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An asterix* indicates a peer-reviewed paper

Front cover: Coupling Odalisque damselflies *Epallage fatime*. Vouvaris River, Lesbos, May 2011.

Back cover: *Upper - Sepsis* sp. Golden Acre Park, Leeds, September 2012.

Lower - Antlion. Genus not so far determined. Monasteraki, Lesbos, September 2011.

Photographs from the ‘Scary but Beautiful’ exhibition by *John Bowers* (see p122).



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Editorial

Photography in *The Naturalist*

Every issue of *The Naturalist* has photographs on the front and rear covers and additionally a 4 page centrefold of coloured plates. The centrefold is primarily intended for the illustrative material accompanying the articles in the issue but not all of the available space is needed for that purpose in every issue. It was not needed for this issue and we have taken the opportunity to include some of the best photographs of Yorkshire wildlife from the YNU Flickr site (see Plate VI, centre pages). We intend to repeat this experiment from time to time as opportunity arises. If you have some iconic photographs of Yorkshire wildlife that you think may be suitable for *The Naturalist*, either for the cover or the centre-spread please put them onto the Flickr site. Suitable photographs should be at least 500 kilobytes in size.

On the occurrence of the nudibranch *Geitodoris planata* in the North Sea and its addition to the Yorkshire marine fauna, with a note on recent new species

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Introduction

G. planata is a large nudibranch (see Plate I, centre pages) of similar size and appearance to the well-known Sea Lemon *Archidoris pseudoargus* and was first described, as *Doris planata*, by Alder & Hancock (1846) from a small, light-coloured specimen. In 1862, they described a large, dark-coloured, heavily blotched and apparently new nudibranch as *Doris testudinaria*, later declaring (in Jeffreys, 1867) that they had come to the conclusion that they were of the same species. These two descriptions by the same authors illustrate the extreme variation to be found in *G. planata*, particularly between younger and older individuals, and further emphasize the care required in examining younger stages which may be misidentified as the common Sea Lemon. Later descriptions by Thompson & Brown (1976 and 1984) and Picton & Morrow (1992) are brief and, although these authors state that the species is variable in colouration, none fully stresses nor describes the extreme colour variability as first demonstrated by the original descriptions of Alder & Hancock, and which could lead to misidentification.

Distribution

G. planata is common throughout the Mediterranean, along the French Atlantic coast and from there to the southern and western coasts of the British Isles. The British distribution and status of *Geitodoris* have hitherto been somewhat confused due to conflicting statements in the literature, the general opinion being that this species was confined to the south and west coasts of the British Isles and of low frequency. Thus, Thompson & Brown (1976) originally stated that it occurred “at various places around the British Isles, but chiefly ... on southwest coasts”, though by their later monograph (1984) they had become aware of the two Scottish North Sea records from the east of Scotland by Dawson (1870) and Walton (1908), given by McKay & Smith (1979).

Later authors disregard these two old records from eastern Scotland and both Hayward & Ryland (1990) and Picton & Morrow (1994) state that this sea slug does not occur in the North Sea. What is certain, however, is that there have been, until recently, no other reports of *G. planata* from the North Sea since Walton’s specimen from off Berwick in 1907. There are no records from Northumberland or Durham and, despite on-shore and off-shore collecting by the author since the early 1960s, this species has only recently been found.

In June 1999 *Geitodoris* was seen for the first time on the Netherlands coast by divers and by July 2001 was reported to be so numerous there that adults and egg ribbons could be seen on most dives, with individuals of an extraordinary size up to 12cm in length (Van

Bragt, 2001). It was seen for the first time in the German Bight in the summer of 2002 at Sudhafen Harbour in Heligoland (Schubert, 2002); these records suggest a recent ingress and expansion of the distribution of *Geitodoris* into the eastern waters of the southern North Sea from the English Channel.

The discovery of a large, 42mm long specimen of *G. planata* on the underside of a rock in an extensive pool on the upper shore at Jackson's Bay, Scarborough, on 15 June 2010 is, therefore, of great interest and extends its distribution to the eastern seaboard of the British Isles. In overall appearance the specimen was handsomely coloured, the background colour of the mantle was orange, inclining to a rich yellow around the extreme edge and mottled with light brown and a few bright chestnut-brown blotches. A primary specific characteristic of *G. planata* is a number of very pale star-shaped patches along each side of the mantle, each with a centrally placed large tubercle. This was extremely obvious in the specimen and gave instant recognition of the find. This was further confirmed by examination of the head, which possessed the lateral oral tentacles not found in Sea Lemon. The rhinophores were dark brown with white tips, similar to those of *Jorunna tomentosa* but unlike those of Sea Lemon. No spots of brown pigment were evident on the underside of the mantle, a feature which the literature states as being a specific characteristic.

Two further specimens were found in different pools at Burniston Bay on 10 May 2012: a small specimen of 25mm total expanded length and a very large individual of 88mm total expanded length, alongside a large coiled ribbon of spawn. The mantle of the small specimen was pale yellow with diffuse, pale brown blotches in an even, almost bilaterally symmetrical pattern, and was the first indication that it was possibly not Sea Lemon. The rhinophores were brownish but the star-shaped patterns of acid glands on the sides of the mantle could only be discerned under a lens. The underside of the body, including both the mantle and the foot, was light yellow and minute points of brown pigment were scattered around the underside of the mantle.

The very large specimen greatly exceeded the maximum length given in the above literature but was still very much smaller than the giant specimens from the Dutch coast noted above. Its appearance was unattractive, of sombre greys and browns with blackish blotches on the centre of the mantle towards the circle of gills; the epidermis within the gill circle and surrounding the anus was also blackish. Two gill plumes were diseased, being stunted and swollen, but no parasites were found to account for this malformation. The star-shaped patches were obvious and numerous along both sides of the mantle, with additional ones on the front of the mantle below the rhinophores. A few spots of brown pigment were present on the underside of the mantle and the protruding dorsal surface of the foot was streaked and spotted with pale brown pigment. This specimen, although much darker, closely resembled Alder & Hancock's 1862 specimen shown in the supplementary volume of Elliot (1910 Part 8, Plate 1, fig.5). All three Yorkshire specimens were filmed and photographed *in situ*.

Other recent biological changes and new species in Yorkshire waters

The appearance of this large nudibranch is the latest in a number of biological changes recorded during the ongoing Yorkshire marine biodiversity survey commenced in 1967 (Whittaker, 2012). Three additions to the littoral taxa of local rocky shores, where these species were unknown thirty years ago, and a reflection of their increased status in Yorkshire waters, include the Velvet Swimming-crab *Necora puber*, the isopod *Zenobiana prismatica* and the Prawn *Palaemon serratus*, while a particularly interesting strand-line find is that of the first Yorkshire occurrence of Japweed *Sargassum muticum*.

Biological changes in off-shore taxa include increasing numbers of Sea Bass *Dicentrarchus labrax* and Red Mullet *Mullus surmuletus*, and the first appearance in Yorkshire waters of Black-bellied Angler *Lophius budegassa* and two decapod crustaceans, Angular Crab *Goneplax rhomboides* and Wrinkled Swimming Crab *Liocarcinus corrugatus*.

Velvet Swimming-crab *Necora puber*

This was formerly rare along the entire north-east coast, including the Yorkshire area. It was rarely seen by commercial fishermen and was not present on the shore, where the dominant crab was the Green Shore Crab *Carcinus maenas*. In 1967, Scarborough crab and lobster fishermen were specifically requested by the author to bring in specimens of this crab for display in newly-established marine aquaria at the Natural History Museum, but it was then so rare that none could be obtained. Odd specimens began to be increasingly returned by the fishing fleet but it was not until the early 1980s that the first occurrence of Velvet Swimming-crab was recorded from the Yorkshire shore, at Burniston Bay near Scarborough. Throughout that decade the numbers increased exponentially with such large numbers eventually being taken in crab pots and gill nets that a targeted Yorkshire fishery for the species began in the early 1990s with the crabs being exported to the continent, by which time it had also become a well-established inhabitant of the Yorkshire littoral zone. For a period in the late 1990s, some Scarborough in-shore trawlers were reporting that the crabs were so prolific in certain areas, particularly towards the south end of Filey Bay and towards Flamborough Head, that they had become a nuisance to fishing operations and were causing the boats to move elsewhere to avoid them. In the aftermath of easterly gales in March 2013, inestimable numbers of Velvet Swimming-crab were driven ashore at Fraisthorpe. This dramatic change has seen it become the dominant crab in shore pools along the Yorkshire coast, with Green Shore Crab occurring mainly in the upper levels of the shore and the harbours of the coast (pers. obs.).

Zenobiana prismatica

This is a small, unmistakable isopod with a parallel-sided body, short stout antennae and a rounded pleotelson, growing to a length of 14mm. Its distribution is Lusitanian, from the Mediterranean, Spain and Portugal extending north to the south-west of the British Isles and along the west coast to the Clyde sea. Its British status is described as rare, and with no distribution into the North Sea (Naylor, 1972; Haywood & Ryland, 1990). Because of this supposed rarity the species is not included in the many recently published popular guides

to the marine life of British shores. Given this apparent distribution, records of its occurrence within the North Sea are of great interest.

The first notice of *Z. prismatica* on the Yorkshire coast is given by Bird & Morris (1992) and it has subsequently been found to be common amongst algae of the middle shore in the Yorkshire area, and can be easily collected (pers. obs.). However, earlier records are extant from the Northumberland coast, from 1976, when it was found to be common in *Corallina* in Druridge Bay (Sheader, 2000). Given the British status of *Zenobiana* in the literature, these records present a surprising and apparently anomalous occurrence within the North Sea and pre-date the increase in records of similar warm-water taxa in the central North Sea from the late 1970s, and the later discovery of *Z. prismatica* on the Yorkshire coast.

Zenobiana is known to inhabit a nest in crevices and holes in algae etc. (Naylor, 1974), and can be, very rarely, encountered fully exposed and easily visible during normal collecting on the shore. Only three such specimens have been seen in Scarborough by the author, the first at Jackson's Bay, in September 2005, the second found fully exposed on the underside of a rock in the South Bay, on 17 February 2010, while another was found in the same area in March 2010. The individual was found, again fully exposed, on the underside of a boulder without any form of nest or concealing case. On the Northumberland coast it is reported from eulittoral fine sand dominated by lugworms *Arenicola* sp.

Common Prawn *Palaemon serratus*

This prawn (see Plate I, centre pages) was previously common only on the Welsh and Channel coasts and formerly very rare in the central North Sea; thus its status at Cullercoats was stated by Dr. H.O. Bull to be extremely rare, there having been only two finds there within a century (Cole, 1958). Since then there have been just a few unconfirmed reports (Moore, 2000). The records for the Yorkshire coast were just as meagre until the last decade, when specimens began to be taken both in the trawl and in crab pots, particularly to the south of Scarborough, in the traps of the Bridlington fishermen working along the extensive Holderness coast. The numbers being caught prompted some fishermen to consider the commercial deployment of special pots for their capture. It is now frequently seen off Scarborough and, as with Velvet Swimming-crab, this prawn has extended into the Yorkshire littoral zone and may be found in the rock pools of the shore (pers. obs.).

Japweed *Sargassum muticum*

Following extended easterly gales in March 2002, drifted fronds of Japweed were found at two Yorkshire localities 40 miles apart, Fraisthorpe and Robin Hoods' Bay, constituting the first records of this alien alga on the Yorkshire coast (Whittaker, unpublished). Japweed was first discovered as attached plants on the British coast at Bembridge, Isle of Wight, in 1971 (Farnham *et al.*, 1973) and subsequently spread along the south coast, eventually entering the southern North Sea and spreading along the coasts of Belgium, Holland, Germany, Sweden and southern Norway. On the English coast it has extended to Suffolk

and Norfolk (Critchley *et al*, 1983, Rueness, 1989). The drifted fronds found on consecutive days at Fraisthorpe and Robin Hood's Bay could conceivably, therefore, have originated from either the English or the European coastline of the southern North Sea; no attached plants have so far been discovered on the Yorkshire coast.

Change in status of Sea Bass *Dicentrarchus labrax*

This fish of southern distribution, previously regarded as uncommon in the North Sea (Wheeler, 1969), has been noted on the Yorkshire coast from the earliest days of biological recording but has never been present in any number, constituting only an occasional catch of usually small, single individuals in trawls and in summertime salmon-netting operations; similarly, the fish has been known as an occasional but unpredictable catch by Yorkshire shore anglers. With such a previously low frequency of capture, there are no historical commercial statistics for Bass within the Yorkshire fisheries. Increasing capture of this fish became noticeable in the early 1990s from the gill and trammel-netting fishery, which eventually led to the specific targeting of the fish by trawling, particularly off Filey Bay and Flamborough Head, where assemblages of the fish, including running ripe mature fish, now occur during the winter months (pers. obs.).

Changes in status of Red Mullet *Mullus surmuletus*.

Formerly a fish of southern waters, the Channel and, in limited numbers, the south-eastern North Sea, this fish occurred in very small numbers elsewhere throughout the North Sea and Scottish waters, being generally regarded as rare in these areas (Wheeler, 1969). Incidence for Yorkshire waters has always been low in the past, in some years occurrences not even reaching double figures. However, very small juvenile fish of some 7-10cm total length, not previously known to be present on the Yorkshire coast, were discovered from infrequent findings during the survey in Cod *Gadus morhua* stomachs but, because of their small size, were not being found in trawl samples.

Shoaling of this fish within the central North Sea showed a marked increase through the 1990s, with a brief yearly fishery developing on a centre of increasing aggregation discovered to the south-east of the Dogger Bank. Despite the subsequent targeting of this shoaling area for a brief period in summer by numerous boats of various north-east ports, including Whitby and Scarborough, together with French boats, Red Mullet appears to be increasingly successful in the North Sea. Fishing activity on this area was heavy in 2001 and included two Whitby boats landing some 1750 kilos of the fish one morning in late June, giving an indication of the strength of Mullet shoals within the central North Sea at that time.

During the last two decades, records of the occurrence of this fish on the Yorkshire coast increased steadily to the point where it is was frequently the case that as many Red Mullet appeared on just one day's market at Scarborough as were previously accumulated in 2, 3 or more years of records in the early days of the survey. More recently, young Red Mullet

15-18cm total length have been a common feature of Cod stomach contents in winter catches from near Flamborough Head.

Black-bellied Angler *Lophius budegassa*

The appearance of this fish in the central North Sea and Yorkshire waters over the last twenty years has been documented in a previous paper (Whittaker, 2012). Poor returns from fishing activity off the Yorkshire coast since that paper was written have forced fishing activity to take place chiefly to the north of Whitby, where this fish is now very frequent in the catches off the Hartlepool sector with, on occasion, some 20% of the *Lophius* catch being of this species.

Angular Crab *Goneplax rhomboides*

The distribution of this crab (see Plate I, centre pages) was previously confined to the Atlantic coasts of the British Isles, its range extending up to the Scottish west coast, but it was regarded as absent from the North Sea basin (Ingle, 1980), although a single occurrence had been recorded from 11 miles east of Blyth by J.A. Allen in October 1963 (Moore, 2000). The crab is an inhabitant of soft, sometimes sandy, mud, and on the west coast even occurs on the shore in suitable localities. Such deposits are scattered throughout the North Sea, and are frequently occupied by colonies of Norway Prawn *Nephrops norvegicus*, one of the most extensive being off the coast of Northumberland and extending south to the Whitby Fine Ground. Angular Crab was recorded as 'rare' during a diver survey on the sandy ground off Newbiggin in July 1992 (Woolmington, 1994); single specimens were found at the North West Rough area of the Dogger Bank in 1998 and on Smith's Knoll off Yarmouth in 2000 (d'Udekem d'Acoz, 2001) and soon afterwards specimens were also recorded off the Dutch coast (Ruijter, 2004; Oosterbaan, 2005). Despite the intense trawling of the Norway Prawn ground off the north-east coast every day for decades, the increasing occurrence of the crab in the trawl discard material was overlooked until 2006, when a specimen taken on the Whitby Fine Ground was returned from a Scarborough whitefish trawler. An immediate examination of by-catch material from Norway Prawn trawlers working off the Hartlepool area then confirmed the abundant numbers of this crab occurring in the by-catch, with *Calocaris macandreae* (Bell) also present, although the latter was previously known to be in the area. Remains of the crab have also been found in the stomachs of Cod taken much further off near Baymans Hole, some 40 miles distant from the coast. More recently, in 2008, the crab was recorded for the first time off the German coast (Neumann *et al.*, 2010), and was also discovered in Swedish waters the same year (Berggren, 2008).

Wrinkled Swimming-crab *Liocarcinus corrugatus*

The previously known distribution of this crab was similar to that of Angular Crab above, its range extending up the west coast to the Orkneys but absent to the east and from the greater North Sea basin, although Ingle (1980) included an unconfirmed and dubious suggestion of a record from Yorkshire. This same distribution is also given by Clarke (1986). A single record of this crab was made by Johnston in the 1830s (Embleton, 1834) from off

the Berwickshire coast and, curiously, echoes the historically known distribution of *Geitodoris*, shown above, in that the otherwise west coast/Atlantic distribution had managed to penetrate just as far as the south-east Scottish/Northumberland border coast. This record, as with the earlier records of *Geitodoris*, has been regarded until very recently as highly suspect. Despite the intense biological recording of the English north-east coast during the 19th and 20th centuries, there are no further records of this crab from the area until April 2011, when a carapace was found on the beach at Bamborough (d'Udekem d'Acoz, 2011), thus validating the singular earlier record from that area by Johnston.

