

A SURVEY OF ANCIENT WOODLAND INDICATOR MOLLUSCS IN SELECTED SITES ON THE ISLE OF MAN

KEITH N A ALEXANDER¹ & A DUBBELDAM²

¹59 Sweetbrier Lane, Heavitree, Exeter EX1 3AQ, UK

²Manx Wildlife Trust, 7-8 Market Place, Peel, Isle of Man IM5 1AB

Abstract A week was spent in August 2011 exploring a selection of wooded ravines for ancient woodland indicator species of mollusc. The site selection was based on ravines where botanical survey has suggested ancient woodland conditions. A total of 36 mollusc species were found across the eight study sites. The majority of species found are natives, with only 2 non-native species recorded at these sites – the mollusc fauna appears to be virtually pristine at present. Four of the six ancient woodland indicators already known from the Island were encountered: *Limax cinereoniger*, *Zenobiella subrufescens*, *Acicula fusca*, *Leiostyla anglica*. The first is the most significant discovery as it had not been reported since it was originally added to the Island's list over 100 years previously. Two species *Spermodea lamellata* and *Vertigo substriata* were not found. Snails in particular were often found in notably low numbers, often just one specimen of a species. The survey was very much an initial exploration, and more detailed investigation is clearly needed in order to find overlooked species and to clarify the pattern of occurrence at site level.

Key words Mollusca, ancient woodlands, nature conservation, Isle of Man.

INTRODUCTION

The Isle of Man has been relatively well-studied for its molluscs. Forbes (1838) provided a notably early review, and this was updated by Garrad (1968, 1972 & 1973) and Tattersfield (1987). Kerney (1999) provides further up-dating. The total number of land snails known from the Island currently stands at about 66 species. This compares with around 134 for the British Isles as a whole and 94 for Ireland alone (Byrne et al, 2009). Precise numbers are not currently possible due to the number of recent taxonomic revisions.

Nine species of land mollusc have been identified as 'indicators of primary woodland' in Britain (Kerney & Stubbs, 1980). They are more or less restricted to primary habitats, or to habitats modified somewhat by human activity but with a long stable history, eg ancient woodlands and ancient wood pastures. The presence of one or more of these species is a useful indication that a site may have conservation value. Boycott (1934) was the first to associate these species specifically with primary woodlands. Of these nine species, six have been reported from the Isle of Man: *Acicula fusca* (Montagu 1803), *Leiostyla anglica* (Férussac 1821), *Limax cinereoniger* Wolf 1803, *Spermodea lamellata* (Jeffreys 1830), *Vertigo substriata* (Jeffreys 1833) and *Zenobiella subrufescens* (Miller 1822).

Four of these are small species and are typically found in moist woodland leaf litter, but *Z. subrufescens* is larger and more a species of the field and shrub layer. These five are very much characteristic of ancient woodlands where the canopy is relatively dense. *L. cinereoniger* is in contrast associated with sites with large old tree trunks rather than woodland leaf litter or field and shrub layer, and is more associated with ancient wood pasture situations – where canopy density may be relatively low – as well as ancient woodlands. The key requirements for permanently moist and frost-free microclimates mean that some of these species can also potentially be found on certain sea cliff and ancient wetland situations. When present within woodlands they are reliable indicators of ancient woodland conditions, while in other situations they are reliable indicators of very stable conditions.

These six species have mostly been known from the Isle of Man for a long time. Only *S. lamellata* is a relatively recent discovery, first reported here in 1968. While this might suggest that there might be other overlooked ancient woodland molluscs present, the other three species listed by Kerney & Stubbs (1980) are very unlikely to be present.

These are mostly western oceanic species, with Atlantic distributions in Europe (Kerney & Cameron, 1989). This is most extreme with *L. anglica* which is almost entirely confined to the British Isles, but *A. fusca*, *S. lamellata* and *Z.*

subrufescens all have very restricted distributions on Continental Europe. *V. substriata* and *L. cinereoniger* have more continental distributions.

While relic oak stands have long been known to occur on the Isle of Man, there had been a perception that the resource was not extensive enough to warrant closer inspection (Dubbeldam, 2011). The Wildflowers of Man Project however demonstrated that many rare vascular plant species under threat from Island extinction occurred in woodlands and this led to a thorough survey of the woodland resource. The Islands many ravine woodlands have proved to be rich foci of biodiversity. They are characterised as areas of oak *Quercus* and hazel *Corylus* with a suite of vascular plants which have been used as ancient woodland indicators, notably hairy woodrush *Luzula sylvestris*. These woodlands have not been enclosed historically and have dynamic boundaries that contract and expand over time in relation to land use practices on adjoining land. They occupy the upland fringes around the Island, with a main concentration in the north and east, and an upper limit of around 150 m.

The mollusc survey reported here (Alexander, 2011b) forms part of a wider investigation of ancient woodland on the Isle of Man. The main work was to survey a small number of the sites to see how well they corroborate the vascular plant and historical map evidence. The selected sites combine good quality vascular plant evidence with virtually unknown mollusc faunas – the few already well-studied sites on the Island were not selected so that the project would extend knowledge of the ancient woodland mollusc fauna. The opportunity was also taken to collate existing mollusc data in order to provide a better framework for site assessment.

