being found under starling roosts but Head Forester, D. F. Fourt of the Soils section of the Forestry Commission's Research Station, says (*in. litt.*) that in 1954 at Wilsey Down Forest in Cornwall he saw many snail shells under a starling roost and that later at Halwell and Wilsey Down he was able to recognize old starling roosts by the snail shell layer in the litter, quite deeply buried by needle accretion since the roost was actually used.

In October 1969 a detailed examination was made by Mr. D. Elgy of the ground undernearth a starling roost in Bevercotes Block, Clipstone Forest, Notts. (Grid reference 4700 3710). Thirty sampling points were chosen by picking random numbers from a ten-yard grid placed over the area and samples taken by the method described above with a tin 75 sq. cms. in cross section. The roost, which has been occupied for three seasons, covers a considerable area of beech and a smaller area of mixed Scots and Corsican pine all planted in 1951, 27 samples were taken in the first, 3 in the second. The area most heavily contaminated by droppings was partly in pine (3 samples) partly in beech (2 samples), the remainder in beech: save in that heavily contaminated area the droppings from 1968–9 and earlier had weathered away.

The greatest number of shells was found in the central, contaminated area: these from sample covering 359 sq. cms. fell into the following categories by size:

Exceeding 10 mm. in width	2	(*Arianta*)
5–10 mm	41	
less than 5 mm.	37	
elongated	1	
total in 350 sq. cms.	81	
total in 200 sq. cms.	46	

Over the remainder of the roost there was only a shallow layer of leaf litter above the mineral soil with few, if any, remains of droppings. In 14 samples there no snail shells at all, in the remainder of the number recovered was negligible, 12 5–10 mm. in width, 5 less than 5 mm. in width, total 17 in 1,875 sq. cms. Two specimens of *Oxychilus alliarius* (Miller) were found, both under beeches, undamaged and translucent: it seems probable that these were part of the normal population. The remaining shells were like those found at Ravenstonedale damaged, bleached and with the periostracum eroded. Again I am

indebted to Dr. Kerney for their identification: the species found are set out below.

Little work seems to have been done on the food of starlings or on the material found under starling roosts but Dunnett (1956) analysing the stomach contents of starlings shot at winter roosts in Aberdeenshire, found that the two main food-stuffs were leather jackets and oats. Weevils were found in small quantities but other insects, spiders and snails were found only occasionally and in very small quantities.

It seems clear that the shells found at Wet Hill must have been brought in by the starlings and voided in their droppings and probable that the same is true of those at Clipstone. Had these last been the result of an increase in numbers of the snails normally found there more undamaged shells and living snails would have been found. The numbers found at Clipstone are in line with Dunnett's findings that starlings occasionally eat snails when feeding on arable land. It is of course impossible to compare the numbers found in the various size categories with the numbers on offer in the field but the two tables do show that starlings regularly eat snails up to 10 mm. in diameter and occasionally larger ones.

The difference between the number of snail shells found at Clipstone, where the roost is three years old, and at Ravenstonedale, where it was only occupied for a few weeks, is remarkable. Since trees were killed at Ravenstonedale and not at Clipstone there must have been many more starlings at the former but the density of shells found in the central area of Clipstone roost, 46 per 200 sq. cms., is so much less than the average over the whole roost at Ravenstonedale, 489 in 200 sq. cms., as to suggest that the Ravenstonedale starlings, in an area of rough grazing and grassland, ate more snails than those at Clipstone, surrounded by arable land. It is perhaps significant that Halwell and Wilsey Down Forests, where Mr Fourt was able to recognize old starling roosts by the remains of snail shells are, Mr Elgy tells me, surrounded by open moorland and poor pasture.

REFERENCE

DUNNETT, G. M., 1956. The autumn and winter mortality of Starlings (*Sturnus vulgaris*) in relation to their food supply. *Ibis*, **98**: 220–230.

LIST OF SNAIL SHELLS FOUND

	Wet Hill	Clipstone
Lymnaea truncatula (Müller)	×	—
Planorbis albus Müller	×	—
Succinea pfeifferi Rossmässler	×	—
S. ? oblonga (Draparnaud)	×	—
Azeca goodalli (Férussac)	×	—
Cochlicopa lubrica (Müller)	×	—
Vallonia excentrica Sterki	×	×
Ena obscura (Müller)	×	—
Clausilia bidentata (Ström)	×	—
C. dubia (Draparnaud)	×	—
C. sp. (fragment)	—	×
Retinella radiatula (Alder)	×	×
R. nitidula (Draparnaud)	×	×
Oxychilus alliarius (Miller)	—	×
Discus rotundatus (Müller)	×	×
Arianta arbustorum (Linn.)	×	×
Hygromia striolata (Pfeiffer)	×	—
H. liberta (Westerlund)	—	×
H. hispida (Linn.)	×	—
Cepaea hortensis (Müller)	×	—