This crab has never been seen during many years of sampling Yorkshire marine biological material, including trawl samples and fish stomach analyses. The first reports that some fishermen working Bridlington Bay and the Holderness coast were finding this crab in their shellfish traps were received in 2010 and the identification was confirmed when specimens were eventually secured. The crab is at present known locally only from this southern sector of the Yorkshire coastal area but may be expected to eventually extend much further north. There is no doubt that Wrinkled Swimming-crab has only very recently appeared in the area.

The significance of hydrographic criteria in relation to the Yorkshire marine biota

The biodiversity of the Yorkshire coast is determined by the hydroclimatic vagaries of the North Sea circulation impinging along the coast. The complex hydrographic system of the North Sea basin is well-known, with variable inflows of oceanic water entering from both the north and the south but with the only general outflow from the basin occurring along a narrow corridor close to the Norwegian coast (Lumby, 1932; Turrell *et al.*, 1992).

The greater influx from the north is derived mainly from the Gulf Stream via the North Atlantic Drift, together with some input from the surfacing of the underlying Lusitanian current. This inflow turns south within the basin, flowing down the western margin, its impetus slowly dissipating along the North East and Yorkshire coasts. This south-going circulation is responsible for most of the occurrences of exotic fishes from the Atlantic and fishes from more northern latitudes, such as Sun-fish *Mola*, Opah *Lampris guttatus*, Ray's Bream *Brama brama*, Greater Forkbeard *Phycis blennoides*, Dealfish *Trachipterus arcticus*, Oarfish *Regalecus glesne*, together with oceanic squids including *Todaropsis*, *Illex* and *Architeuthis*, and other organisms such as the Buoy Barnacle *Dosima fascicularis*, reaching the Yorkshire coast. The recent Yorkshire occurrences of the Leatherback Turtle *Dermochelys coriacea* and the Pilot Fish *Naucrates ductor* are examples of such exotic animals following this current (Whittaker, 2012).

The circulation of the basin is influenced by the Coriolis force which, between Flamborough Head and the Humber, creates a cyclonic (anticlockwise) turn of the water towards the east around the southern end of the Dogger Bank in a somewhat confused stream that contains small cyclonic eddies, with a greater eddy at the south-east corner of the Dogger. This front, extending to the east of the Humber, and across the Silver Pits, delineates within

varying degrees the southernmost or northernmost distribution limits of many organisms within the North Sea. The Slipper Limpet *Crepidula fornicata* is extremely common to the south and within the Silver Pits but is extremely rare further north and off the rest of the Yorkshire coast. Similarly, while there are abundant records for the Sting Ray *Dasyatis* to the south of this front, this fish very rarely penetrates further north to the Yorkshire coast, most of the rare occurrences being restricted to small juvenile fish (pers.obs.).

Due to the Coriolis effect, warmer water entering from the Channel via the Dover Straits flows principally to the east along the continental coast towards the Heligoland Bight but a smaller flow extends to the west, flowing north along the English coast and dissipating near the Humber. This is responsible for the Yorkshire occurrences of southern fishes such as Sea Bass, Red Mullet, John Dory *Zeus faber*, the members of the Sea-breams and probably also the increasing Yorkshire occurrences of the Atlantic Bonito *Sarda sarda*. This current has also assisted the spread and establishment of Japweed as far as the Norfolk coast. The distribution of the warm-water squid *Loligo vulgaris* extends from the Channel into the southern North Sea, principally off the continental coasts where it is known to reproduce but, due to this circulation, this squid also occurs with sporadic but low frequency as far north as Scarborough (pers obs.), where it was unrecognised by Stevenson (1935).

This water mass induces the introduction of organisms of a southern distribution from the Channel into the southern North Sea, where most establishment of invasive biota takes place along the continental coasts, as typified by Japweed that has thus penetrated as far north as Sweden and southern Norway. The recent occurrence of the nudibranch *Geitodoris* on the Netherlands and German coasts has followed this pattern of invasion.

Although the western margin of the North Sea basin is thus roughly divided by circulation into two sectors at the approximate latitude of the Humber, this overall picture is highly variable since the influx of water from either entrance to the basin may vary to a greater or lesser extent from year to year. In addition to the underlying residual currents thus created, the complexity of semi-diurnal tidal cycles of ebb and flood within the basin creates temporary daily reversals of flow and therefore differing transport paths depending on the state of the tide at any given locality.

Although the residual current of the Yorkshire coast is from north to south, a tidal flow from south to north becomes evident for a period during the ebb cycle before and after high water at Dover, during which period drifting and pelagic organisms can be transported contrary to the normal residual current. In the southern North Sea these tidal cycles also create flows contrary to the residual current there (Anon, 1942), allowing the transport of larvae or drifting organisms from the continental to the English coasts. Additional meteorological conditions of extreme southerly or easterly gales may enhance these tidal streams and such transport pathways, hence the recent occurrence of drifted Japweed as far north as Robin Hood's Bay. The occurrence of this alga also demonstrates a possible

mechanism for the progressive direct transport of small organisms to the Yorkshire coast from waters to the south and east, such as *Zenobiana*, by clinging to drifting flotsam.

Discussion

The changes in biodiversity noted for the Yorkshire coast denote immense biological changes taking place here as elsewhere within the North Sea, with many species either newly colonising or expanding their range within this semi-enclosed sea basin, as a result of climatic change and increasing sea temperatures, those of British coastal waters having risen by up to 1°C since the mid-1980s (Hawkins *et al.*, 2003) and those of the southern North Sea being particularly noticeable. Increasing and pronounced climate-induced response of the marine ecosystem has been recorded, including the more pronounced warming of the north-east Atlantic over that of the global average (Intergovernmental Panel on Climate Change, 2007).

The Yorkshire coast is somewhat unique in the overlapping hydrographic influences it receives, since it is at the tail end of currents derived from the Gulf Stream via the North Atlantic Drift but also receives influence derived from the Channel influx and may, therefore, receive invasive biota from either north or south. The question as to how taxa newly arrive or expand within the Yorkshire area is not easily answered and may be different for some of the various taxa under consideration. The warming of the North Sea is considered to be responsible for the increased numbers of the commercially valuable Sea Bass and Red Mullet off the Yorkshire coast since 1990, but crustaceans in particular appear to have benefited from the increase in water temperatures (Lindley *et al.*, 2010; Lindley & Kirby, 2010). The earliest Yorkshire indicator of these changes was the Velvet Swimming-crab whose population is considered to have begun to expand locally towards the end of the 1970s and which by 1990 had become prolific.

The presence of *Zenobiana* in the area is more problematical. It had either been completely overlooked in the North Sea prior to 1976 or has extended its range into the North Sea in recent decades. Without special collecting techniques, species inhabiting cases of hollow algal fragments or nests among algae could perhaps easily be overlooked. However, since individuals can on rare occasions be discovered without any form of concealment, and given that this species is very distinct and instantly distinguishable from all other marine isopods, it is unlikely to have been so overlooked for any length of time on the Yorkshire coast, prior to the survey by Bird & Morris (1992). *Zenobiana* must, therefore, be regarded as having extended its distribution to the central North Sea in recent decades.

The north-east population expansion of Angular Crab appears to have taken place from the 1990s and, from the vast numbers already present in the north-east Norway Prawn by-catch in 2006, must have been equally as rapid as that of Velvet Swimming-crab. Neumann *et al.* (2010) suggest that the expansion of Angular Crab in the southern North Sea may have been due to the enhanced survival of larvae that had entered from the Channel, due to the increase in sea temperature, particularly as winter sea temperatures there are also

higher than formerly. However, this explanation does not take into account the considerable eruption of the population off the Northumberland coast much earlier in the decade, the first German and Swedish specimens not being recorded until 2008 from areas that had been sampled frequently over many years previously, and it would therefore be more reasonable to consider that the increase in population was triggered in the north-eastern North Sea, with the population increasing rapidly through the rest of the North Sea through successive years of increasing numbers of larvae being transported down the North Sea.

The increase in abundance of the Common Prawn has similarly taken place within the last decade, while the extension of the range of the Wrinkled Swimming-crab is even more recent and has taken place within the last five years. Both of these events occurred at the southernmost extent of the Yorkshire coast and both these crustaceans of southern, warm-water distribution are considered to have expanded their range to the Yorkshire coast from the southern North Sea.

The nudibranch *Geitodoris* has no previous historical record within the North Sea basin other than the proven tentative, rare presence from offshore in the Berwickshire area, but there is no evidence of even minor spread from this locality to the immediately adjacent coastline. Although this nudibranch has long been recognised to have a greater occurrence in the warmer conditions of the Channel coasts, it has only increased its range to the southern North Sea within the last decade and it is therefore considered that its occurrence on the Yorkshire coast is, like those of Common Prawn and Wrinkled Swimming-crab, a signal of climate change and the result of northward expansion from the warmer southern North Sea, rather than from the apparently static and small Berwickshire population.

It is pertinent to note that three of the changes described here have given additional opportunity to the Yorkshire fisheries, with targeted and previously unknown commercial exploitation of Velvet Swimming-crab, Red Mullet and Sea Bass developing here from 1990. Despite these new opportunities, the historically important gadoid fisheries have collapsed and moved northwards away from the Yorkshire coast.

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Seasonal trends in emergence times and culling pressure on the Red Fox in lowland South Yorkshire

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Introduction

The Red Fox *Vulpes vulpes* is mainly nocturnal and crepuscular with an element of diurnal activity, though this is dependent on the degree of local persecution. For instance, where foxes are tolerated, daylight sightings are quite frequent in city centres. In summer they may remain active long after dawn, especially the vixens when feeding young cubs (Baker & Harris, 2008).

Post-emergence behaviour as monitored by radio tracking is highly variable. A rural study in southern England showed that activity peaked in the hours after sunset and before sunrise (Reynolds & Tapper, 1995). In one study of urban foxes they were found to be most active after midnight (Woolland & Harris, 1990) and a study in urban Oxford showed that activity levels declined after midnight (Doncaster & Macdonald, 1997). The Oxford foxes were active for a mean of 6 hours 52 minutes irrespective of time of year, this being made up of cycles of active and resting periods characteristically of 2 to 2½ hours long. Similar studies in Bristol revealed a mean nocturnal activity periods of 8 hours 12 minutes (Saunders *et al.*, 1993).

Though seasonal trends in the timing of the nocturnal emergence of the Badger *Meles meles* are well documented (see Neal, 1977 and 1986), as yet there are few equivalent published analyses of the emergence behaviour in the Fox, despite the popularity of watching urban Foxes and with the recent availability of electronic devices to remotely monitor mammal activity.

Sources and methods

In 1970 Mr Jim McGarry, working as a gamekeeper/pest control contractor, deposited at Doncaster Museum and Art Gallery a set of five 'Lion Brand' writing pads filled with his notes, records and observations of Foxes within the lowland agricultural parishes of Thorpe in Balne (SE5910), Kirk Bramwith (SE6111), Fishlake (SE6513), Sykehouse (SE6216) and Moss (SE5914) situated between the tidal rivers Don and Went within the Metropolitan Borough of Doncaster.

Among these notes were observations made in 1969 at a series of natal Fox earths. Sixty nocturnal visits were made to one site simply referred to as 'Fox Holes'. On thirty-nine of these visits the times at which Foxes first emerged were recorded. The nature and outcomes of eighteen culling incidents throughout the study area were also recorded. These data form the basis of the current study.

Since British Summer Time (BST) was experimentally extended from 18 February 1968 to 31 October 1971, the entirety of 1969 remained as BST; consequently it was not necessary to convert timings between GMT and BST in spring and autumn. These times have been plotted against days after 1 January and compared with local daily sunset times for 1969 obtained from nearby Finningley (Robin Hood) Airport located at 53°28'1"N 1°0'0".

Results and discussion

Figure 1 shows that emergence times varied from as early as 1,081 minutes (18.01hrs) on day 46 (15 February) to as late as 1,220 minutes (20.20hrs) on day 167 (16 June) and broadly oscillated around sunset time, ranging from 43 minutes before to 33 minutes after sunset with a mean of 15.2 minutes before sunset. Unlike equivalent graphs for the emergence times of Badgers (*loc. cit.*) and Daubenton's Bats *Myotis daubentonii* (Oxford *et al.*, 1996) which show an even seasonal association with sunset time, figure 1 indicates Fox

emergence up to day 125 (5 May) to be exclusively after sunset and thence exclusively before sunset.

By representing sunset time as zero and showing emergence times as minutes before or after sunset, figure 2 allows a clearer analysis of the relationship between sunset and the seasonal patterns of emergence behaviour. In the early part of the breeding cycle when the cubs were at an early stage of development, remaining constantly below ground, the series of emergence times ranged from 105 minutes to 10 minutes (mean 48.5 minutes) after sunset.

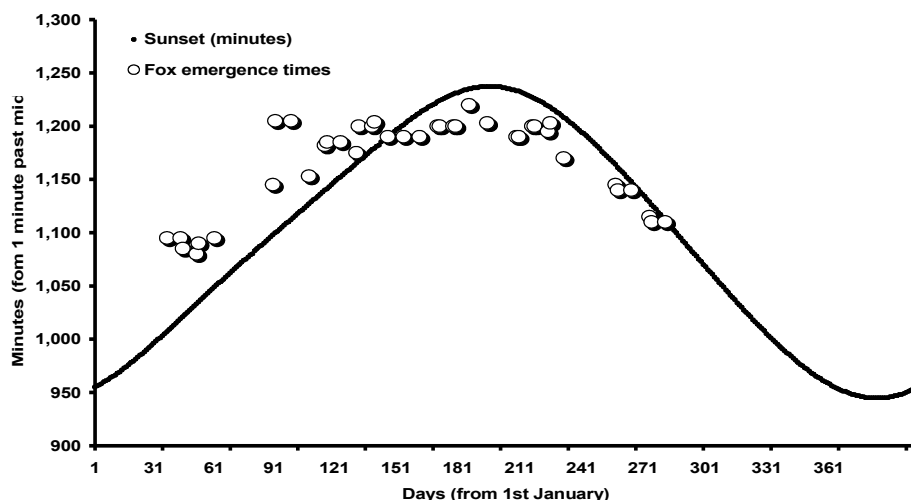


Figure 1: 39 emergence times of Foxes plotted against local sunset time (BST).

The general trend during this period, however, was for emergence to become progressively earlier with emergence precisely at sunset on 11 May (day 131). Above-ground activity is known to be reduced on cold wet nights (Baker & Harris, 2008); indeed this study shows that particularly late emergence times coincided with periods of windy, cold and stormy weather (see figure 2).

From late April, when cubs begin to appear above ground (Harris & Baker, 2001), emergence times became progressively earlier, the earliest time 43 minutes ahead of sunset being recorded on 6 and 7 July. During July and August, when cubs increasingly lie up away from the natal earth (Harris & Baker, 2001), the trend in observed evening activity times became progressively later, the last time recorded on 9 September being just 2 minutes before sunset. Recorded emergence times were cut short on 10 September and we see from Mr McGarry's notes that the natal earth was gassed on 11 September (day 254). Despite 21 evening visits from 17 September no sign of re-occupancy was noted until 25 December.

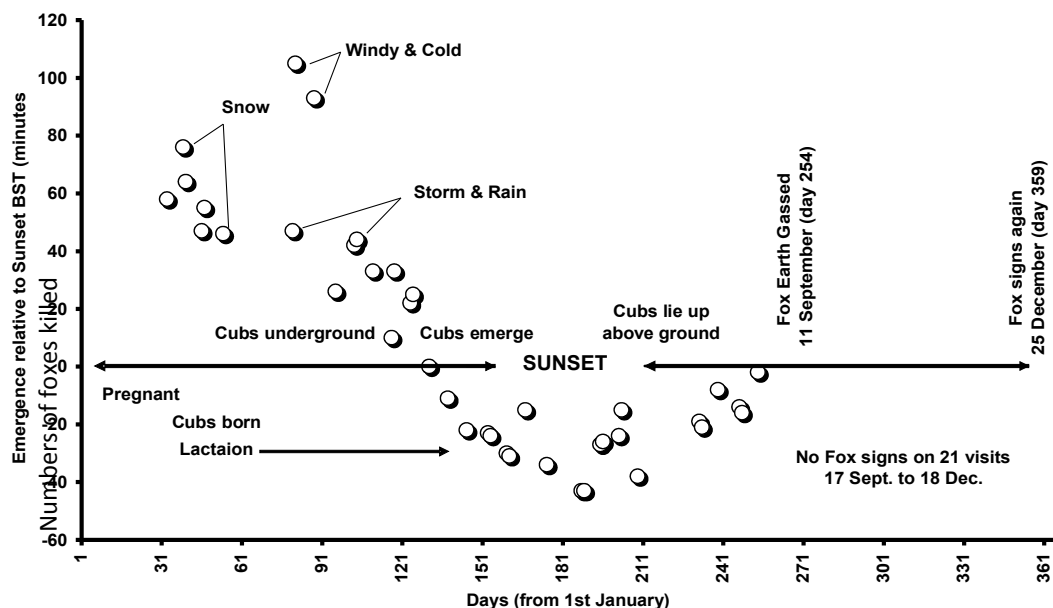


Figure 2: Emergence times of Foxes related to weather conditions and cub development. Seasonality of cub activity based on Harris & Baker (2001).