MATERIAL AND METHODS

While many invertebrates are highly seasonal in their availability for survey, having largely annual life cycles, this does not apply so strongly to molluscs. The May to October period is generally suitable for mollusc surveys, although extended periods of dry weather and especially hot sunshine are best avoided. A full week in mid August was judged to be suitable in the context of the Isle of Man's Atlantic climate: the five days August 15th to 19th were chosen for the work. The intention was not to obtain complete

or near complete records of the mollusc fauna present but to provide a 'flavour' of the fauna.

Systematic survey is not advisable for woodland molluscs as each woodland varies in the availability of niches, and this also varies with time – woodlands are dynamic environments. The most productive approach is a general exploration of the site with targeted surveying of wherever the potential for finding molluscs is deemed greatest, relying on the field skills of a suitably experienced surveyor. The recommended methodologies for woodland mollusc survey in a United Kingdom context are sweep-netting and ground searching (Drake *et al.*, 2007) – the main assemblage type occupied by molluscs is described by Natural England's ISIS (Invertebrate Species & habitats Information System) as a "shaded field layer assemblage" type (F31). Species feeding on epiphytes are included within the "wood decay assemblage" types (A21) as they are detected using some of the same methodologies, i.e. beating aerial branches and direct observation on tree trunks. Some leaf litter species are small and difficult to see under field conditions and are best sought in litter samples taken back for examination in the lab.

Identification generally requires the availability of full grown animals; juveniles can be very difficult to identify to species level. Juvenile shells were retained on occasion for later comparison with voucher material. Identifications were supported using a wide variety of literature: Kerney & Cameron (1979), Cameron *et al* (1983, 1994) and Clements (2006). Nomenclature is from Anderson (2005).

Most species were sought by turning over logs and branches lying on the soil surface. Small twigs lying across wet flushed ground were especially targeted as these are a favoured place for finding some of the smaller snails. Close examination was also made of the trunks of living trees, where epiphyte browsing species might be found. Also searching was carried out beneath loose bark and in any rot-holes encountered. Fruit bodies of fungi were inspected for any feeding slugs.

A standard entomological sweep net was also used, for both sweeping and beating. Sweeping involves swinging the net through ground vegetation and shrub foliage in order to dislodge any molluscs present into the net bag. Aerial branches on trees and shrubs were also beaten with a stick while the net was held beneath to

catch any dislodged molluscs. Few conchologists use a sweep net and so their surveys tend to overlook the aerial component of the fauna. Sweeping requires the vegetation to be dry or else too much material becomes attached to the net bag, which also become heavy with rainwater that has soaked in to the bag material.

One or two bags of leaf litter were gathered at most sites, where litter of suitable depth could be found. The litter was later decanted into a white tray and examined under a low power microscope in order to detect any molluscs present. It is important to appreciate that the four smaller snails are easy to overlook in the field and that absence of evidence does not equate to evidence of absence.

A selection of specimens was retained for transfer to the Manx Museum collections at the end of the project.

A total of eight sites were covered by the survey – see Table 1. Much of a whole day was spent exploring Glen Roy (7 hours), but only half days were spent in the other sites (3–4 hours). The sites are best described as oak-hazel woodlands associated with deep ravines. Information on area and altitude are taken from the ancient woodland inventory project (Dubbeldam, 2011).

RESULTS

The hand-searching revealed a good range of molluscs overall although the return on effort

Table 1 General information about the wooded ravines surveyed

Site no.	Site name & OS grid reference	Extent of semi-natural oak-hazel woodland (ha)	Altitudinal range (m)	Notes on any adjoining tree cover, etc
	Ballure Glen SC453927	5.18 – in two blocks separated by a reservoir	30–150	Plantation forestry lies adjacent on most sides, and stands of mature broad-leaved trees extend from the lowest section westwards
	Brookdale SC437928	3.58	50–200	Plantation forestry lies adjacent on most sides
	Elfin Glen SC448933	5.96	80–150	Plantations extend the area of woodland cover both east and west along the adjoining slopes, linking up with Ballure Glen (q.v.).
	Glen Roy SC429843 to SC410837	20	40–150	Plantations and secondary woodland extend the area of woodland cover considerably.
	Groudle Glen SC416788	5.97	20–70	Plantations and secondary woodland extend the area of woodland cover considerably; a major Victorian pleasure ground, and remains a developed visitor attraction, with well-drained pathways.
	Narradale SC395939	5.6	50–110	The most discrete site, with very little linkage to other woodland or plantation areas.
	Santon Gorge SC297693	0.7	0–15	A gorge cliff woodland; a ribbon of large old ash and wych elm trees extends inland along the valley.
	Silver Burn SC276710 to SC 258727	0.9		Another Victorian pleasure ground and a long history of disturbance from landscape gardening; native broad-leaved woodland is virtually non-existent but the area retains a woodland aspect, albeit dominated by non-native trees.

was all too often surprisingly and disappointingly low. The leaf-litter samples were also very disappointing, apart from the Ballure Glen samples which were good. A total of 36 mollusc species were found across the eight study sites – see Table 2.

DISCUSSION

The mollusc fauna of ancient woodlands is not a defined ecological assemblage, but rather an accumulation of species sharing overlapping – to some extent – ecological requirements. This means that no one site can be assumed to contain the full suite of possible species in the absence of evidence – the presence of one ancient woodland indicator species does not imply that others will also be present. However, the presence of one indicator species is generally adequate to indicate ancient woodland conditions.

The British Isles are fortunate in having been subject to surveys of ancient woodland molluscs in many other districts. Studies have been published on Nettlecombe in west Somerset (Bishop, 1976), ‘southern’ England (Cameron, 1973), west Cambridgeshire (Paul, 1975, 1978a & 1978b), the south Pennines (Tattersfield, 1990), the Malham area of the Yorkshire Dales (Cameron & Redfern, 1972; Cameron, 1978), the North York Moors (Wardhaugh, 1995, 1997 & 2011), and West Cork and Kerry (Bishop, 1977). These provide a useful framework for comparison with the Isle of Man study.

The species totals for the sites visited were mostly in the range of 9 to 23, which is broadly comparable with data from other recent survey work on the Island, at Glen Maye, Santon Gorge and Port Cornaa (Boyce & Fowles, 1989) and Dhoon Glen (Felton et al, 1996), with species totals of 17, 19, 19 and 21 respectively. The latter surveys are not directly comparable either in scope or methodology, and species of open country have been removed from the lists to improve comparability. The total catch for Santon Gorge in 2011 was only 4 as access into this site proved very difficult – Boyce and Fowles (1989) clearly knew how to penetrate this site as their total was 19 species (it seems likely that water levels were lower at that time, enabling access along the riverbank). The overall total from the week’s surveys was 36 species which makes an interesting comparison with Wardhaugh’s (1995) prediction

Table 2 Species of terrestrial mollusc present in eight ancient woodland sites on the Isle of Man (Nomenclature follows Anderson (2005). *See Table 1 for names and further details of the woodlands surveyed.)

Species	Site number*							
	1	2	3	4	5	6	7	8
<i>Acicula fusca</i>	*							
<i>Deroceras panormitanum</i>		*	*	*	*	*	*	*
<i>Deroceras reticulatum</i>	*		*		*	*	*	*
<i>Arion ater</i> agg	*	*	*	*	*			*
<i>Arion flagellus</i>	*							
<i>Arion subfuscus</i>		*	*		*	*	*	
<i>Arion circumscriptus</i> seg						*		
<i>Arion silvaticus</i>	*	*		*		*		*
<i>Arion distinctus</i>	*		*	*	*			*
<i>Carychium minimum</i>						*		
<i>Balea heydeni</i>	*	*	*	*	*	*	*	*
<i>Clausilia bidentata</i>	*	*	*	*		*		*
<i>Cochlicopa lubrica</i>	*	*	*					
<i>Discus rotundatus</i>	*	*	*	*		*		*
<i>Euconulus fulvus</i> seg	*	*	*					
<i>Zonitoides nitidus</i>								*
<i>Cepaea nemoralis</i>				*	*			
<i>Cepaea hortensis</i>	*			*				
<i>Trochulus striolatus</i>	*	*						
<i>Zenobiella subrufescens</i>	*			*		*		
<i>Leiostyla anglica</i>	*		*			*		
<i>Lehmannia marginata</i>	*	*	*	*	*	*		*
<i>Limacus maculatus</i>		*		*	*			*
<i>Limax cinereoniger</i>		*						
<i>Tandonia sowerbyi</i>								*
<i>Aegopinella pura</i>	*					*		
<i>Aegopinella nitidula</i>		*				*		
<i>Nesovitrea hammonis</i>	*	*	*					
<i>Oxychilus alliarius</i>	*	*	*	*		*		*
<i>Oxychilus cellarius</i>	*			*				
<i>Oxychilus draparnaudi</i>				*				
<i>Vitrea crystallina</i>	*	*						
<i>Punctum pygmaeum</i>	*							
<i>Columella aspera</i>	*	*	*	*				
<i>Vitrina pellucida</i>								*
Total	23	18	15	16	9	15	4	14

that older, undisturbed and moist sites in the North York Moors area are likely to contain about 35 species of terrestrial mollusc.

Table 3 Total numbers of terrestrial mollusc found by site plus details of known presence of ancient woodland indicator species; sequence ordered by richness of the latter

Site name	Total species	Total AWI *	AWI species, including historic records in square brackets
Ballure Glen	23	3 [4]	<i>Acicula fusca</i> , <i>Leiostyla anglica</i> , <i>Zenobiella subrufescens</i> [<i>Limax cinereoniger</i> 1909]
Narradale	15	2	<i>Leiostyla anglica</i> , <i>Zenobiella subrufescens</i>
Glen Roy	16	1 [2]	<i>Zenobiella subrufescens</i> [<i>Spermodea lamellata</i> 1978]
Brookdale	18	1	<i>Limax cinereoniger</i>
Elfin Glen	15	1	<i>Leiostyla anglica</i>
Silver Burn	14	0 [2]	[<i>Zenobiella subrufescens</i> 1886; <i>Leiostyla anglica</i> 1969]
Santon Gorge	4	0 [1]	[<i>Leiostyla anglica</i> 1989]
Groudle Glen	9	0 [1]	[<i>Zenobiella subrufescens</i> 1904]
All sites	36		

*The first figure is the total found in 2011; the second includes historic records

The 2011 survey sites are listed in Table 3 together with the species totals and numbers of ancient woodland indicator species which have been found there – either by the 2011 survey or by previous researchers. The sites are ordered according to the richness of the mollusc fauna and the numbers of known ancient woodland indicator species.