Mortality

During the year there were nine cases of occupied earths being dug out and four cases of earths being gassed. Culling methods were shooting 24 (34%), terriers 9 (13%), gassing 5 (7%), hunting 2 (3%), not stated 30 (43%). Since the bodies of gassed animals remain underground unless dug out, it is likely that body counts of gassed foxes are under-recorded. Of the 70 foxes culled from the local population in 1969, cubs numbered 49 (70%), adult vixens 12 (17%) and adult dog foxes 9 (13%), the seasonality of recorded culling is shown in figure 3. Within the 55 x 1km² study area the culling pressure equated to 1.27 per km².

Since annual cub survival and population levels can fluctuate widely according to land use, game management, weather and levels of disease, it is difficult to judge how significant this culling level may have been. The Game Conservancy Trust based population estimates of adult Foxes at the start of the breeding season in 1995 to 1997 on night counts conducted using spotlights along roads in East Anglia, the Midlands and mid-Wales (Heydon *et al.*, 2000). In these areas it was estimated that Fox densities varied from 0.16 to 1.17 Foxes/km² though it is now widely believed that this method underestimates population figures (Baker *et al.*, 2006).

The Mammal Society national Fox survey of 1999/2000, based on counts of Fox droppings in 444 sampled 1km squares in different landscapes across Britain, revealed Fox densities ranging from 0.21 to 2.23 per km² (Webbon *et al.*, 2004). On the basis of these surveys it would seem that the culling pressure in the interests of game preservation in our Doncaster

study area was particularly high, though it was ironic, considering the political antipathy to fox hunting, that the local fox hunt only accounted for 3% of the overall cull.

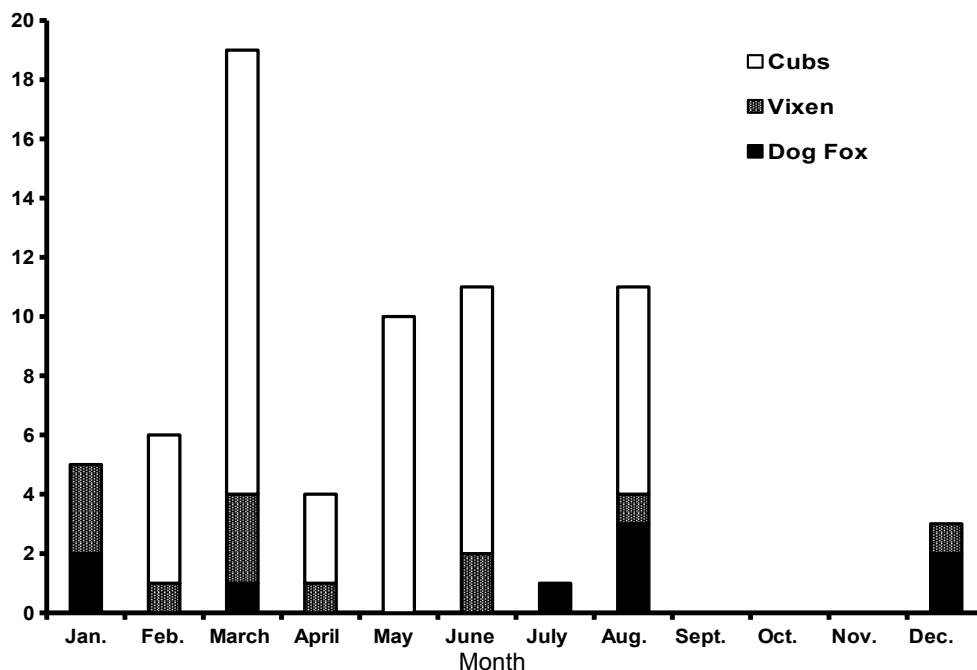


Figure 3: Seasonality of 70 Foxes killed in the study area during 1969.

Acknowledgements

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Field Note: Herring Gull feeding on Swallow

On a visit to Doncaster Lakeside Park (SE594016) at 5pm on 5 May 2012, under an overcast sky and with a brisk and chilly easterly wind creating choppy water conditions, the main body of the lake was being actively worked for insects by hundreds of migrating Swallows *Hirundo rustica*, House Martins *Delichon urbicum* and Sand Martins *Riparia riparia* with a small number of Swifts *Apus apus*. The birds were hawking very low in a zone no more than 3m above the water surface. In mid-water, out amongst this busy turmoil of hawking hirundines, were small numbers of feeding Great Crested Grebes *Podiceps cristatus*, Tufted Duck *Aythya fuligula*, Coot *Fulica atra* and apparently roosting Black Headed Gulls *Chroicocephalus ridibundus*, Common Gulls *Larus canus* and Herring Gulls *Larus argentatus*. Two of the adult Herring Gulls were creating a conspicuous and static symmetrical pattern, appearing to be attached at the beak and holding or stuck to a black object. After a few moments one of the gulls broke free and the dark object could be identified as the body and narrow swept-back wings of a Swallow. Whether the Swallow had ditched in the choppy water and been scavenged or been plucked from the air by one of the gulls was not seen, but the incident represented an interesting seasonally opportunistic feeding behaviour of these large gulls.

Placing this anecdote in context, John Wint of the YNU Ornithological Section comments "It is common to see the larger gulls feeding on - or even attacking for 'fun' - incoming migrants just offshore on the east coast in the autumn". Subsequent visits to Lakeside have found the remains of two Swallows and one Swift amongst the shoreline flotsam, indicating that these aerial-plankton feeders do occasionally ditch while hunting over choppy waters.

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Tree colonization following sheep exclusion alongside the A169 across the North York Moors

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Introduction

Wide expanses of upland heath, dominated by Heather *Calluna vulgaris* and essentially devoid of trees, are characteristic of the North York Moors National Park (Atherden & Simmons, 1996). The land is maintained and managed by periodic burning and is used for grouse shooting and sheep grazing. Soils are generally shallow, overlies Jurassic sandstones and shale and are leached, acid and nutrient-poor. They have an underlying iron-oxide pan which is impermeable to plant roots, hinders drainage and locks up nutrients beneath it. The lack of trees is a result of human activity: today's moorlands were once forest. This is evidenced by the remains of forest-derived soils found beneath Bronze Age barrows (Dimbleby, 1962) and by extensive studies of pollen preserved in peat deposits (Atherden, 1992). For example, the pollen record for Fen Bog (Atherden, 1976a, 1976b, 1999), a site that is within 0.5km of the road addressed in this article, suggests that in the early post-glacial period, from about 10,000 years ago, birch and then pine were important in the area. From c.7,000 years ago to c.2,300 years ago, a period that encompassed the probable hunter-gatherer and shifting agriculture of Mesolithic, Neolithic and Bronze Age cultures, oak and alder were important, albeit with an increasing proportion of grass and herb pollen latterly. Following this, and corresponding with Iron Age and Romano-British culture, and increased demand for timber and more settled agriculture, tree pollen became less dominant while that of grasses and herbs increased and cereals appeared. During the Dark Ages (c.1,600 to 1,100 years ago) and again in the Post-Medieval Period (c.430 to 180 years ago) the pollen record suggests transient increases in tree and shrub cover, notably birch and Hazel *Corylus avellana*, although Heather pollen was also important, indicating that open ground remained. These resurgences were presumably related to depression in agricultural/socio-economic conditions. The final preponderance of Heather pollen was established about 180 years ago, indicating a mid-19th century shift to the present-day regime of Heather moorland.

A number of major roads cross the moors and many of them are now fenced to prevent collisions between vehicles and sheep. Atherden (1992) points out that this leaves a strip of ungrazed moorland between the carriageway and the fence which might eventually be colonized by trees and shrubs; a succession that might be interesting to study. The A169 Whitby-Pickering road from the top of Blue Bank (NZ867058), 11.5 km southwards to Saltergate Bridge (SE853948), is an example of a fenced main road that crosses open moorland. A plaque in the car park adjacent to the top of Blue Bank was "unveiled October 1988 following completion of the Pickering to Whitby Moorland Road Fencing Project to prevent the killing of sheep on the highway". There has been regeneration of trees and shrubs alongside this road over the 25 years since sheep were excluded. This is obvious to

travellers along the A169 and the fact that the process has entered the popular consciousness is suggested by the tinsel and bauble decoration of occasional conifers as if they were Christmas trees. The relevance of the fence to regeneration is shown, for example, by comparison with the minor road to Goathland which diverges from the A169 at NZ855034; this road, which remains unfenced, traverses the Heather-dominated Goathland Moor and has margins that are devoid of trees and shrubs.

The work described in this contribution: (1) counted and identified trees and shrubs along the west side of the A169 between the top of Blue Bank and Saltergate Bridge; (2) recorded trees and shrubs beyond the roadside but in the environs of the A169 that are potential sources of seed; (3) compared the rate of regeneration of trees and shrubs along the upland roadside with that at Dalby Forest, a more favourable habitat in the North York Moors area; (4) explored reasons for a relatively slow rate of tree colonization along the A169 roadside.

Trees, shrubs and ground vegetation along the A169

Almost all of the 11.5km of road between the top of Blue Bank and Saltergate Bridge is above 200m altitude (Fig. 1). The highest point (288m) is at 2.65km while low points are at the crossing of Brocka Beck (200m) at 5.2km and Eller Beck (170m) at 7.9 km (distances are by road from the top of Blue Bank). Along the west side of the road the fence is generally sited 20-25m from the edge of the carriageway, is usually about 1.1m in height and consists of strands of galvanized wire stapled to round wooden posts about 1.9m apart. Mostly there is a roughly-mown grassy verge alongside the tarmac, about 3m wide, then a ditch and then Heather-dominated moorland, or in some places rough grassland, up to the fence. The Heather on the roadside is not subject to burning nor is that immediately adjacent to the fence on the far side, presumably to spare the fence posts from fire. An additional feature is that between 2km and 3km the fence diverges to about 125m from the road. Also, at about 7.9km, where the Yorkshire Wildlife Trust's Fen Bog Reserve (established 1964; Round, 2012) abuts the A169, the fencing turns westwards at about 100m north and about 300m south of Eller Beck to enclose the Eller Beck Valley west of the road. This valley, protected from burning and grazing, has a long-established community of trees and shrubs.

For recording purposes, the road was divided into twenty-three 0.5km sections and the trees and shrubs in each section along the west side of the road between the carriageway and the fence were identified and counted. Recording, from June to November 2011, was done on foot and separate note was made of individuals more than 2m in height. In addition the parallel strip of 20-25m wide heathland beyond the fence was scanned for trees and shrubs. Those along the roadside at Eller Beck, where both the roadside and the valley beyond are protected from grazing, were not included because they represent a long-established community rather than recent regeneration. Hence in the section from 7.5-8.0km south of Blue Bank only the northern 300m were recorded, while in the section 8.0-8.5km only the southern 300m were recorded. Ground flora at about the mid-point of each 0.5km section was recorded on both sides of the fence. A 2m x 2m quadrat was placed

in representative vegetation and vascular plants and bryophytes were identified and scored according to their approximate ground cover using the Braun-Blanquet abundance scale (Kent, 2012).

Twenty-four species of trees and shrubs were found between the carriageway and the fence (Table 1 and Plate II, centre pages). This is omitting several low-growing woody heathland species that were also present; i.e. Heather, Crowberry *Empetrum nigrum*, Bell Heather *Erica cinerea*, Cross-leaved Heath *Erica tetralix*, Bramble *Rubus fruticosus* agg. and Bilberry *Vaccinium myrtillus*.

Table 1. Trees and shrubs recorded on the west side of the A169 between the carriageway and fence over 11.5km southwards from the top of Blue Bank to Saltergate Bridge; June–November 2011.

Species of tree/shrub	<i>n</i> of 0.5km lengths of road in which species recorded (out of 23)	<i>n</i> of individuals >2m height	Total <i>n</i> of individuals
<i>Acer pseudoplatanus</i> (Sycamore)	1	0	1
<i>Betula pendula</i> (Silver Birch)	10	9	27
<i>Betula pubescens</i> (Downy Birch)	18	15	64
<i>Cotoneaster horizontalis</i> (Wall Cotoneaster)*	1	0	1
<i>Crataegus monogyna</i> (Hawthorn)	21	22	94
<i>Cytisus scoparius</i> (Broom)	1	0	6
<i>Fraxinus excelsior</i> (Ash)	9	4	20
<i>Ilex aquifolium</i> (Holly)	4	2	6
<i>Juniperus communis</i> (Common Juniper)*	2	0	8 [†]
<i>Picea abies</i> (Norway Spruce)	2	1	2
<i>Picea sitchensis</i> (Sitka Spruce)	5	3	6
<i>Pinus contorta</i> (Lodgepole Pine)	7	12	23
<i>Pinus pinaster</i> (Maritime Pine)*	1	1	1
<i>Pinus sylvestris</i> (Scots Pine)	6	7	22
<i>Prunus spinosa</i> (Blackthorn)	7	0	10
<i>Quercus cerris</i> (Turkey Oak)*	3	2	3
<i>Quercus petraea</i> (Sessile Oak)	2	1	2
<i>Quercus robur</i> (Pedunculate Oak)	1	0	1
<i>Rosa canina</i> (Dog-rose)	16	2	84
<i>Salix alba</i> (White Willow)	2	0	2
<i>Salix caprea</i> (Goat Willow)	11	6	41
<i>Salix cinerea</i> (Grey Willow)	18	45	205
<i>Sorbus aucuparia</i> (Rowan)	23	40	175
<i>Ulex europaeus</i> (Gorse)	10	0	>250
Total of all species (except Gorse)	-	172	804

*Not otherwise recorded within 1.0km of the road. [†]Includes four Juniper surviving from a batch planted in rabbit guards.

Gorse *Ulex europaeus* was especially abundant immediately south of the top of Blue Bank with >200 individuals recorded between 0-0.5km. Otherwise the most abundant species were Grey Willow *Salix cinerea* with 205 individuals, Rowan *Sorbus aucuparia* 175 individuals, Hawthorn *Crataegus monogyna* 94 individuals, Dog-rose *Rosa canina* 84 individuals and Downy Birch *Betula pubescens* 64 individuals. Coniferous trees were most notably represented by Lodgepole Pine *Pinus contorta* 23 individuals and Scots Pine *Pinus sylvestris* 22 individuals. Most trees and shrubs were small. Only 172 (21%) out of a total of 804 individuals (which excludes Gorse) were >2m in height; these included 45 Grey Willow, 40 Rowan, 22 Hawthorn, 15 Downy Birch and 12 Lodgepole Pine. The more widely distributed species, in that they occurred in more of the 0.5km sections, were Rowan which was recorded in all 23 sections, Hawthorn in 21 sections, Downy Birch and Grey Willow both in 18 sections, Dog-rose in 16 sections, Goat Willow *Salix caprea* in 11 sections and Silver Birch *Betula pendula* and Gorse both in 10 sections. There were many more trees and shrubs in the fenced-off roadside strip than on the open moorland beyond; altogether only five individuals were recorded along 11.5km of road in the 20-25m wide parallel strip west of the fence (2 Gorse, 2 Downy Birch, 1 Rowan).

The species richness of trees and shrubs per 0.5km of roadside was very variable and ranged from 2-14 species (Fig.1). Species richness was higher closer to the top of Blue Bank (8-14 species per 0.5km between 0-5.0km) than further south (2-6 species per 0.5km from 8.0-11.5km). Exceptions to this were high values of 11 and 10 species per 0.5km close to the Eller Beck Valley at 6.5-7.0km and 7.5-8.0km. Linear regression analysis indicated significant decrease in species richness with distance southwards ($P<0.01$).

The density of total trees and shrubs per 0.5km and of those >2m high decreased with distance southwards ($P<0.01$), although there was quite a lot of irregular variation superimposed on this pattern (Fig.1). Thus the total number of trees and shrubs (excluding Gorse) from 0-4km south of Blue Bank ranged from 29-109 per 0.5km compared to 8-25 per 0.5km from 8.5-11.5km. Similarly, trees >2m high ranged from 4-21 per 0.5km from 0-4km south of Blue Bank compared to 2-7 per 0.5km between 8.5-11.5km. No relationships were found between mean altitude of each 0.5km section of road and species richness, n of total trees/shrubs, nor n of trees/shrubs >2m ($r=0.37-0.40$, $n=23$, $P>0.05$). The most obvious feature of these quantitative results is that, although the regeneration of roadside trees is eye-catching, the absolute density of trees and shrubs remains low after approaching 25 years of regeneration. The total roadside area surveyed, from which sheep were excluded, was approximately 30ha. Excluding Gorse the overall density of trees and shrubs equalled about 27 individuals per hectare and about six per hectare for individuals >2 m in height.