Comparable data is available for two other sites on the Island: Glen Maye: *Acicula fusca*, *Leiostyla anglica*, *Spermodea lamellata*, all 1998; Glen Mooar: *Acicula fusca* (1990), *Leiostyla anglica* (1987 & 1990), *Vertigo substriata* (1968). Ballaglas Glen also has records for both *Acicula fusca* and *Zenobiella subrufescens*, although only from 1904.

Numbers of individual molluscs found in 2011 were notably low in many cases. It is difficult to account for the general lack of molluscs, particularly snails, encountered during this survey. It seems unlikely to be due to local droughting as summer 2011 appears to have been wetter than average, but may reflect the distribution pattern of the molluscs within these wooded ravines. It is possible that molluscs are much more localised than might immediately be expected, due the general wetness of the local climate and the regular flows of rainwater and localised flooding. The size and height range of the local catchment may also be involved – the richest site, Ballure Glen, drains land rising to 565 m at North Barrule, whereas Glen Roy drains land rising to 621 m at Snaefell; volumes of water and flow rates vary considerably from site to site. However, the low numbers are also a UK-wide phenomenon and may be due to the weather conditions over recent years rather than just this particular season, with

most areas of old woodland being much drier than usual (A. Norris, pers. comm.). The Isle of Man species totals are actually comparable with those found by other recorders in recent years and the proportion of ancient woodland indicator species is also comparable (Boyce & Fowles, 1989; Felton et al, 1996), so it must be a local feature. More detailed studies of the mollusc fauna of the ravines would be required to investigate this subject area more fully.

The ancient woodland indicator species Ash-black slug *Limax cinereoniger* is very much a species of old growth forest, requiring a combination of large rotting tree trunks on the forest floor and/or live veteran or ancient trees with wood-decay cavities and rot-holes within an overall framework of ancient woodland or ancient wood pasture. Rotting trunks and rot-holes provide daytime refugia for the slugs which feed mainly on epiphytes on the trunks of living trees. Tree density is not important – within certain limits – and the slug may be found within areas of closed tree canopy as well as very open wood pasture. Open forest may be more suitable in the more oceanic climate of western Europe than in more continental climate.

In the continental parts of its range, with the colder winters and warmer drier summers, it appears that ash-black slug requires larger extent of suitable habitat to maintain a viable population. In a study of deciduous old-growth forests in the Lower Rhine Embayment, Germany (Kappes *et al.*, 2009), it was suggested that this species seems to need forests of in excess of 1000 ha. Such extents of ancient woodland are

not available on the Isle of Man, but a requirement for relatively large expanses of habitat may explain the slug's restricted distribution on the Island.

The species was discovered in the Ramsey district by Fred Taylor during a short holiday there in August 1909 (Taylor, 1910). His mollusc recording activities targeted slugs and live material was forwarded to Denison Roebuck, the leading British authority on these animals at the time. These included a number of *L. cinereoniger*: "Douglas Road, Ramsey", one adult collected 29th August – the specimen is in the Manx Museum collections (Garrad, 1966); "Fern Glen, Glen Aldyn" three nearly adult and one half grown, collected 1st September. No further records from the Island have been traced. The discovery of a specimen on the edge of Brookdale, 17th August 2011, is therefore the key discovery of the 2011 survey, and apparently the first sighting of this old forest species on the Island for over 100 years.

This area of hillside above Ramsey includes a series of wooded ravines – Glen Auldyn, Brookdale and Fern Glen on the west side and Elfin Glen and Ballure Glen to the east. The latter eastern areas are linked by the mature plantations of Lherghy Frissell and Cloughbane Plantation. This is a sizeable concentration of woodland in the context of the Island, and this is consistent with the requirement for a large expanse of habitat.

Spermodea lamellata is a classic ancient woodland species, living amongst moist leaf litter or on fallen twigs and branches; it is often associated with great wood-rush *Luzula sylvatica* (Kerney, 1999). It is considered a useful indicator of ancient woodland that has never been clear-felled, although it can also occur in boggy ground overhung by trees, especially on the margins of floodplains. Known sites include a variety of mixed, partially replanted, or managed woods such as hazel coppices, but it has never been found in pure conifer plantations. Many populations are vulnerable, being in small woodland remnants easily destroyed by clearance or replanting by conifers. Its world distribution is centred on the British Isles and the coasts of southern Scandinavia (Kerney, 1999).

Knowledge of its habitat requirements has recently been refined, based on studies in North-east Yorkshire (Wardhaugh, 2011). It was shown to live in deep leaf litter, generally of at least

10 cm or more, overlying deep, soft, loamy soil in sites that remain moist throughout the year but which are rarely very wet. It has not been found in shallow leaf-litter samples overlying drier or compacted soils or those composed predominantly of leaves which decay more rapidly, such as sycamore, ash or hazel. The dominant litter types in which it has been found are beech, oak, pendulous sedge *Carex pendula* and greater woodrush *Luzula sylvatica*. There may however be regional differences in the detail – in drier districts it will be even more moisture demanding, but in wetter districts such as the Isle of Man, it may be less demanding.

This species was first discovered on the Island only in 1968, in Glen Roy, by Mrs J.A. Paton (Garrad, 1972). It has subsequently been found in Glen Maye by Barry Colville in 1998 (Conchological Society records). Given its requirement for deep leaf litter (and moisture but not wetness) it must be very restricted in the wooded ravines on the Island. Accumulations of leaf litter were found to be of very restricted occurrence, and are mainly associated with the gentler upper slopes. Wardhaugh (1995) associated it with larger areas of woodland (mean area 65.5ha). Glen Roy is certainly the largest area of ancient semi-natural oak-hazel woodland on the Island, at 20ha, but Glen Maye is of more typical extent for the Island's wooded ravines, at 4.14ha.

Vertigo substriata is the most broadly ranging of the six species in terms of the situations where it has been found, although permanently moist conditions and long-term lack of gross disturbance remain key factors: marshes, damp woods, hillside flushes and dune slacks (Kerney, 1999). It is better known on the Island from boggy ground in areas of rough grazing in the highland zone. Its occurrence in leaf litter in ancient woodlands is amongst the rarest situations where it has been found. At 1.7–1.9 mm shell height, it is the smallest of the six ancient woodland indicator species and tends to be under-recorded as a result. It has a central and northern European range.

Garrad (1972) was only aware of two records from the Island: Whitestrand, c 1890, Robert Cairns (1902) and Glen Mooar, 1st May 1968, Mrs J.A. Paton. There is also a specimen from Whitestrand in the collections at Liverpool Museum dated 1904 (Conchological Society records). A third locality appears to have been overlooked by Garrad: Ballaugh Curragh, April 1904, coll. J.R.

Tomlin, det. J.W. Taylor (Conchological Society records). It has been found at the last locality subsequently, by Boyce & Fowles (1989). The records illustrated in Kerney (1999) are consistent with these three reports.

Like the other three small snails, *A. fusca* lives amongst moss and leaf litter, but, unlike *V. substriata*, primarily in ancient woodland. In the more oceanic parts of the British Isles it may additionally be found in relatively exposed situations such as sea cliffs and even mossy roadside banks on occasion. It has a central western distribution in Europe, known mainly from the British Isles, France, Belgium and western Germany.

This appears to have first been noted on the Island at Whitestrand, where it was taken by Fred Taylor, William Moss and Robert Cairns in August 1894 and 1904; it was described as numerous under stones in a ravine near the shore (Conchological Society records); a specimen exists in the Manx Museum collections (Garrad, 1966). This was presumably a sea cliff site. There is also a record from Knock Rushen in 1942, C.I. Paton (via K. Hawkins), presumably also a sea cliff site. The species has also been found in wooded ravines: Ballaglas Glen, 1904, B.R. Lucas; Glen Mooar, 8th April 1990, Peter Tattersfield; and Glen Maye, 18th June 1998, Barry Colville.

A single fresh shell was found in 2011, in a leaf litter sample taken from the upper section of Ballure Glen, a new site and a new 10 km square for the species.

Z. subrufescens has a quite different lifestyle to the smaller woodland snails. The snails are active in the field and shrub layers, even ascending into the tree canopy on occasion. Populations tend to live at relatively high density, making them easier to find on demand. This means that they are more readily findable by sweep-netting – a technique rarely used by conchologists – and the failure to find any by this means generally means that the species is currently absent locally. Kerney (1999) states that they are mostly found in ground litter but this is not correct – see Alexander (2011) for instance – reflecting only the fact that conchologists have not adopted the sweep net! Dense ground vegetation tends to be favoured – generally *Mercurialis perennis* over much of Britain, but also *Luzula sylvestris*, especially in Ireland and on the Isle of Man. They may be found in alder stands, ash-wych elm, and also

oak woodlands. Very occasionally populations may occur in more open situations such as ancient hedgerows, ancient marshes, and suitable sea cliff situations. The world distribution is centred on the British Isles, with north-western France having the only other major populations (Kerney, 1999).

The association with field layer vegetation means that this species is particularly sensitive to heavy grazing, although it is known to persist under light grazing regimes. It is also tolerant of coppicing and returns to cut-over coups very quickly, benefiting from the well-developed structure provided by hazel re-growth (Alexander, 2011).