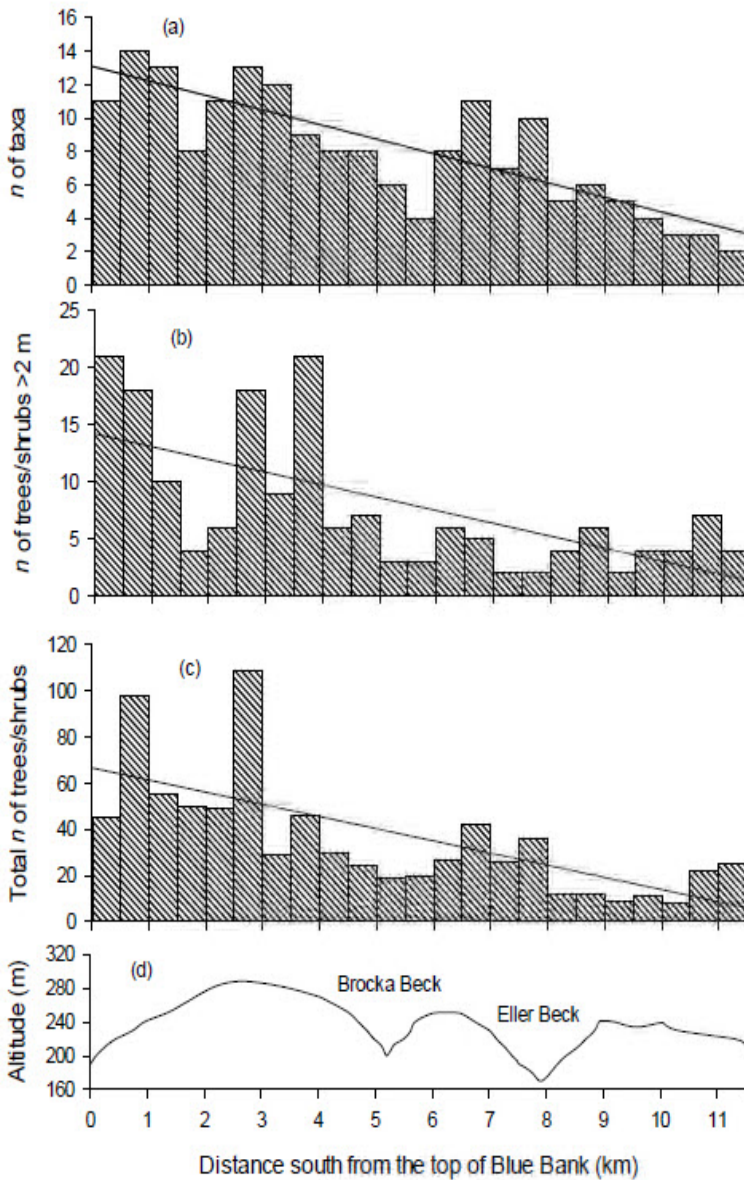


Figure 1. Trees and shrubs along the west side of the A169 from Blue Bank to Saltergate Bridge, June–November 2011:

(a) number of taxa per 0.5 km,
 (b) number of individuals >2m in height per 0.5 km,
 (c) the total number of individuals per 0.5 km (omitting Gorse), and
 (d) altitude.

Best-fit linear regression lines are included ($P < 0.01$).

The ground flora generally appeared to be similar on both sides of the fence. There was possibly a tendency to taller vegetation and more grassland on the road side of the fence but the recorded species composition of vegetation was very similar on both sides. In all 37 ground-flora species, which included 10 mosses, were recorded in quadrats; 21 of these were found on both sides of the fence, 10 on the roadside only and six only beyond the fence. Heather was much the most important, present in all quadrats and recorded as >75% cover in 21 out of 23 roadside quadrats and in 20 out of 23 quadrats beyond the fence. Another important component was the moss *Hypnum cupressiforme* agg., which was

recorded in 22 roadside quadrats and 20 quadrats beyond the fence. Specifically this was probably Heath Plait-moss *Hypnum jutlandicum* which was found by Burch (2008) to be abundant amongst Heather on the North York Moors. The next most frequently recorded plants were Cross-leaved Heath (8 roadside quadrats and 9 beyond the fence) and Bell Heather (9 roadside quadrats and 4 beyond the fence). Comparison between quadrats was made using de-trended correspondence analysis (Kent, 2012). This is a multivariate statistical method that compared quadrats on the basis of all species and their Braun-Blanquet abundance scores. The analysis confirmed that quadrats that were adjacent but on opposite sides of the fence tended to be similar whereas quadrats at different distances along the road tended to differ. Thus each side of the fence did not have its own distinct ground flora; rather the vegetation was similar on both sides of the fence but changed along the road, presumably in response to change in variables such as soil quality, slope and wetness.

Trees and shrubs in the environs of the A169 – potential sources of seed

Although the Heather moorlands of the North York Moors are essentially treeless there are contiguous stands of established trees and shrubs. There are enclosed pastures with hedgerows, areas of broadleaved woodland and shrub, scattered plantings of broadleaved and coniferous trees and, most conspicuous, extensive areas of coniferous plantation forest. Established trees and shrubs in the environs of the A169 are a potential source of seeds for colonization of the roadside. Sites with established trees and shrubs within 1.0km of the road between the top of Blue Bank and Saltergate Bridge were surveyed in September and October 2011 and May 2012. The relevant sites were: scrub, woodland and hedgerows within 1.0km of the top of Blue Bank; scattered trees and woodland in the Eller Beck Valley; woodland, plantation and hedgerows within 1.0km of Saltergate Bridge.

Thirty-seven tree and shrub species were recorded within 1.0km of the road (Table 2); most were in the neighbourhood of Blue Bank (37 species) while 13 were found in the Eller Beck Valley and 23 in the neighbourhood of Saltergate Bridge. The 37 species found in the 1.0km environs included almost all (20 out of 24) of those that have colonized the roadside.

Regeneration of trees and shrubs in Dalby Forest – a more favourable habitat

The regeneration of trees and shrubs in the part of Dalby Forest that had been clear-felled in 1996 was studied to allow comparison of regeneration in a potentially more favourable habitat with that alongside the A169. The 3600ha of Dalby Forest represents part of the widespread coniferous afforestation within the North York Moors National Park area that was begun around 1921 (Perry, 1983). Dalby Forest and its history are described by Rushton & Walker (2009). The principal plantation trees are Sitka Spruce, Hybrid Larch *Larix × marschlinii* and Japanese Larch *Larix kaempferi*, Scots Pine, Douglas Fir *Pseudotsuga menziesii* and Corsican Pine *Pinus nigra* but there are lesser stands and scattered individuals of many other conifers and also significant areas of diverse broadleaved trees. Thus a group of Hull University students identified 18 conifers and 27 broadleaved trees during a morning's walk in the forest (Goulder & Scott, 2009).

Table 2. Trees and shrubs recorded at sites within 1.0km of the A169; September-October 2011 and May 2012

Species of tree/shrub	Scrub, woodland and hedgerows within 1.0km of the top of Blue Bank	Scattered trees and woodland in Eller Beck Valley	Woodland, plantation and hedgerows within 1.0km of Saltergate Bridge
<i>Abies grandis</i> (Giant Fir)	+	-	-
<i>Acer campestre</i> (Field Maple)	+	-	-
<i>Acer pseudoplatanus</i> * (Sycamore)	+	+	+
<i>Aesculus hippocastanum</i> (Horse-chestnut)	+	-	-
<i>Alnus glutinosa</i> (Alder)	+	+	+
<i>Betula pendula</i> * (Silver Birch)	+	+	+
<i>Betula pubescens</i> * (Downy Birch)	+	+	+
<i>Corylus avellana</i> (Hazel)	+	+	+
<i>Crataegus monogyna</i> * (Hawthorn)	+	+	+
<i>Cytisus scoparius</i> * (Broom)	+	-	-
<i>Fagus sylvatica</i> (Beech)	+	-	+
<i>Fraxinus excelsior</i> * (Ash)	+	+	+
<i>Ilex aquifolium</i> * (Holly)	+	-	+
<i>Larix</i> sp. (larches)	+	-	+
<i>Malus pumila</i> (Apple)	+	-	-
<i>Picea abies</i> * (Norway Spruce)	+	-	+
<i>Picea sitchensis</i> * (Sitka Spruce)	+	-	+
<i>Pinus contorta</i> * (Lodgepole Pine)	+	+	+
<i>Pinus sylvestris</i> * (Scots Pine)	+	+	+
<i>Prunus avium</i> (Wild Cherry)	+	-	+
<i>Prunus domestica</i> (Plum)	+	-	-
<i>Prunus spinosa</i> * (Blackthorn)	+	-	+
<i>Quercus petraea</i> * (Sessile Oak)	+	-	+
<i>Quercus robur</i> * (Pedunculate Oak)	+	+	+
<i>Ribes sanguineum</i> (Flowering Currant)	+	-	-
<i>Ribes uva-crispa</i> (Gooseberry)	+	-	-
<i>Rosa canina</i> * (Dog-rose)	+	-	+
<i>Salix alba</i> * (White Willow)	+	-	-
<i>Salix caprea</i> * (Goat Willow)	+	-	+
<i>Salix cinerea</i> * (Grey Willow)	+	+	+
<i>Sambucus nigra</i> (Elder)	+	-	+
<i>Sorbus aucuparia</i> * (Rowan)	+	+	+
<i>Symphoricarpos albus</i> (Snowberry)	+	-	-
<i>Syringa vulgaris</i> (Lilac)	+	-	-
<i>Taxus baccata</i> (Yew)	+	-	-
<i>Thuja plicata</i> (Western Red-cedar)	+	-	-
<i>Ulex europaeus</i> * (Gorse)	+	+	-
Number of taxa	37	13	23

*Also recorded alongside the A169 between the top of Blue Bank and Saltergate Bridge.

(+) = present, (-) = not recorded.

The study site was at Haygate, about 9km south of Saltergate Bridge, in an area of forest with a complicated history (Brian Walker, pers. comm.). The area is more or less level and is at an altitude of about 150m. There are Neolithic earthworks and the site may have been heath or Rabbit warren in the 18th century. In the 19th century there was possibly pine plantation which was felled in the early 20th century and replanted with Scots Pine and larch by the Forestry Commission in the 1930s. In 1996 trees were clear-felled in parts of this pine and larch plantation to create nine circular clearings, each about 45m diameter. In May and June 2012 the trees and shrubs that had regenerated in two of these clearings over 16 years were recorded. A 10m radius (area 314m²) circular quadrat was marked out in each clearing and all living trees and shrubs were recorded. Individuals >2m height were recorded separately while dead trees/shrubs, possibly killed by deer or squirrel damage, were ignored. Low-growing heathland woody plants (Heather, Bilberry and brambles) were also ignored.

It was very evident that there had been substantial regeneration of trees in the clearings. By summer 2012, trees and shrubs had regrown to the extent that it was difficult to push through the regrowth and walk across the clearings. Nine tree taxa were recorded in the quadrats (Table 3) the most abundant being larch, followed by birch and Rowan. Tree density was high; 191 individuals (of which 151 were >2m) were recorded in 10m radius Quadrat 1 (centred at SE85158574) and 222 individuals (148 >2 m) were recorded in Quadrat 2 (centred at SE85218581). This gave an average overall density of 6577 trees ha⁻¹ of which 4761 trees ha⁻¹ (72%) were more than 2m in height.

Table 3. Number of trees and shrubs recorded May-June 2012 in 10m radius circular quadrats in areas of Dalby Forest clear-felled in 1996

Trees & shrubs	*Quadrat 1	†Quadrat 2	Total
	>2m height	>2m height	
<i>Abies grandis</i> (Giant Fir)	0	0	1
<i>Betula pendula</i> (Silver Birch)	28	39	12
<i>Betula pubescens</i> (Downy Birch)	19	23	26
<i>Fagus sylvatica</i> (Beech)	1	1	2
<i>Ilex aquifolium</i> (Holly)	0	3	0
<i>Larix</i> sp. (larches)	80	85	79
<i>Pinus sylvestris/contorta</i> (Pine)	3	3	0
<i>Quercus robur</i> (Pedunculate Oak)	9	12	10
<i>Sorbus aucuparia</i> (Rowan)	11	25	18
Total numbers	151	191	148
Tree density (per hectare)	4809	6083	4713

*Quadrat 1 centred at SE85158574; †Quadrat 2 centred at SE85218581. Area of quadrats = 314m².

The ground flora of the clearings appeared to be succumbing to shading although Bilberry and Wavy Hair-grass *Deschampsia flexuosa* persisted with Purple Moor-grass *Molinia caerulea* in wetter areas. Broad Buckler-fern *Dryopteris dilatata* was abundant in places and bryophytes were conspicuous and diverse with Heath Plait-moss being the most abundant.

The ridges and furrows of 1930s ploughing and bryophyte-colonized stumps of the trees felled in 1996 were also evident

Discussion

For trees and shrubs to colonize upland heath following the exclusion of sheep requires a source of seeds. There are established trees and shrubs within the environs of the A169. Thirty-seven species were found within 1.0km of the A169 (Table 2) and since 20 of the 24 that were recorded along the roadside (Table 1) were amongst these it is likely that the established trees and shrubs in the neighbourhood were the principal source of seeds for regeneration. The seeds of some are likely to have been carried to the roadside by wind (e.g. birch, Ash, Sycamore, pine) while others are liable to have been spread by birds (e.g. Rowan, Dog-rose, Holly, Hawthorn). This suggestion is supported by the tendency to greater species richness and abundance of colonizing roadside trees closer to Blue Bank (Fig. 1), where there is greatest diversity and substantial abundance of established trees and shrubs within the 1.0km environs of the road (Table 2). Furthermore, the secondary increases in species richness at 6.5-7.0km and 7.5-8km south of Blue Bank (Fig. 1) were close (1.0km or less) to the established tree and shrub community of the Eller Beck Valley. A parallel to these observations is that during natural re-colonization of clear-felled forest in Sweden the abundance of tree seedlings decreased further away from seed-producing mature trees (Ackzell, 1992).

Road traffic may also have contributed to the dispersal of tree seeds along the A169. Seeds can potentially be carried for considerable distances trapped in vehicle bodywork or tyres before being released at the roadside. Zwaenepoel, Roovers & Hermy (2006) found Downy Birch amongst 33 species of seedlings that they germinated in mud collected from car bodies in Belgium. Furthermore, when Von der Lippe & Kowarik (2007) germinated the seed rain collected in long road tunnels in Germany, and therefore uncontaminated by seeds from proximate roadside vegetation, they found that seeds of Silver Birch were the third most frequent amongst a total of 204 species collected overall. Moreover the composition of the tunnel seed rain reflected the regional rather than the roadside flora adjacent to the tunnels; hence dispersal was over long distances (several kilometres) rather than local. A further potential source of tree propagules along the A169 is fly-tipping of garden waste. The garden shrub, Wall Cotoneaster *Cotoneaster horizontalis*, between 2.5-3.0km was accompanied by a pink-flowered cultivar of Columbine *Aquilegia vulgaris* and a large-leaved lady's-mantle *Alchemilla* sp., both obviously of garden origin; elsewhere Pampas-grass *Cortaderia selloana* was established at the roadside.

As the roadside trees and shrubs along the A169 have become more numerous and have matured to the extent of producing their own seed, it is possible that some of the younger individuals have originated as seed from plants already established along the roadside. This may, for example, be the case with Grey Willow where it has extensively colonized the ditch between 0.5-1.0km south of Blue Bank, and is certainly so for Gorse between 0-0.5km. It is also possible that some of the roadside trees have been planted. There is, however, little

evidence of this, although many of the trees within the wider 1.0km environs of the road have clearly been planted. Four Juniper *Juniperus communis* plants that survive in rabbit guards, close to aged and possibly indigenous Juniper shrubs at 2.5-3km, are an exception.

The rate of colonization by trees and shrubs along the A169 roadside after nearly 25 years of sheep exclusion, an overall average of 27 individuals per hectare (excluding Gorse), is shown to be extremely low by comparison with the regeneration rate in clear-felled areas of Dalby Forest. There, after just 16 years of regeneration, a mean density of 6577 individuals per hectare had been achieved. This density is commensurate, for example, with a mean of 7133 seedlings per hectare of mainly Scots Pine, Norway Spruce, Downy Birch and Silver Birch achieved by natural regeneration 10 years after clear-felling of forest in Sweden (Ackzell, 1994). Furthermore, growth rates were much less alongside the A169 where only 21% of individual trees and shrubs were >2m in height compared with 72% in the clearings at Dalby Forest.

Several potential and not mutually exclusive reasons for the exceptionally low rates of colonization and growth along the A169 are considered below.

Seed availability. Dimbleby (1953) showed that Scots Pine and Downy Birch colonized open moorland in North Yorkshire only when mature trees to supply seeds were obviously present. Mature trees and shrubs are absent in the wider environs of much of the A169 (i.e. within 1.0km), even though there is considerable species richness where they are present (Table 2). Shortage of seeds is likely to limit colonization. This is supported by the decrease in abundance southwards away from the locally abundant trees and shrubs in the vicinity of Blue Bank (Fig. 1). The rapid regeneration at Dalby Forest, in contrast, was in clearings surrounded by mature trees. Regeneration in clear-felled forest is known to be dependent upon mature seed-bearing trees retained in the neighbourhood (Malcolm, Mason & Clarke, 2001) and decreases with distance away from the edge of seed-bearing stands (Hanssen, 2003).

Ground vegetation. Heather-dominated ground flora, as along the A169, is well known to be inimical to germination and development of tree seedlings. Causes of this inhibition include nutrient impoverishment and harmful allelopathic effects (Mallik, 1995); Heather roots produce toxins that may interfere with the mycorrhizal fungi of tree roots (Robinson, 1972; Jalal & Read, 1983). Indeed, some of the earliest work on inhibition of trees by Heather was done in the North York Moors area by Weatherell (1953), who showed that elimination of Heather by mulching or hoeing reversed check in seedlings of Sitka Spruce, Norway Spruce and Lawson's Cypress *Chamaecyparis lawsoniana*. Suppression by ericaceous ground flora is likely to have contributed to the low density and slow growth of trees along the A169. In the Dalby Forest clearings, in contrast, there was little Heather in the ground flora.