It appears to have been overlooked by Garrad (1973) in her review but Garrad (1966) notes a specimen of '*Helix fusca*' in the Manx Museum collections, collected at Atholl Bridge (Silver Burn) by W. Dennison Roebuck. The record is referred to as published in 1889. Conchological Society records provide further details: it was actually found by J.E. Mason on 12th September 1887, and presumably subsequently passed to Roebuck for documentation. Further sites for *Zenobiella* were discovered in 1904 (Conchological Society records): Ballaglas Glen, B.R. Lucas and Groudle Glen, also B.R. Lucas. Kerney (1999) only shows pre 1965 records from SC26 (Silverdale, which is actually in SC27), SC47 (Groudle Glen) and SC48 (Ballaglas Glen), but it was also found in Dhoon Glen in 1996 by recorders from Liverpool Museum (Felton et al, 1996).

This was the most widespread of the ancient woodland molluscs found during the 2011 survey. It was found in Ballure Glen, Glen Roy and Narradale Glen, but not along the Silver Burn or in Groudle Glen, where it has been reported in the past. The Atholl Bridge section of the Silver Burn appeared suitable, with large stands of *Luzula sylvestris* and scattered hazel bushes, but was found to be supporting an abundant population of *Trochulus striolatus* (C. Pfeiffer 1828). It seems possible that *T. striolatus* has replaced *Z. subrufescens*. *T. striolatus* is a native species which is favoured by human activity, and especially the provision of lime which is needed for its relatively thick shell. While it can apparently co-exist with *Z. subrufescens* – at least temporarily – generally where *T. striolatus* is abundant, *Z. subrufescens* is absent. The development of this glen by the Victorians as a pleasure

ground may have eliminated *Z. subrufescens* by encouraging *T. striolatus*.

L. anglica is the largest of the small ancient woodland snails and can generally be found more readily as a result. In western oceanic areas of Ireland and Scotland this species lives in humid places within a wide variety of undisturbed semi-natural situations, both open and shaded, but it becomes increasingly confined to ancient woodlands further south and east. Oceanic situations include marshes, dune slacks and sea cliffs, as well as ancient woodlands, much as for striated whorl snail *Vertigo substriata*. Its world distribution is almost entirely the British Isles, but it is also recorded from a number of areas along the Atlantic coasts to the south – France, Spain, Portugal and into the Mediterranean Region at Algeria. In the British Isles it is most widespread in Ireland, and absent from most of the south and east of England.

Garrad (1972) only lists five records from the Island: Kentraugh woods, 1923, W.H. Heathcote (1924) – specimen in Manx Museum collections (Garrad, 1966); Whitstrand, c 1909, Fred Taylor (1910) – specimen in Manx Museum collections (Garrad, 1966); also ‘Peel’, 1897, R. Cairns & 1966, M.F.; Quarry west of Ballasalla, 23rd January 1966, LSG; Glen Maye, c1890, Robert Cairns (1902); also found here in 1989 & 18th June 1998, Barry Colville; Niarbyl, c 1890, Robert Cairns (1902); also between here and Dalby Point in 1989. Cairns (1902) also includes: Port Soderick, Fred Taylor (1910). There are also other records, as follows: Cooil Dharry, 1987, Peter Tattersfield & 1998, Barry Colville; Glen Mooar, 1987 & 1990, Peter Tattersfield; Lhoob Doo, 1989, Boyce & Fowles; Port Cornaa, 1989, Boyce & Fowles; Port Erin, June 1904, B. Tomlin; Santon Gorge, 1989, Boyce & Fowles; Silverdale, March 1969, Larch Garrad.

Other mollusc species of note *Acanthinula aculeata* (O.F. Müller 1774) is one of the small leaf-litter inhabiting snails, and is only known on the Island from a single record, having been discovered by Peter Tattersfield in Glen Mooar in 1987 and found here again in 1990. Although it is small, it is very distinctive. Its absence from all of the 2011 litter samples suggests that it may prove to be another Island rarity.

Zonitoides nitidus (O.F. Müller 1774) was reported “near Peel” c 1890, Robert Cairns (1902)

but Garrad (1973) notes “not re-found”. Kerney (1999) indicates just one post-1965 presence, in NX40 and one pre 1965 presence in SC39. The NX40 10 km square is where Boyce & Fowles (1989) found this species: Ballakesh Ayres and Loch Cranstal. Felton (Liverpool Museum) also found it in Dhoon Glen in 1996. Its discovery in the alder carr along the Silver Burn in August 2011 is therefore a significant record and the first for the south of the Island. It is a characteristic species of wet marshy conditions and is virtually amphibious.

While this study has focused on acknowledged ancient woodland indicator species in the British context, the European literature also recognises other species as stenocious forest species such as *Arion silvaticus* Lohmander 1937, *A. subfuscus* (Draparnaud 1805) and *Lehmannia marginata* (O.F. Müller 1774) (Kappes, 2006). This appears much less the case in the oceanic climate of the British Isles, with the last associated with trees and bare rock in semi-natural situations throughout the west. The other two are however of potential value as second level indicator species. Boyce & Fowles (1989) also suggest that *Arion flagellus* Collinge, 1893 is also something of an old woodland species in Britain. All three *Arion* were found during August 2011, with an overall emphasis on the richer mollusc sites, so they may also prove useful in site quality assessment on the Isle of Man.

Conservation status on the island The sequence of rarity of the six ancient woodland indicators known from the Island is as follows:

Limax cinereoniger – only known from the wooded slopes above Ramsey;

Spermodea lamellata – only known from two sites, including the largest wooded ravine, Glen Roy;

Vertigo substriata – only known from three sites;

Acicula fusca – only known from six sites, including Ballure Glen;

Zenobiella subrufescens – known from a small number of wooded ravines only – Ballure Glen, Dhoon Glen, Glen Roy and Narradale, and apparently lost from the Silver Burn and Groudle Glen;

Leiostyla anglica – relatively widespread on the Island, occurring on coastal cliff sections as well as wooded ravines.

The only species where there appears to be reliable evidence for a decline is with *Z. subrufescens*, which appears to have been lost from the Silver Burn catchment at some stage since its discovery on the Island there in 1889, and possibly also from Groudle Glen where it was reported in 1904.

A red list using current IUCN Guidelines is not available in Britain – although there are plans for producing one are under way (pers. comm. of I. Killeen, M. Seddon), but one has recently been produced for Ireland (Byrne *et al.*, 2009). Of the six ancient woodland indicator species, *S. lamellata* has been assessed as ‘Endangered’, while *A. fusca*, *L. anglica*, *L. cinereoniger* and *Z. subrufescens* as ‘Vulnerable’, with *V. substriata* assessed as ‘Near Threatened’. Of interest is *A. aculeata* which is also ‘Near Threatened’. This provides a useful parallel view of the conservation status of these species. They mostly also feature in the red lists of other European countries – *Z. subrufescens* and *L. anglica* are the exceptions as France, Portugal and Spain have not produced red lists and these species do not occur outside the British Isles and these countries.

Presence of non-native species A striking feature of many of the mollusc communities in the Manx wooded ravines was the relative absence of introduced and synanthropic species. The only widespread non-native species was *Deroceras invadens* (Reise, Hutchinson, Schunack & Schlitt 2011), a putative Mediterranean species which has become widely spread by human activities (syn. *Deroceras panormitanum* (Lesson & Pollonera 1882)). Typically a species of disturbed habitats, it is well-known to penetrate into semi-natural situations in climatically mild and humid regions such as the oceanic west.

Another non-native species, *Limacus maculatus* (Kaleniczenko 1851), was found at Brookdale, Glen Roy and Groudle Glen; this is native to the broad-leaf forests of Crimea and the Caucasus, and has been spread by human activities. In the British Isles it is best known from Ireland where it is very widespread and has spread into native woodland situations

The only other non-native species encountered was *Tandonia sowerbyi* (Férussac 1823) which was found in the garden area of Silverdale Glen. Again, this appears to be a Mediterranean species which has been spread by human

activities, especially along the oceanic west of Europe.

A fourth species which is particularly characteristic of human disturbance is *Trochulus striolatus* which was locally abundant in Silverdale as far upstream as just beyond Athol Bridge, and also present in the roadside areas at Brookdale. Although considered native in Britain, its natural distribution appears to have been relatively southern, and it has been expanding in response to human disturbance and occasionally becomes a pest, for example in strawberry fields. It is also known from Glen Maye (Boyce & Fowles, 1989) and Dhoon Glen (Felton *et al.*, 1996) – the latter site is the only one where it currently co-exists with *Z. subrufescens*.

Overall the mollusc faunas of most of the wooded ravines visited appears minimally disturbed, the main exception being the more ‘developed’ glen of Silverdale, with its indicators of human disturbance. This is in contrast with data from better known sites such as Dhoon Glen and Glen Maye, both ASSI, which have both been colonised by *Trochulus striolatus*.

CONCLUSIONS

The present survey is the first targeted exploration of the mollusc fauna of the Isle of Man’s ancient and semi-natural woodlands. As such it has revealed considerable conservation interest and raised a number of ecological questions. It is very clear that the Island’s ancient woodland indicator molluscs are of some ecological interest and further survey is needed to clarify their patterns of occurrence across the Island.

Limax cinereoniger is confirmed as occurring only on the slopes above Ramsey. As the rarest of the six indicator species chosen here it merits particular conservation action, both to clarify its distribution locally and to ensure that its old growth habitat is managed sensitively.