Ground Disturbance. The inimical effects of heathland ground flora can be countered by the physical disturbance of the substratum. Thus Dimbleby (1953) showed that regeneration of Scots Pine and Downy Birch on the North York Moors occurred when the ground had been disturbed, especially after burning, and diminished when ground-vegetation cover re-established. Similarly, Gimingham (1978) described how birch seedlings were successful on Dinnet Moor, Aberdeenshire, only subsequent to burning of Heather. The heathland between the fence and carriageway along the A169 is not subject to burning while tree colonization beyond the fence, where there is burning, is presumably stopped by sheep. It is notable that many of the trees and shrubs that did manage to establish along the A169 were associated with the unstable habitat of the roadside ditch. Willows tended to grow in the ditch and Dog-rose and Hawthorn on its sides. It was principally birch, Rowan and pine seedlings that managed to establish sparingly amidst the heath vegetation. Scarification, to break up ground flora and expose mineral soil, encourages natural regeneration in forest habitats, of, for example, Scots Pine (Ackzell, 1993) and Corsican Pine (Kerr, 2000). Certainly, the felling and removal of mature trees will have caused the substantial ground disturbance in the Dalby Forest clearings that is likely to have encouraged their rapid re-colonization by trees.

Soil quality. The moorland soils tend to be sandy, podsolized with an iron pan and nutrient, especially phosphate, deficient (Perry, 1983); deep ploughing to break down the pan is a prerequisite of successful commercial afforestation (Dent, 1972). Thus poor soil conditions along the A169 are liable to restrict tree growth. In contrast, the clearings at Dalby Forest will have benefitted in the 1930s from the ploughing and fertilization that is part of the North Yorkshire forest regime (Perry, 1983) and from subsequent forest maintenance. Hence, when trees were cleared in 1996 the soil was likely to have been more favourable than it is alongside the A169.

Felling and dieback. There is some evidence of felling or coppicing of trees that have colonized alongside the A169. This is notable at 11.0-11.5km south of Blue Bank where two pine stumps, diameter 10cm and 20cm, were observed and between 10.5-11.5km where at least 13 Rowan had been sawn off at ground level; regeneration from the substantial stumps was <2m in height. Some of the pine and spruce trees were showing signs of yellowing and dieback; occasional dead pine and spruce were observed but not counted.

Exposure. Colonizing trees are more exposed to wind and extreme weather alongside the A169 than in the sheltered Dalby Forest clearings. This may be important because, although there was no (negative) relationship between colonization and altitude along the A169, all the roadside trees were more exposed than those at Dalby Forest. Altitude as such is probably not important considering that the tree line in the Cairngorm Mountains, mainly Scots Pine and birch, frequently runs at about 490m and potentially extends to >600m (Pears, 1967), altitudes that are much in excess of the maximum of 288m reached by the A169.

Although colonization alongside the A169 has been slow over the 25 years or so since sheep were excluded, trees and shrubs have nevertheless reached a state of abundance and size that makes them noticeable to travellers. This is a process which, if left alone, will continue and may speed up as trees that have established become mature and themselves produce seeds. Although highways have many negative impacts upon wildlife (Forman & Alexander, 1998; Spellerberg, 1998) the roadside flora of North Yorkshire is an attractive asset (Atherden & Sykes, 2012) and furthermore travellers appear to appreciate roadside vegetation, being especially appreciative of natural-looking vegetation backed by trees and shrubs (Akbar, Hale & Headley, 2003). The highway authority for the A169 will at some time need to establish a management policy for the trees and shrubs along the A169. Ideally the diverse mix of native and interesting exotic trees will be respected and there will be sound management reasons (e.g. road safety, preservation of vistas) for any decisions to remove trees or shrubs.

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Tansy Beetle conservation: Yorkshire data, national implications

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Introduction

The Tansy Beetle *Chrysolina graminis* (Linnaeus, 1758) is a large (c.10mm), green, iridescent leaf-beetle (see Plate IV, centre pages) which is currently confined in the British Isles to the banks of an approximately 45km (27.5 mile) section of the Yorkshire Ouse centred on York. Its common name refers to one of its major food plants (Tansy *Tanacetum vulgare*) and the one almost exclusively eaten around York. The ecology, behaviour and life-cycle of the Tansy Beetle have been described previously (Oxford *et al.*, 2003; Chapman *et al.*, 2006). Its past distribution in the British Isles is not easy to determine because of possible confusion with the almost identical Mint Beetle *C. herbacea*. Although the adults of these two leaf-beetles differ in rather subtle ways, the larvae are quite distinct (Chapman *et al.*, 2006). Cox (2007) provided a map of past records, although at least some may not have been properly verified. For example, one from Redmoor in Cornwall almost certainly refers to *C. herbacea* (G. S. Oxford, unpublished) while another from St Mary's on the Isles of Scilly is a result of a data-transfer error at the Biological Records Centre (M. L. Denton, pers. comm. – the record was in fact of *C. banksi*). A determined trawl of museum collections is required in order to appreciate fully the beetle's previous range.

The Tansy Beetle was certainly found in the East Anglian Fens until a few decades ago. Howard Mendel (personal communication *via* D. Sivell) recorded it at Wicken Fen in the second half of the 1980s, apparently the last sighting there. This observation post-dates the 1981 "last record" mentioned in Oxford *et al.* (2003). The Cambridge University Zoological Museum has specimens from Woodwalton Fen collected between 1956 and 1975 by H. E. Henderson (S. Warrington, pers. comm.). Another, undated, record in the Cambridge Museum is from Whittlesey Mere, near Peterborough (S. Warrington, pers. comm.). The reduction in the beetle's distribution in the British Isles, particularly its apparent loss from the Fens, and similar trends in numbers and occupancy across its Palaearctic range (Sivell, 2003) make the York population increasingly important for its long-term conservation. Even on the Yorkshire Ouse, its distributional limits and numbers fluctuate dramatically from year to year (see below). The species is listed as Nationally Scarce A (Hyman and Parsons, 1992) but Oxford *et al.* (2003) considered that this designation woefully underestimated the plight of *C. graminis*: it probably now merits Endangered or Vulnerable status according to IUCN criteria.

In 2007 the Tansy Beetle was added to the UK BAP Priority Species list (Anon, 2007) and this put an onus on statutory bodies with jurisdiction over those sections of the River Ouse with

Tansy Beetle populations to consider the beetle and its habitat requirements as part of their environmental strategies. The beetle was highlighted as needing conservation action in the local BAPS of Hambleton District Council, City of York Council and Selby District Council, the three relevant local authorities in Yorkshire. Representatives of four organisations – the University of York, North Yorkshire County Council (NYCC), City of York Council (CYC) and the Environment Agency (EA) – met on February 27th, 2008, and agreed to form a Tansy Beetle Action Group (TBAG). The overall aim of the Group was to enhance the conservation of the beetle by sharing knowledge and expertise and by co-ordinating activities. Subsequently, a number of other organisations joined TBAG (see acknowledgements). In 2009 TBAG secured a three-year grant from the SITA Trust to fund practical aspects of riparian management and to raise the profile of the Tansy Beetle and its conservation with the general public.

Here we outline the progress we have made over the first five years of TBAG, in particular (1) the undertaking and monitoring of practical conservation activities on the River Ouse and awareness raising, both funded in the main by the SITA Trust, and (2), the initiation of annual, fine-scale surveys of both the beetle and its food plant in order to understand more fully their fluctuations in time and space. Because the beetle is confined to Yorkshire, the information gathered locally is, *de facto*, of national importance. We discuss the implications of our work for securing the future survival of the Tansy Beetle in the British Isles.

Practical conservation work

The conservation work funded by the £18,500 SITA Trust grant concentrated on 11 sites across the beetle's range and targeted three main strands of work:

- Himalayan Balsam *Impatiens glandulifera*, a highly invasive, non-native plant that shades out and replaces patches of Tansy, has been removed at a number of existing Tansy Beetle locations. Strimming and pulling over successive years have proved very effective but these efforts need to be continued as balsam recolonises very quickly.
- Willows have been coppiced along the river bank in areas where the trees were tall and dense and shading out Tansy patches. This work took place at both extant Tansy Beetle sites and at those at which the beetle had been recorded in the past. The project aimed to reintroduce Tansy and allow the beetles to recolonise.
- Yorkshire-provenance Tansy plants were purchased and planted out in historical beetle sites where the food-plant had disappeared. This was done in conjunction with the previous two forms of management, if those were believed to be the causes of Tansy loss. At some sites it was clear that overgrazing by cattle was responsible for the disappearance of Tansy. In these cases wooden enclosures (c.6 x 3m) were constructed to prevent grazing and new Tansy patches established within them.

All these conservation measures were designed to increase the number and, more importantly, the connectivity between Tansy patches along the riparian fringe. This is

crucial as Tansy Beetles rarely if ever fly in Britain and find new food-plant locations by walking. Chapman *et al.* (2007) showed that gaps of more than c.150-200m between patches disrupt this process, leading to isolated populations of beetle that are vulnerable to local extinction. The success or otherwise of these interventions will be carefully monitored during annual surveys of Tansy and beetles.

Awareness Raising

TBAG has always been keen to raise awareness of the beetle and the causes of its plight. The SITA-funded project included the design and purchase of two information boards, which were located near the National Trust property Beningbrough Hall (map reference SE513579) and at the picnic area in Fulford, York (SE608487) – well visited stretches of the riverbank where the beetle is normally found (Ref.1).

Outside of the SITA project, TBAG produced a species management sheet for Ouse riparian landowners applying for Environmental Stewardship schemes (Ref.2) and a leaflet for riparian landowners in general, concentrating on how to distinguish between Tansy and Ragwort *Jacobaea vulgaris*, a plant that is often controlled under the Weeds Act (1959) and the Ragwort Control Act (2003) (Ref.3).

Raising awareness among the general public included producing a poster for events such as the Insect Festival and the National Insect Week celebration held every two years in York. A York jewellery shop offered to produce handmade Tansy Beetle brooches for added publicity and TBAG produced a postcard of the species for sale in York shops and at events. York's Science & Innovation Grand Tour held between May and September 2012 included a large Tansy Beetle board erected on the waterfront at King's Staith in York city centre.

Surveys of beetles and their food plant

The first comprehensive survey of the River Ouse was undertaken by Calvert (1998), who searched for beetles between Linton Lock and opposite Bishopthorpe on the east bank and from Nun Monkton down to just north of Acaster Selby on the west bank. Tributaries of the Ouse were not examined. He counted beetles and mapped the locations of major Tansy clumps and identified the apparent limits of beetle populations north of York. Subsequently, two graduate students at the University of York, Duncan Sivell (2000 to 2003) and Dan Chapman (2003 to 2006) delimited what was thought to be the entire range of the beetle, although there were conspicuous gaps in their coverage and surveys were not carried out in every year (Sivell, 2003; Chapman, 2006).

The first attempt to survey comprehensively the whole section of river used by the Tansy Beetle was in 2009. A team of surveyors was established in late spring of that year comprising colleagues from the University of York, members of TBAG and a number of NYCC volunteers. Training was provided in the identification of the beetle and its food plant and of the survey protocol to be used. The latter, briefly, involved the walking of an allocated length of river bank and noting the location and approximate size (small, medium,

large, very large) of all Tansy clumps using specified criteria. Locations were geo-referenced with Garmin GPS12 or Garmin *etrex* GPS units (some of which were purchased with SITA funding). Clumps were examined for the presence or absence of beetles and, if present, the numbers were counted by slowly circumnavigating the clump or estimated using a defined scale. Surveys were carried out on warm, sunny days when previous work by Sivell (2003) had shown that approximately half the beetles in the clump are visible. The surveys were performed during a month-long window from approximately the beginning of the second week in August to the end of the first week in September, to catch the new generation of adults (Oxford *et al.*, 2003; Chapman *et al.*, 2006). Surveys have been repeated in subsequent years.

The results of these annual surveys are compiled into a detailed report where the implications of changes from one year to the next are discussed. All data are lodged with the North and East Yorkshire Ecological Data Centre (NEYEDC). Inevitably, despite training, there will be differences in the efficiency with which the various surveyors locate Tansy clumps and discover and count beetles, and there is a natural turnover of surveyors from year to year, both of which introduce an element of 'noise' to the data. However, without our dedicated band of surveyors we would have no data at all, and so these factors have to be acknowledged and borne in mind when interpreting the results. The overall distribution map of Tansy clumps and Tansy Beetles for 2012 is shown in Figure 1 and suggests that the total range of the beetle on the Ouse was similar to that in 2011 and 2010, viz. along c.45km of river (in 2009, the river was surveyed less completely).

However, as always, the devil is in the detail. Quantitative assessments can be made of changes in the numbers and distributions of both Tansy clumps and Tansy Beetles where the same stretches of river are monitored by the same surveyor(s) over two or more years.

Examples of distribution maps for one section of river in 2011 and 2012 are shown in Figure 2 (Plate V, centre pages) and numbers for equivalent stretches in 2010, 2011 and 2012 given in Table 1. The marked annual fluctuations in beetle locations and numbers are abundantly clear. Between the 2010 and 2011 surveys there had been, on average, a doubling in beetle counts along river stretches north of York, but numbers had plummeted to about a tenth of their 2010 value south of York. The reason for this geographical variation is not clear but seems not to be a result of flooding. A similar comparison for 2011 and 2012 showed a falling off in numbers for most stretches, irrespective of geography (Table 1), but this was not universal. Some stretches held their own while a few increased. Comparing the 2011 and 2012 results for these numerically reliable stretches, the total number of Tansy clumps located fell from 1727 to 1361, a decline of c.21%, while the proportion of these clumps occupied by beetles fell from 19% to 13.2%, a decline of some 30%. The total number of beetles counted along these same stretches dropped from 2097 in 2011 to 1101 in 2012, down by 52.5%, although this figure hides considerable variation between different parts of the river (Table 1).

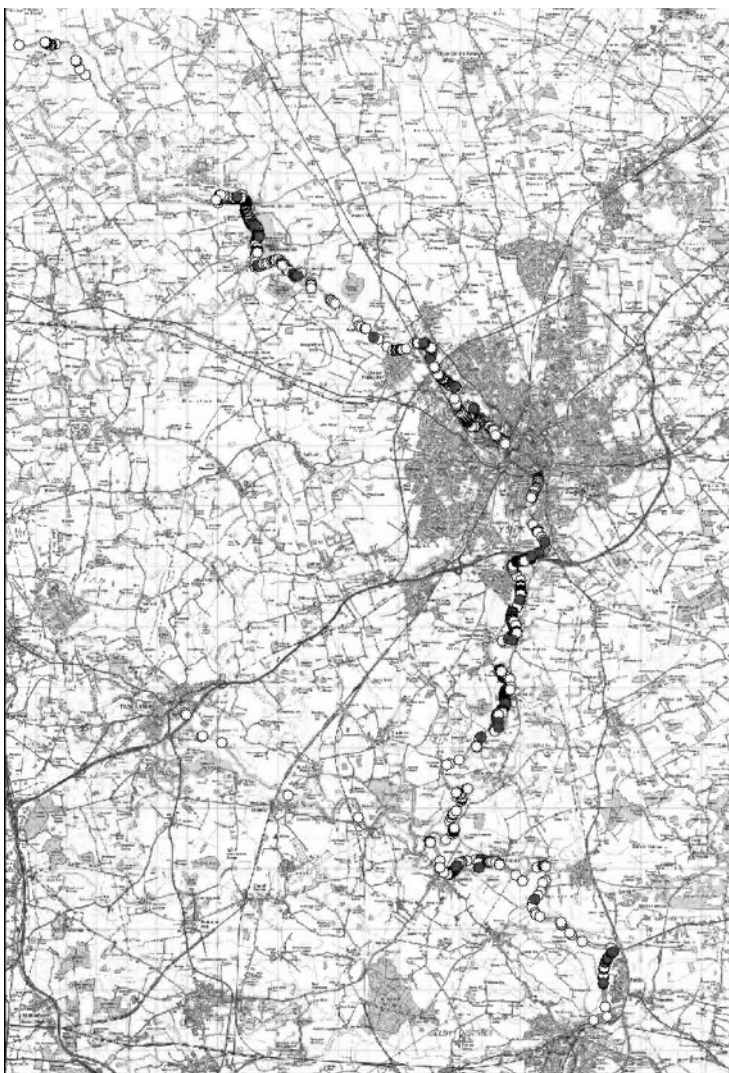


Figure 1. Overview map of the distributions of Tansy clumps without beetles (white symbols) and Tansy clumps with beetles (black symbols) derived from the 2012 survey. The large grey urban area is York, with Selby on the lower edge of the map. The river distance between the most northerly and the most southerly beetle records is c.45 km.

Map © Crown Copyright/ database right 2012. An Ordnance Survey/EDINA supplied service.

The principal reason for the general decline between 2011 and 2012 seems to be summer flooding, with 2012 seeing the wettest summer for 100 years (www.metoffice.gov.uk/news). Mortality during the winter, when adult beetles hibernate underground, is extremely low, despite almost annual floods at that time of year (Sivell, 2003; Chapman *et al.*, 2006). However, flooding during the active season, which is approximately early April through to late September, can be devastating. There were at least eight major flood events in 2012, spread throughout the year (Figure 3).

Table 1. Comparisons of Tansy Beetle counts along stretches of river surveyed between 2010 and 2012. In all but two cases the same surveyor was involved across the three years (* and ** represent different surveyors). The river stretches are ordered north to south, with the position of York indicated. E = east bank, W = west bank.

Stretch (bank) north to south	No. of beetles counted		
	2010	2011	2012
Linton Lock to Nidd (W)	245	433	0
Linton Lock to Nidd (E)	505	939	9
Nidd to Railway Bridge (E)	32*	272**	2**
Nidd to Poppleton (W)	-	0	21
Railway Bridge to Clifton Bridge (E)	76	113	1
YORK			
York to Ring Road (W)	62	9	-
Bishopthorpe to Acaster Malbis (W)	-	167	274
Acaster Malbis to Acaster Selby (W)	1554*	79*	718**
Acaster Selby to R. Wharfe (W)	68	30	0
Naburn to Stillingfleet (E)	-	33	7
Cawood to Riccall (E)	28	20	2
Cawood to Wistow Clough (W)	12	1	1
Wistow Clough to Great Clough (W)	68	1	66

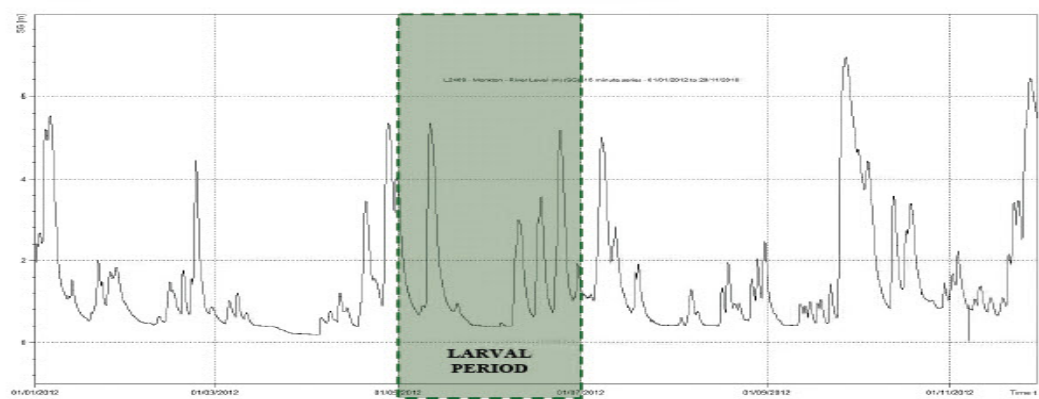


Figure 3. River levels at Moor Monkton gauging station (as metres above gauge zero) January 1st to November 29th, 2012, with the approximate Tansy beetle larval period superimposed. This figure contains Environment Agency information © Environment Agency and database right.

Those occurring between early May and late June would have coincided with the time when larvae were on the food plant (Figure 3). Larvae simply sink and drown when dislodged from foliage by flooding (Sivell, 2003; G.S.Oxford, pers. obs.). Adults may also be affected by earlier or later floods, but perhaps not to the extent expected. Beetles may become trapped at the tops of plants as floods rise (Oxford *et al.*, 2003; Sivell, 2003) and eventually float off, possibly to colonise sites further downstream. Chapman (2006) showed that, at a mark-release-resighting site on Clifton Ings, summer flooding did not result in the reduced survival of marked beetles, which moved away from the immediate riverbank and onto the flood embankment as the waters rose. He also observed beetles climbing down the stems of plants into the floodwater, possibly to enter the soil where they may survive in air pockets (Chapman, 2006; Chapman *et al.*, 2006).

Without local information on river levels and details of the riparian topography, or direct observation during inundation, it is not possible to state which flood events seriously affected specific stretches of riverbank. Some of the populations that showed an increase or at least held their own in 2012 may have been on slightly higher ground, but this does not apply to all of them. For example, the most southerly site in Table 1, just to the north of Selby, will have suffered from flooding and the exacerbating effects of tidal flow, and yet the beetle count in just a few adjacent Tansy clumps immediately next to the riverbank increased dramatically compared to that in 2011. Other, as yet unknown, factors must be involved.

These annual surveys, together with the earlier mapping of beetles by Calvert (1998), suggest that the overall range of the beetle on the River Ouse fluctuates to some extent from year to year but that, over the medium term, it is relatively stable. Over the longer term, however, the range has almost certainly contracted (Sivell, 2003; Chapman *et al.*, 2006). An experimental introduction on the east bank near Newton-on-Ouse (Figure 2) in 2005 successfully established the beetle on a stretch occupied around the middle of the 20th century but from which it had been lost (Calvert, 1998; Chapman, 2006; Chapman *et al.*, 2006). Tansy on the west bank (Figure 2) was not, unfortunately, surveyed until 2010 and so it is not known whether the beetle populations there pre-date the re-introductions on the opposite side of the river. Figure 4 shows a schematic diagram (not to scale) of the range changes north and south of York on the east and west banks of the Ouse between 2011 (2010 on the east bank south of York) and 2012. The overall length of river occupied marginally increased (by some 440m) between the two years, but this result is due to the recording of single individuals in Tansy clumps at the range margins. It is a matter of chance whether or not beetles at such low densities are spotted, which makes the determination of overall range rather unreliable. The apparent contraction on the east bank south of York also rests on a very small number of beetles found in 2010. However, it is undoubtedly the case that there has been a major reduction in beetle populations along this stretch over the past 10 years or so as a result of overgrazing by cattle. The significant loss of ground on the west bank north of York is abundantly clear from Figure 2 and, were it not for the discovery of an apparently new but relatively small population of beetles c.1.5km south of the River

Nidd confluence, the northern limit on this bank would have contracted by an additional 3.5km (i.e. c.7.75km in total).

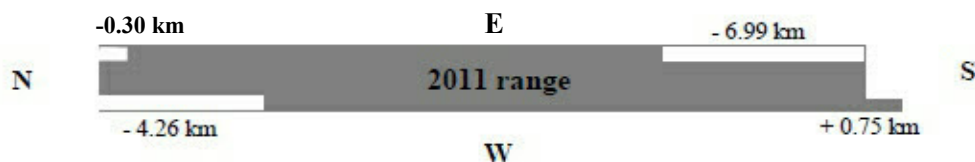


Figure 4. A schematic diagram showing changes to the northern (N) and southern (S) limits of the Tansy Beetle on the east (E) and west (W) banks of the River Ouse between 2011 and 2012 (not to scale). The range in 2011 (2010 for the east bank to the south) is represented by the broad grey bar. Range expansion in 2012 is shown by the narrow grey bar and contractions by the white bars (see text for more details).

Discussion and conclusions

The SITA-funded conservation work was very successful in securing a number of riverbank sites for existing beetle populations and creating new sites for beetles to colonise, thus expanding the metapopulation-like network along the Ouse. However, the annual surveys of the beetle’s range have highlighted the fact that, despite the positive work on safeguarding the beetle, factors out of our control could still threaten the species’ survival.

The most notable element affecting beetles on a year-by-year basis is flooding. Instrumental river-level records (annual maximum) for York began in 1877, with more sporadic documentary sources dating back to 1263 (Radley & Simms, 1970; Longfield, 1998; Macdonald & Black, 2010; Macdonald, 2012). This represents the longest set of flood data in the entire country – the Viking record (Lane, 2003). Using the Viking record, Lane (2003) analysed counts of the number of water level peaks over a threshold of 8.058m above Ordnance Datum (AOD) for each decade between 1881 and 2000. He showed that the number of floods and the decadal mean annual maximum flood have both tended to increase from the 1940s onwards. The cause(s) of these increases are less easy to establish (Lane, 2003; Fowler, 2005). What is of particular concern for the conservation of the Tansy Beetle is whether the seasonality of flood events is changing and, especially, whether summer flooding is increasing or decreasing. Macdonald (2012) recently addressed this question by comparing flood seasonality at York for the last 200 years, using normalised data to take account of the imbalance in the number of recorded floods between the 19th and 20th centuries. He concluded that there had been a considerable increase in February-March floods but a decrease in those occurring in June-July during the 20th century. April-May and August-September flooding showed little change. Seasonality of annual maxima floods during 50-year (normalised) periods and the distributions of floods above a threshold (8.75m AOD) in the same 50-year periods showed that these trends were also evident between the first and second halves of the 20th century. The earlier work of Longfield (1998) suggested an increase of peak-over-threshold floods during March to May from the 1960s onwards. Different authors therefore come to slightly different conclusions.

The historical data suggest that summer flooding is becoming less frequent on average rather than more, although there might be some increases during March to May. There is, of course, a highly stochastic element in the occurrence of flood events and, from the Tansy Beetle's perspective, the occasional large flood at the wrong time in its life cycle can be devastating, as illustrated for many sites during 2012. A similar rash of summer floods in 2013 might well seal the beetle's fate across much of its range on the Ouse. Of course, major flooding has happened in the past and the beetle has survived. In historical times, however, the floodplains of the Ouse were probably less intensively managed and the beetle's distribution may have extended further inland, possibly onto slightly higher ground less affected by flood-water. Rawcliffe Meadows may provide a modern-day example of this phenomenon. Currently, the majority of beetle populations are constrained by grazing and cultivation to a narrow strip of riverbank where the effects of floods are maximised.

The vulnerability of the species has been recognized by TBAG, which has taken three approaches to tackle the problem. First, we have established and are monitoring the success of large patches of Tansy and beetles away from the Ouse floodplain but nevertheless close to York. These beetle 'arks' will serve as insurance in the event of catastrophic summer floods. Secondly, a number of zoos and wildlife visitor centres have expressed an interest in captive-breeding Tansy Beetles as an illustration of invertebrate conservation in Britain and also as a source of material for possible future introductions. These would act as more distant ark sites. Thirdly, and most importantly, we are exploring the feasibility of re-introducing Tansy Beetles to former locations away from the Ouse corridor; the obvious contenders are within the East Anglian Fens as part of the Great Fen Project and the Wicken Vision.

In conclusion, over the past 15 years we have made significant progress in understanding the ecological and conservation requirements of the Tansy Beetle. Work at the University of York has furnished much of our ecological knowledge of this species while the creation of the Tansy Beetle Action Group in 2008 served to focus attention on what conservation actions needed to be taken. By sharing responsibilities across its constitutive members, TBAG has succeeded in achieving, or at least initiating, many of its original aims. The next five years should see major advancement in our attempts to secure the future of this iconic beetle. We hope that, in time, the Tansy Beetle will no longer solely be known as the 'Jewel of York'.

Summary

We report on the progress made during the first five years of the Tansy Beetle Action Group (TBAG) towards (a) practical conservation, (b) monitoring the distributions and numbers of the beetle and its food plant and (c) identifying key threats to the species' future. A SITA grant enabled habitat management to be implemented along specific sections of the River Ouse in order to protect the beetle's food plant and extend its range. Educating the general public about invertebrate conservation has also been an important feature of this project. Annual fine-scale surveys of both the beetle and its food plant have been initiated and

these demonstrate major year-to-year fluctuations in beetle numbers and distributions – the prime influence appears to be summer flooding. These results highlight the vulnerability of the River Ouse (i.e. the British) population and emphasise the urgency of establishing populations at other locations unaffected by flooding.

Conservation footnote

We have presented information in this paper that enables the localisation of certain Tansy Beetle populations. We urge entomologists not to collect more than a single reference specimen from the wild.

Acknowledgements

Much of the early work on Tansy Beetle ecology was undertaken at the University of York with two grants from NERC, with CASE support from English Nature (EN) as part of its Species Recovery Plan. We thank Dr Roger Key (EN) for facilitating this support, Professor Calvin Dytham for co-supervising the Ph.D. projects and the City of York Council (CYC) for additional financial help. Roma Oxford pioneered the techniques for successful captive-breeding of the beetle. Conservation work over the last five years has been co-ordinated by the Tansy Beetle Action Group (TBAG) comprising Daniel Calvert (CYC), Simon Christian (Natural England), Des Cotton (National Trust), Martin Fuller (Environment Agency), Ian Hughes (Dudley Zoo and the British and Irish Association of Zoos and Aquariums), Claire Jackson (Yorkshire Wildlife Trust), Vicky Kindemba (Buglife), Helen Kirk (Carstairs Countryside Trust), Judith Layzell (West Leeds Countryside Park), Douglas Louis (Leeds City Council), Rachel Midgley (CYC), Bob Missin (CYC), Roma Oxford, Mark Pethullis (National Trust), Deirdre Rooney (Askham Bryan College), David Ward (West Leeds Countryside Park) and the authors. We are extremely grateful to all TBAG members for their ideas and actions and to the SITA Trust for funding practical aspects of our conservation work for the past three years. We would particularly like to thank all the volunteer surveyors whose careful work has enabled us to construct detailed annual maps of beetle distributions. Ben Scott and Martin Fuller (Environment Agency) kindly supplied the river-level data, Howard Mendel, Duncan Sivell and Stuart Warrington provided information about the beetle in the East Anglian Fens and Mike Denton clarified the beetle record from the Isles of Scilly.

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Review: Scary but beautiful - portraits of insects

An exhibition by John Bowers, shown at the Headingley Enterprise and Arts Centre, Headingley, Leeds, from 1 April until 3 June, 2013.

A walk around these 34 portrayals of insects and other natural life, busying themselves in their multifarious activities, is a walk that captures them at moments and magnifications when their range of colour and bodily engineering is a continual surprise. The postures and situations in which the photographer has caught them are the rewards won by many hours of searching and waiting and, of course, loving commitment. The places at which the creatures are pictured vary from the magic isle of Lesbos to the more homely Primrose Park, but all are looked at with the same levels of wonder and, at times, astonishment.

Such an exhibition might, at first thought, be expected to appeal primarily to the entomologist or naturalist, but stay with it sometime longer and it is equally concerned with the pictorial space viewed as an abstract composition, based on line and curve, the individual inscapes of the creatures shown contributing some intriguingly detailed structures and patterns. Such a pioneer of aesthetic form in natural phenomena as D'Arcy Thompson would have loved it.

AH

Yorkshire Hedgehog bounty payments: a window on four centuries of status and distribution change

Colin A. Howes

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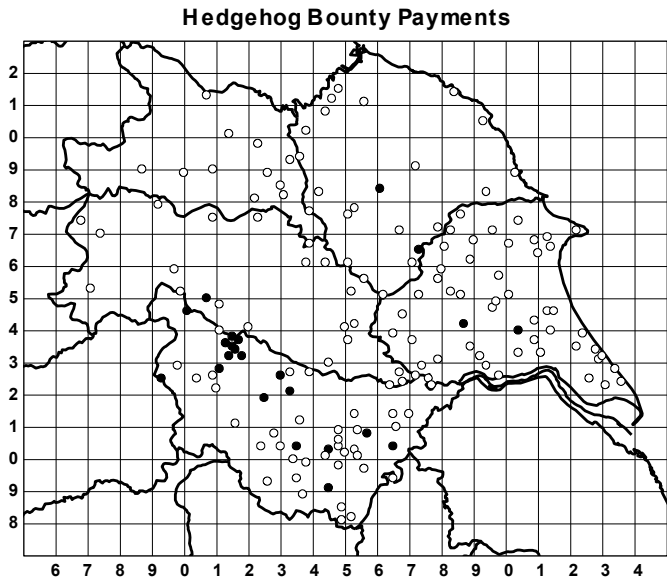
Tudor vermin bounty legislation

In 1532 Henry VIII passed an *Act made and ordained to destroy Choughs* (any member of the Corvidae). This law was substantially enlarged in 1566, in the reign of Elizabeth I, by the *Act for the Preservation of Grayne*. A rather misnamed legal instrument, it encouraged the slaughter of a wide range of predatory birds and mammals which would otherwise have controlled rodents and seed-eating birds that naturally fed on or spoiled grain. In addition to these predators, insectivorous mammals such as Hedgehog *Erinaceus europaeus*, Mole *Talpa europaea* and bats were included. The 1566 Act required parishes to levy a tax or rate to fund the payment of bounties for the heads of these prescribed “Vermin”, though it was left to the discretion of vestry meetings which, if any, vermin to target. In that financial transactions were involved, detailed records of each bounty payment or seasonal accumulations of such payments were kept by the parish Churchwardens and latterly by such civic officers as Parish Constables and Overseers of the Poor.

Parish accounts, a valuable source of biological records

These documents, often on vellum and often in untutored hand, were traditionally stored in church parish chests. Today regulations require that they be brought together with Diocesan records located in Local Authority Archives or County Records Offices with some maintained in academic institutions such as the Borthwick Institute for Archives, York University. Though somewhat laborious to locate, decipher and extract, the particular value of these sources lies in their provenanced, dated, statistically based and often long-term nature. Though samples of vermin bounty payments from individual Yorkshire parishes were occasionally published as curiosities in the topographies and local histories so popular during the late 19th century, e.g. those for Wakefield (Banks, 1871), Worsbrough (Wilkinson, 1872) and Lofthouse (Roberts, 1882), more rigorous analyses were provided in the studies of the accounts from parishes within the Bradford Diocese (Wroot, 1895) and Kildwick (Booth, undated). Through the work of Howes (1980, 1984, 2002a and 2009) and Lovegrove (2007) churchwardens’ and similar accounts of 163 Yorkshire parishes and townships have now been examined. Of these, 108 (66%) contained references to payments for vermin bounties but only 23 (21%) of this latter set contained evidence of payments made for killing Hedgehogs (See Figure 1). This could indicate that Hedgehogs were either genuinely restricted in distribution or that they were not universally deemed to be pests.

Figure 1: Map of the five Yorkshire vice counties showing the locations of the parishes examined for 16th to 19th century ‘Vermin’ bounty payments. Solid dots indicate parishes where bounties were paid for Hedgehogs.



Specific entries are too numerous to list here but are catalogued in Appendix 2.1-3 in Howes (2009) and Appendix 1 in Lovegrove (2007). A brief analysis is given here in Table 1.

Table 1: Frequency of Hedgehog bounties in Yorkshire parishes (calculated from Howes 2009 and Lovegrove 2007). Figures in square brackets [] indicate relative frequency on a scale of 1-5, very infrequent to very numerous (Lovegrove 2007).