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REFERENCES

- ALEXANDER KNA 2011a How should we define the 'habitat' of molluscs? *Mollusc World* **26**: 18–19.
- ALEXANDER KNA 2011b *A Survey of Ancient Woodland Indicator Molluscs in selected sites on the Isle of Man*. Unpublished contract report for Manx Wildlife Trust.
- ALEXANDER KNA 2011c Field meeting in south Devon in search of *Malacolimax tenellus*. *Mollusc World* **27**: 4–5.
- ANDERSON R 2005 An annotated list of the non-marine Mollusca of Britain and Ireland. *Journal of Conchology* **38**: 607–637.
- BISHOP MJ 1976 Woodland Mollusca around Nettlecombe, Somerset. *Field Studies* **4**: 457–464.
- BISHOP MJ 1977 The Mollusca of acid woodlands in West Cork and Kerry. *Proceedings of the Royal Irish Academy B* **13**: 227–244.
- BOYCOTT AE 1934 The habitats of land Mollusca in Britain. *Journal of Ecology* **22**: 1–38.
- BOYCE DC & FOWLES AP 1989. *Invertebrate conservation in the Isle of Man – an assessment of selected sites of ecological interest 30 April – 5 May 1989*. Unpublished manuscript.
- BYRNE A, MOORKENS EA, ANDERSON R, KILLEEN IJ & REGAN EC 2009 *Ireland Red List No. 2: Non-Marine Molluscs*. Dublin: National Parks & Wildlife Service.
- CAIRNS R 1902. List of Mollusca collected in the Isle of Man. *Proceedings of the Isle of Man Natural History and Antiquarian Society* **1**: 509–513.
- CAMERON RAD 1973 Some woodland mollusc faunas from southern England. *Malacologia* **14**: 355–370.
- CAMERON RAD 1978 Terrestrial snail faunas of the Malham area. *Field Studies* **4**: 715–728.
- CAMERON RAD 1994 *Keys for the identification of Land Snails in the British Isles*. Shrewsbury: Field Studies Council.
- CAMERON RAD, EVERS HAM B, & JACKSON N 1983 A field key to the slugs of the British Isles. *Field Studies* **5**: 807–824.
- CAMERON RAD & REDFERN M 1972. The terrestrial Mollusca of the Malham area. *Field Studies* **3**: 589–602.
- CLEMENTS D 2006 *A revised field key to British slugs*. Unpublished manuscript.
- DRAKE CM, LOTT DA, ALEXANDER KNA & WEBB J 2007 Surveying terrestrial and freshwater invertebrates for conservation evaluation. *Natural England Research Report NERR005*.
- DUBBELDAM A 2011 *Oak/Hazel Woodlands on the Isle of Man. Part One: The Natural History of Manx Oak/Hazel Woodlands*. Peel: Manx Wildlife Trust.
- FELTON C, GREEN T & MAWDESLEY T 1996 *Records from survey carried out In Dhooon Glen by staff from Liverpool Museum* (manuscript lists).
- FORBES E 1838 *Malacologia Monensis. A Catalogue of the Mollusca inhabiting the Isle of Man and the neighbouring sea*. Edinburgh: John Carfrae & Son.
- FOSTER A 1983 National Review of Non-Marine Molluscs. Nature Conservancy Council: *Invertebrate Site Register Report No 14*.
- GARRAD LS 1966 *Non-marine Molluscs in the collection of the Manx Museum & Manx records*. Manuscript in the Manx National Heritage Archive.
- GARRAD LS 1968 The non-marine molluscs of the Isle of Man. *Peregrine* **3** (6): 184–188.
- GARRAD LS 1972 Non-marine molluscs of the Isle of Man II. *Peregrine* **4** (1): 41–44.
- GARRAD LS 1973 Non-marine molluscs of the Isle of Man III. *Peregrine* **4** (2): 71–72.
- KAPPES H 2006 Relations between forest management and slug assemblages (Gastropoda) of deciduous regrowth forests. *Forest Ecology and Management* **237**: 450–457.
- KERNEY M 1999 *Atlas of the Land and Freshwater Molluscs of Britain and Ireland*. Colchester: Harley Books.
- KERNEY M & CAMERON RAD 1979 *A Field Guide to the Land Snails of Britain and North-west Europe*. London: Collins.
- KERNEY M & STUBBS A 1980 *The conservation of snails, slugs and freshwater mussels*. Shrewsbury: Nature Conservancy Council.
- PAUL CRC 1975 The ecology of Mollusca in ancient woodland. 1. The fauna of Hayley Wood, Cambridgeshire. *Journal of Conchology* **28**: 301–327.
- PAUL CRC 1978a The ecology of Mollusca in ancient woodland. 2. Analysis of distribution experiments in Hayley Wood, Cambridgeshire. *Journal of Conchology* **29**: 281–294.
- PAUL CRC 1978b The ecology of Mollusca in ancient woodland. 1. Frequency of occurrence in west Cambridgeshire woods. *Journal of Conchology* **29**: 295–300.
- TATTERSFIELD P 1987 *A Preliminary Checklist of the Terrestrial Mollusca of the Isle of Man*. Unpublished manuscript (copy held at Manx Museum).
- TATTERSFIELD P 1990 Terrestrial molluscan faunas of some south Pennine woodlands. *Journal of Conchology* **33**: 355–374.
- TAYLOR F 1910 Notes on the land and freshwater Mollusca of the Isle of Man. *Proceedings of the Isle of Man Natural History and Antiquarian Society* **1**: 509–513.
- WARDHAUGH AA 1995 The terrestrial molluscan fauna of some woodlands in North East Yorkshire, England. *Journal of Conchology* **35**: 313–327.

WARDHAUGH AA 1997 The terrestrial molluscan fauna of some woodland in north east Yorkshire England: a framework for quality scoring and association with old woodland flora. *Journal of Conchology* **36**: 19–30.

WARDHAUGH AA 2011 The Scarborough Snail and what it has to tell us about ancient semi-natural woodland. *British Wildlife* **22**: 176–183.