Parish	Date range of archive	Total Hedgehog bounties	Maximum Hedgehog bounties per year	Mean no. of Hedgehogs/year over 10+ year date-range
Arksey with Bentley	1719-1773	6	6 in 1732	0.11
Addingham	1668-1825	[1]		
Beverley	1592-1736	7	7 in 1646	0.04
Bolton on Dearne	1738-1808	unspecified		
Bradford	1668-1748	121	24 in 1678	1.51
Bowling	1678-1680	6	3 in 1678	
Cramb	1736-1794	[1]		
Doncaster (Auckley)	1620	2		
East Ardsley	1811	10		
Eccleshill	1678	13		
Helmsley	1671 to 1782	[2]		
Horton	1680	3		
Kildwick	1660-1826	265	124 in 1673	1.59
Langfield	1771-1832	[3]		
Little Heaton	1678	2		

Parish	Date range of archive	Total Hedgehog bounties	Maximum Hedgehog bounties per year	Mean no. of Hedgehogs/year over 10+ year date-range
Manningham	1677-1680	4	4 in 1680	
Market Weighton	1681-1784	[2]		
Northowram	1677-1688	8	8 in 1688	0.72
Shipley	1676-1778	14	6 in 1676	0.13
Thornhill	1672-1823	59	59 in 1823	
Wakefield	1682-1683	37	35 in 1682	
Whiston	1683-1846	4	4 in 1688	
Worsbrough	1704-1825	62	38 in 1727	0.51

This study located records of Hedgehog bounty payments in 23 Yorkshire parishes and counted a total of 609 specimens. The pattern of bounty payments from 1620 to 1823 is shown in Figure 2.

The intermittent occurrence and levels of persecution are as yet unexplained, though it is not due to gaps in date runs in available archives (see table 1). The distinct group of bounties paid during the early 19th century may relate to the prejudice against Hedgehogs concurrent with the rise of shooting estates where Hedgehogs were deemed to predate the nests of game birds, or may be partly a reflection of raising the Hedgehog bounty tariff from 2d. per head, as set in the 1566 Act, to 4d. per head in the parishes of Kildwick from 1807 and East Ardsley from 1811.

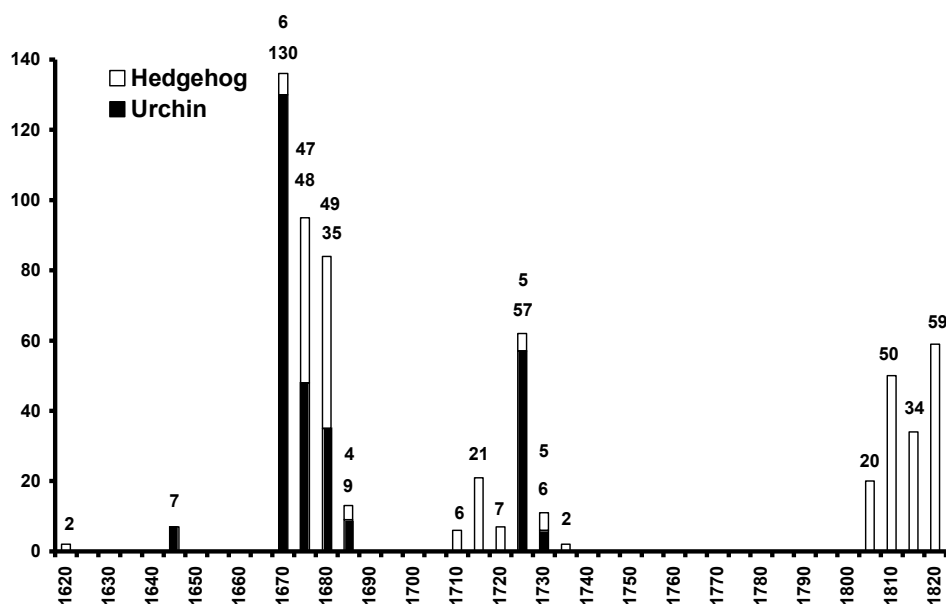


Figure 2: Cumulative numbers of Hedgehog bounties paid in Yorkshire parishes in five year periods 1620 to 1824 recorded under the names of Hedgehog or Urchin.

The highest annual figures were 24 in Bradford in 1678; 35 in Wakefield in 1682; 38 in Worsbrough in 1727; 59 in Thornhill in 1823 and 124 in Kildwick in 1673. The highest cumulative numbers of Hedgehog bounties per 10+ year data runs were 62 (mean of 0.51 per year) from Worsbrough, 121 (mean 1.51/year) from Bradford and 265 (mean of 1.59/year) from Kildwick. These are significantly fewer than in adjacent counties to the south, for instance in the parish of Worksworth in Derbyshire with a total of 3,164 Hedgehog bounties giving a mean of 46.52/year or in Rosthern in adjacent Cheshire with a total of 4,064 Hedgehog bounties giving a mean of 51.44/year.

Discussion

Distribution: Figure 1 effectively provides the earliest distribution map of the Hedgehog in Yorkshire, with dates ranging from 1620 to 1824. This therefore pre-dates records generated by late 19th and 20th century scientific and natural history societies. Although the distributional range extends from Langfield (Todmorden, SD9324) and Kildwick (SE0145) in the west to Market Weighton (SE8741) and Beverley (TA0439) in the east, and from Whiston (SK4590) in the south to Helmsley (SE6183) in the north, there was a marked concentration in upland south and west Yorkshire and a marked absence from parishes in the central Vales of Mowbray, York and the Humberhead Levels, the Humber Estuary, Holderness plain and the Vale of Pickering. In the north, there was a total absence from parishes in the northern parts of Mid-west Yorkshire (VC64), all of North-west Yorkshire (VC65) and the northern and eastern extremities of North-east Yorkshire (VC62), including the Tees lowlands. This is in marked contrast to the 20th century distribution shown in (Howes 1983) updated in Delany (1985) and in the 1996-2006 re-mapping of terrestrial mammals in North Yorkshire (Oxford *et al.*, 2007). Further, the YNU Hedgehog road casualty frequency monitoring survey of 1990-91 (Howes 2002b) showed a contrary pattern with higher densities in the Dales fringes of VCs 64 and 65 (9.72 Hedgehog casualties per 100 miles), Vales of Pickering (10.11/100miles), York and Mowbray (10.80/100miles) and Holderness (11.68/100miles) compared with the conurbations of South and West Yorkshire (5.55/100miles) and the Southern Magnesian limestone (2.15/100miles).

Since the majority of records pre-date many of Yorkshire's major wetland drainage schemes and the plethora of those associated with the Parliamentary Enclosure Acts of the mid-18th to mid-19th century, Figure 1 may indicate a specific avoidance of Yorkshire's lowland and river valley geography. Landscapes dominated by wetlands subject to additional seasonal flooding would have been inimical to a terrestrial hibernator.

Lovegrove's (*loc. cit.*) study of churchwardens' accounts from English and Welsh counties revealed an intriguing distributional trend, showing the counties with most Hedgehog bounties occurred south of a line from the Mersey to the Humber, greatest frequencies being in the south-western counties. Counties north of this line, including Yorkshire, had many fewer as demonstrated by the contrasting Derbyshire and Cheshire examples mentioned above, while the northern English counties of Cumberland, Durham and Northumberland had no records of Hedgehog bounties at all. This latter feature is reversed

in the current distribution map in Bond (2012), which demonstrates a wide and dense distribution.

Vernacular names

Vernacular terms used in bounty records are of two basic forms, Urchin and Hedgehog. The Urchin form occurred 292 (48%) times and tended to be of earlier usage, from 1642 to 1732 (see Figure 2). Spelling variations included Ourchant, Urchant, Uerchan [the plural form ending in s or es], Urchin and Urchon. Interestingly, according to the Oxford English Dictionary the earliest usage of the term Urchin, thought to derive from the medieval French (Morris, 1983), was by Richard Rolle, the religious mystic of Hampole near Doncaster, in his *Hampole Psalter* written about 1340.

The currently familiar Hedgehog form occurred 317 (52%) times in the churchwardens' accounts from 1620 through to 1823. The relative frequency of its usage increased from the late 17th century; it became the exclusively used form by the 19th century (see Figure 2). The spelling and format variations in the first syllable included Hedge, Hedg, Heg, Hegg, Heig and Hej. The second syllable which included hodg, hog and hogg, could be linked as one word or separated by a space or a hyphen. There was no discernible difference in the geographical distribution of the two basic name forms, the list of parishes in which the two forms occurred being almost identical.

Acknowledgements

This project was assembled for presentation to the YNU History Section meeting at The Yorkshire Museum on 29 May 2013. It is a by-product of research undertaken while registered as an external student at Bradford University (see bibliography) and I must thank Professor Mark Seaward for considerable encouragement over many years. Thanks are due to Jill Lucas for permission to use her illustrations. I am most grateful to Albert Henderson for the interpretation of the Richard Rolle text.

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Urchins on the doorstep: revelations of a Hedgehog 'Mark and Release' project

Colin A. Howes

Introduction

Following the methods outlined by Morris (1983) a Hedgehog *Erinaceus europaeus* mark and release project was undertaken during 1992 and continued to a lesser extent in 1993 and 94 in a small suburban back garden in Doncaster, South Yorkshire. The aim was to investigate the population of Hedgehogs visiting a recently constructed housing development, to look for any patterns of occurrence or behaviour, monitor seasonal weight changes and generally to enjoy observing Hedgehogs from one's own back doorstep.

Study area: The project was undertaken on the Arden Gate housing estate (SK557998), a 1979/82 'green field' development of approximately 200 mainly detached houses and bungalows on the outskirts of Balby, Doncaster. The estate is situated between the embankment of the A1(M), a 'B' road (Broomhouse Lane), a 'C' road (Springwell Lane) and a disused, now wooded, railway embankment. Adjacent land use includes an area of municipal allotments and company sports grounds. The 4.5m x 10m rear garden is primarily a rectangular lawn on heavy clay soil, thinly edged by shrubs of Japanese Quince *Chaenomeles japonica*, Wall Cotoneaster *Cotoneaster horizontalis*, Holly *Ilex aquifolium*, *Hydrangea macrophylla*, Honeysuckle *Lonicera periclymenum* var., *Kerria japonica*, Rose-of-Sharon *Hypericum calycinum*, Tamarisk *Tamarix pentandra* and Greater Periwinkle *Vinca major* with various ornamental conifers including *Chamaecyparis*, *Juniperus* and *Thuja* spp.

Adjacent to the garden is a prefabricated concrete garage covered by Ivy *Hedera helix*, to the rear of which is a compost bin and a 2m x 3m plot on which was grown Potatoes *Solanum tuberosum*, Runner Beans *Phaseolus coccineus* and a crown of Rhubarb *Rheum rhabarbarum*. Adjacent to the garage is a small 1m x 2m pond surrounded by Elephant-eared Saxifrage *Bergenia cordifolia*.

Equipment and methods: Equipment consisted of a torch with a 4inch wide beam, powered by four 1.5V batteries, a pair of sturdy gardening gloves, a set of 'Salter' kitchen scales, a tin of 'Crown' white undercoat paint and a 2 inch wide paint brush. To act as a focus for Hedgehog activity, saucers of water, bread and milk, and dog or cat food were placed in the centre of the lawn.

Observations, through a clear glass door during bad weather or an open door in fine weather, were generally made during a four hour period from 10.30pm to 2.30am. Markings, usually a conspicuous 5cm diameter white dot, followed the pattern and sequence outlined in Morris (1983).

Results

Observations were kept on 94 occasions in 1992, fourteen occasions in 1993 and two occasions in 1994. Altogether 24 Hedgehogs were marked: five females, five males and fourteen of unknown sex.

Fifteen Hedgehogs were marked in 1992 and the 94 occurrences were recorded during 63 nights from 21 May to 17 November with up to five Hedgehogs present at any one time. Five Hedgehogs were marked in 1993 and they were recorded during eleven nights from 4 April to 25 July and four Hedgehogs were marked in 1994 when there were just four recorded occurrences on 20 to 21 July.

Population monitoring: The pattern of recruitment into the marked population in 1992 is given in Figure 1, which shows that encounters with nine (60%) of the visiting Hedgehogs took place within 26 nights. Subsequent 'new' animals turned up at intervals of 59, 32, 18, 1, 18 and 23 nights. The last, occurring on 17 November and weighing only 252g, was a recently born and possibly a second litter animal. The initial rush of recruits may be an indication of the size of the core foraging population. Morris (1983) reported at least eleven Hedgehogs visiting the feeding bowl in his study site in just seventeen nights.

The fifteen specimens did not represent the entire local population in 1992 since two unmarked Hedgehogs were road casualties within 100m of the study site.

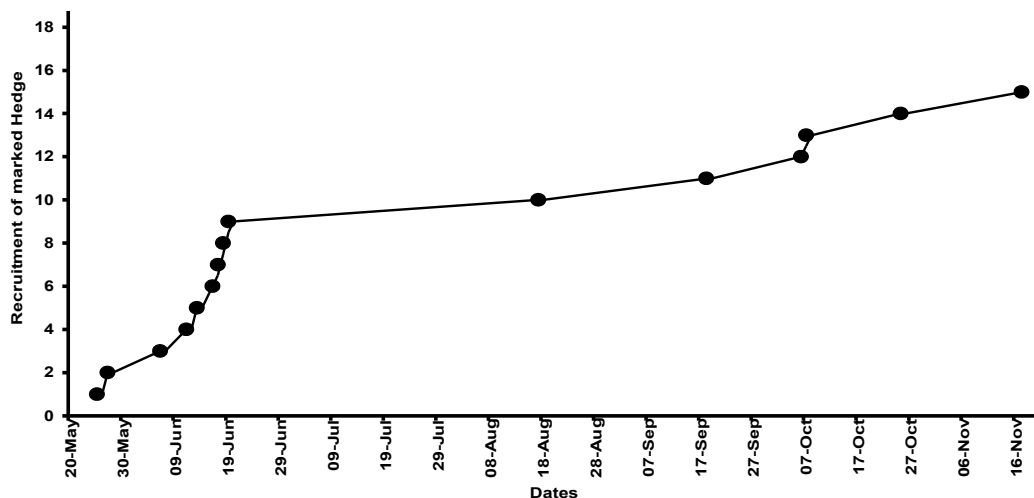


Figure 1. Pattern of recruitment of fifteen marked Hedgehogs entering the study site 26 May to 17 November 1992.

How often individual Hedgehogs visited the study site is shown in Table 1. Visits ranged from one to 25 (mean return visit frequency = 6.2 nights per Hedgehog).

Table 1: Frequencies with which marked Hedgehogs were recorded at the study site.

Number of marked Hedgehogs	10	4	2	2	1	1	1	1	1	1	1
Number of nights present	1	2	3	4	5	6	8	9	13	14	25

Ten (66%) of the colour-marked specimens were only recorded on one occasion, presumably indicating that the study site was peripheral to their foraging ranges. For the remaining specimens the study site was presumably closer to the core of their foraging ranges and, in the case of the female which returned on twenty five occasions, it may have been close to her natal nest site. An indication of the size of the local Hedgehog foraging range was a report of one of the colour-marked specimens observed in a garden 600m (straight line) away on an adjacent housing estate (Andrea Marshall *pers. comm.*). Morris (1983) noted that his radio tracking studies on a golf course and adjacent gardens where food was plentiful showed that Hedgehogs travelled 2-3 km per night, though extensive radio tracking by his student Nigel Reeve (1994) revealing the sizes and shapes of larger male and smaller female home range polygons, suggests that this distance indicated a male.

Since Hedgehogs were generally observed on each monitoring night, Figure 2 is essentially a record of monitoring activity, though the patterns of multiple occurrences may represent periods of increased foraging activity. Occurrences in April possibly related to heightened feeding activity to replenish body weight post-hibernation. The late May to late July activity peak, with up to five present at the feeding bowls in a single evening, may represent heightened courtship activity and enhanced food foraging by lactating females. The October peak coincides with increased weight deposition and presumably, therefore,

enhanced foraging activity prior to autumn hibernation (see also Tables 3 & 4 and Figure 5). No adult Hedgehogs visited after October.

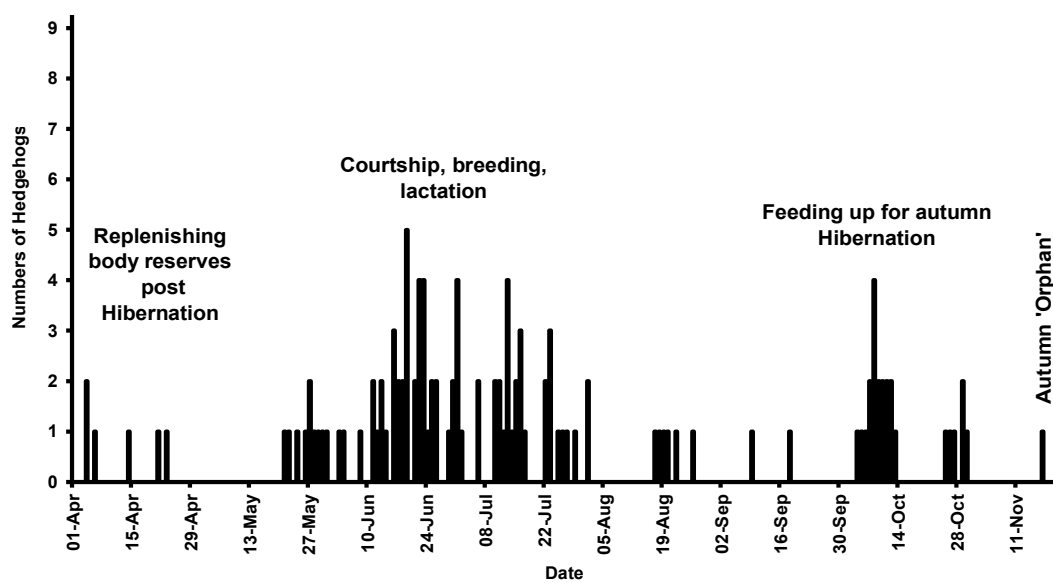


Figure 2. The numbers of Hedgehogs recorded on single nights. (1992-1994 combined).

Occurrence times: As Hedgehog daytime nests were never found within the study site, it is assumed that the timing of Hedgehog visits to the garden did not refer to emergence times but to perambulating specimens being active within their foraging ranges. The earliest nightly times that individual Hedgehogs appeared in the study site are shown in Figure 3. From 24 May to 18 September 41 appearance times ranged from 83 to 328 minutes after sunset (mean 206 minutes) and from 4 to 27 October, the thirteen monitored appearance times ranged from 277 to 601 minutes after sunset (mean 380 minutes).

No significant differences in my monitoring patterns could explain this step change and all times were recorded during the period of British Summer Time. However, the later mean appearance times through October coincided with the phase when Hedgehogs were rapidly increasing their body weights. This could suggest that Hedgehogs were concentrating on more productive feeding areas elsewhere within their home ranges and were arriving in the garden later. Reeve (1994) notes that later in the season Hedgehogs remain active later in the darker mornings, possibly taking advantage of extra foraging time to improve body condition before hibernating.

Weights: During the project 44 weight measurements were taken from twenty animals, the ranges and means for males, females and animals of unknown sexes are given in Table 2 and the overall weight range and pattern of 50g weight categories are shown in Figure 4.

Figure 3. Occurrence times, midnight and sunset times plotted in minutes within 48hrs.

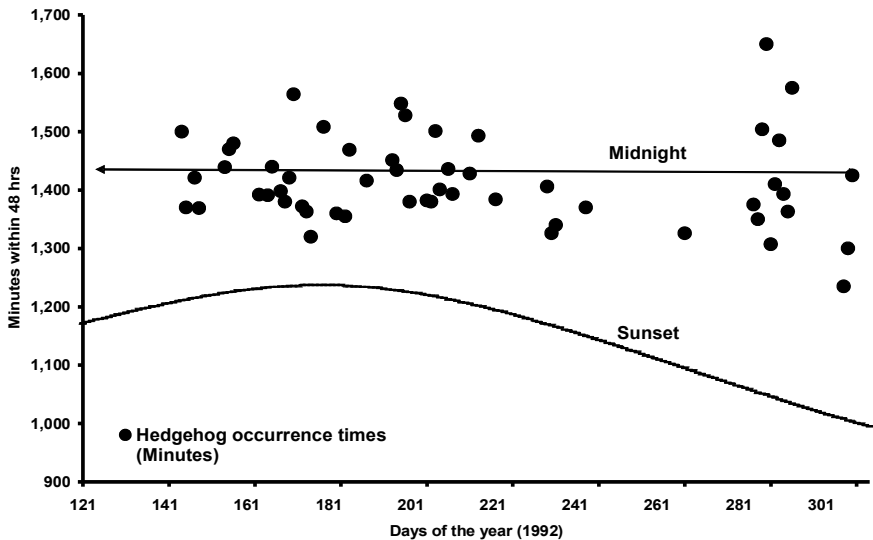


Table 2. Hedgehog weight (g.) ranges and means

	Range	Number	Mean
Female	595 to 1,247	16	1,014
Male	794 to 1,077	6	958
Unknown	255 to 1,247	22	862
Total	595 to 1,247	44	983

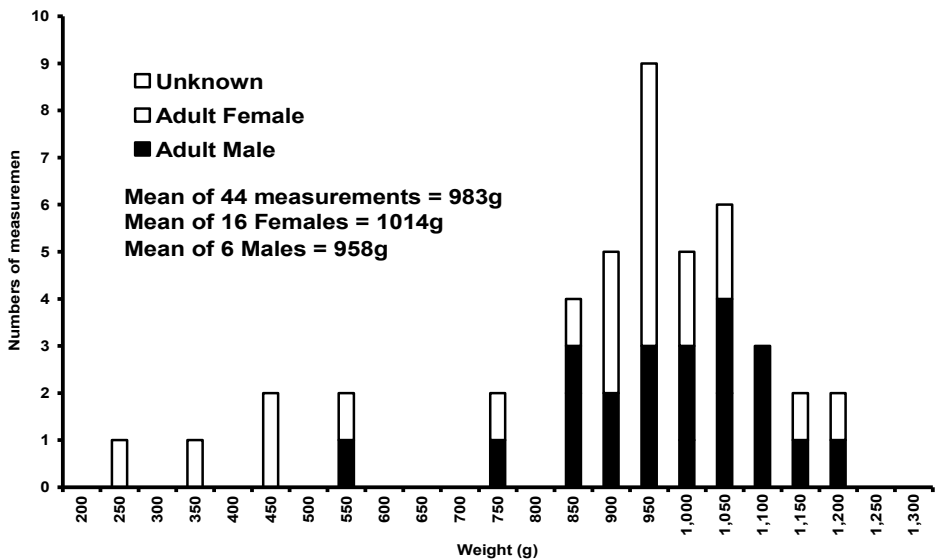


Figure 4. Weight range of all measurements taken from males, females and specimens of unknown sexes (1992-1994 data combined).

Pregnancy, birth/lactation & weight loss: Three specimens showed weight fluctuation from June to August which was likely to be due to parturition and/or lactation (see Figure 5). A female, heavily pregnant and with distended nipples, and weighing 1049g on 1 July lost 425g (40.5% of her peak weight), reaching the low weight of 624g by 25 July. A female weighing 850g on 21 April, increased to 935g on 8 June and 992g by 29 June. She then lost 397g (60% of her peak weight), reaching the low weight of 595g by 25 July. A specimen of unknown sex weighing 851g lost 57g (6.7% of its weight) from 23 July to 1 August.

Table 3. Pre-hibernation body weight (g.) increment in six Hedgehogs.

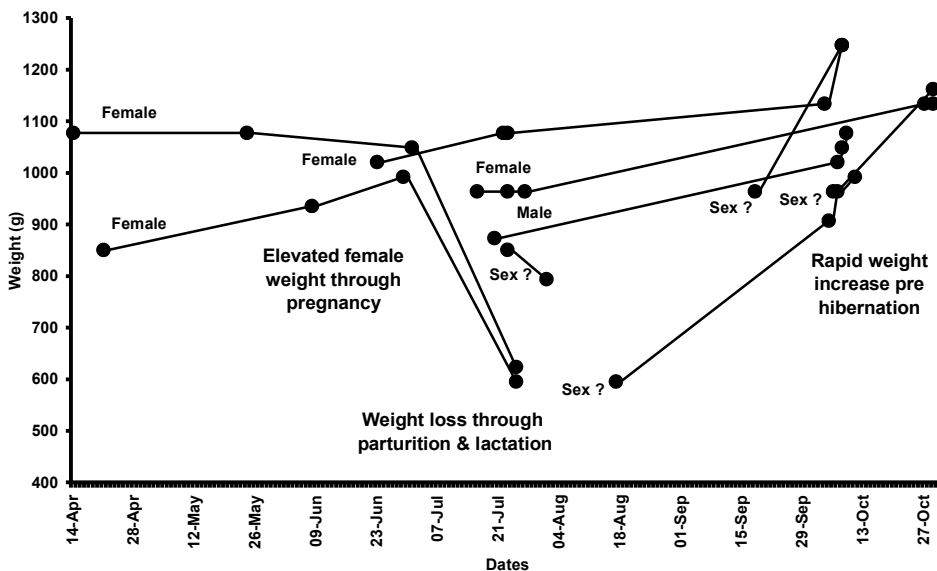


Table 4 shows that the mean weight of 927g (n = 16) in July rose to 1,079g (n = 13) in October. Three specimens weighing 1lb (453g) or less were deemed to be young of the year and not included in Table 4. Their weights were 454g (22 Aug), 453g (9 Sept) and 255g (17

Nov), the last being taken into captivity for overwinter feeding since its weight would not have allowed successful hibernation.

Table 4. Mean weights (g.) of Hedgehogs above 453g April to October 1992

Month	Range	Number	Mean
April	805 to 1,077	3	1,001
May	1,077	1	
June	907 to 1,020	3	954
July	595 to 1,190	16	927
August	794 to 595	2	695
September	963	1	
October	907 to 1,247	13	1,079

Conclusions

Though revealing a number of aspects of activity patterns and cycles of weight loss and acquisition not previously examined in Yorkshire, this preliminary study could not in itself generate sufficient data to do more than hint at these trends and patterns in the life cycle, behaviour and ecology of this familiar though little studied mammal. In order to make progress I would encourage naturalists to attempt similar mark and release projects with Hedgehogs, though this may nowadays be enhanced with such devices as camera traps and radio tracking.

Acknowledgements

Thanks are due to Andrea Marshall for reporting one of the colour-marked Hedgehogs in her garden. Acknowledgement is due to my long-suffering neighbours.

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Hedgehog diet during the extreme drought of summer 1976

Colin A. Howes

Introduction

In the context of UK weather patterns which seem increasingly prone to extremes of meteorological events (floods, droughts, heat waves, cold spells, storms, etc.), the responses of our fauna to these events is currently of interest, leading to speculation of

local extinctions and changes in biodiversity status. The ability of the Hedgehog *Erinaceus europaeus* to cope with the extreme drought of 1975-76 was fortuitously made possible by the analysis of a series of 22 Hedgehog droppings collected from 12 July to 3 October 1976 in a garden off Anchorage Lane, Sprotbrough, Doncaster (SE/5603).

A number of diet studies have been undertaken in Britain and abroad against which this evidently atypical sample can be compared. Dimelow (1963) undertook food preference tests under laboratory conditions. Of free living populations, Kruuk (1964) examined 33 droppings collected March-June 1963 from the Black-headed gull *Chroicocephalus ridibundus* colony at Ravenglass sand dunes, Cumbria, Yalden (1976) examined the contents of 137 stomachs from Hedgehogs killed on various East Anglian shooting estates 1966-1969, Wroot (1984) examined 39 droppings collected July-November 1981 and April-July 1982 from a suburban golf course and adjacent gardens in Ashford, Middlesex, and Dickman (1988) examined 87 stomachs/guts from rural and suburban localities in Oxfordshire from November 1982 to July 1984. Grosshans (1983) examined 125 Hedgehog stomachs from rural and suburban sites in Schleswig-Holstein, Germany in 1975-1976; in New Zealand, Brockie (1959) examined the contents of 5 stomachs and 90 droppings of feral European Hedgehog from rural and suburban sites; in 1970-1971 Campbell (1973) examined 230 droppings from pastureland near Canterbury, South Island.

Study site

The rear garden was bounded by a tall, thick hedge of Garden Privet *Ligustrum ovalifolium* and a line of Lombardy Poplars *Populus nigra* var *italica*. It contained an Apple *Malus domestica* and Pear *Pyrus communis* orchard, a soft fruit area growing Goosberries *Ribes uva-crispa*, Red and Black Currants *Ribes rubrum* and *R. nigrum* and Raspberries *Rubus idaeus*. The garden also included a greenhouse in which were grown Tomatoes *Solanum lycopersicum*, a rockery with a small central ornamental pond, an open compost heap, two lawned areas and a raised garden shed under which Hedgehogs could take refuge. The garden directly abutted onto four other rear gardens which formed part of an extensive acreage of mature gardens of inter-war residential properties. This study is a continuation of a field note on suburban Hedgehogs (Howes, 1976).

Meteorological context

May 1975 to April 1976 was the driest 12 month period for England and Wales since records began in 1727. Murray (1977) showed that from May 1975 to August 1976 only 60% of mean rainfall (mean for 1916-1950) was recorded, a deficit situation exacerbated by an increased mean temperature of 3°C above the 1941-1970 average. In 1976 the temperature in Doncaster was above 27°C (80°F) for 33 days from June to the end of August, reaching 32°C (89.6°F) on 27 June, 2 and 3 July. Further, rainfall during June to August 1976 was only about 20% for the summer mean (1916-50). The soil moisture situation was of critical importance to the terrestrial and soil invertebrates on which Hedgehogs depend for much of their food weight. On 21 April 1976 there was already an estimated soil moisture deficit of 25mm and by 25 August parts of Doncaster were amongst

the areas of the UK (along with parts of Cambridgeshire and Kent) with an estimated extreme soil moisture deficit as low as 138mm. June/July/August of 1976 was easily the driest, sunniest and warmest summer in the 20th century and probably the hottest summer for over three centuries. Despite the considerable soil moisture deficit reached by late August, the exceptionally wet September brought the official drought to an end and record high precipitation brought the soil moisture to capacity before the end of October. Precipitation over this period was the tenth highest since records began in 1727.

Methods

Hedgehog droppings were collected from the study site on 20 dates from 12 July to 3 October 1976. The drought was declared over by 10 September (Murray, 1977) and fortuitously diets (11 droppings each) were monitored on 10 dates either side of this threshold.

Droppings were examined separately under a binocular microscope. Where possible the numbers of identifiable prey items were estimated, eg. by counting the heads of ants, woodlouse telsons, pairs of earwig anal cerci and centipede poisonous claws. In addition to pairs of caterpillar mandibles, it was not unusual for the rather 'leathery' body sacks of larger Noctuidae caterpillars to partially survive digestion. All beetles and bees were identified by my colleague Dr Peter Skidmore by comparing fragments of leg and elytra with entire specimens in the Doncaster Museum entomological collection. Soft-bodied organisms were probably underestimated, though on five occasions the subcutaneous vestigial shells of slugs were identified. Earthworms were indicated by the presence of the fine gritty element of soil from their gut in which were amber-coloured locomotory chetae. Earthworm frequency was recorded in terms of numbers of chetae per dropping.

Daily precipitation and temperature records for the project period were obtained from the weather station at nearby RAF Finningley (Coordinates 53°48'N 1°0'0"W).

Results

Table 1 lists the food items identified and gives the number of droppings containing these items. It also gives the estimate of numbers of each item and its percentage frequency. Evidence of earthworms was identified in most of the droppings although it was not possible to estimate the number of individuals eaten. They were excluded from these totals and therefore from the percentage frequencies of prey items.

Droppings (numbers in brackets) also contained a range of evidently non-food items including moss (4), grass (4), feathers (3), Apple leaf (2), Tomato seeds (2), privet leaf (1), carpet tuft (1), wood (1), coal (1) and pebble (1). All but the privet leaf were taken during the drought phase and were assumed to have been taken while foraging *in extremis* for depleted sources of terrestrial invertebrates. 344 quantifiable prey items (arthropods and slugs) were identified together with an unknown though minimal volume of earthworms.

246 prey items were identified in the drought diets and 98 after the drought was deemed to have ended on 10 September.

Table 1: Prey items identified in 22 Hedgehog droppings 12 July to 3 October 1976

Prey taxa	No. of droppings with	% Droppings	Minimum No. of Prey items	% Prey items
Oligochaeta				
earthworms (inc. <i>Lumbricus terrestris</i>)	16	72%	94 (chetae)	
Isopoda (Woodlice)	8	36%	20	6%
Common Shiny Woodlice <i>Oniscus ascellus</i>	4		8	
Common Rough Woodlouse <i>Procellio scaber</i>	4		12	
Diplopoda (Millipedes)				
<i>Tachypodoiulus niger</i>	1	5%	1	<1%
Chilopoda (Centipedes)				
<i>Lithobius forficatus</i>	6	27%	6	2%
Coleoptera (Beetles)	20	91%	23	7%
Carabidae indet.	11		11	
<i>Amara familiaris</i>	1		1	
Black Clock <i>Pterostichus madidus</i>	1		1	
<i>Pterostichus melanarius</i>	1		1	
<i>Pterostichus</i> indet.	4		4	
Devil's Coach-horse <i>Ocypus olens</i>	1		1	
7-spot Ladybird <i>Coccinella 7-punctata</i>	1		1	
14-spot Ladybird <i>Proglyea 14-punctata</i>	1		1	
<i>Strophostethus lardarius</i>	1		1	
Curculionidae indet.	1		1	
Dermaptera (Earwigs)				
Common Earwig <i>Forficula auricularia</i>	17	77%	140	41%
Lepidoptera (Moths)				
Lepidoptera larvae	14	64%	25	7%
Hymenoptera (Bees & Ants)	8	36%	118	34%
bumble bee (indet.)	4		4	
Small Black Garden Ant <i>Lasius niger</i>	4		114	
Araneae (Spiders)	2	9%	2	1%
Opiliones (Harvestmen)	4	18%	4	1%
<i>Paroligolophus agrestis</i>	1		1	
Opilionidae (indet.)	3		3	
Gastropoda (Slugs)	2	9%	5	1.5%
Total invertebrate prey excluding earthworms	22	100%	344	

Prey weight: Yalden (1976) computed prey weight by weighing examples of prey types (excluding earthworms) taken from either the diet samples or from separately collected specimens. These weights were multiplied by the estimated numbers of that prey type and

expressed as a proportion of the total for all prey. In this study Yalden’s prey conversion weights have been used, the results displayed as the pie diagram in Figure 1.

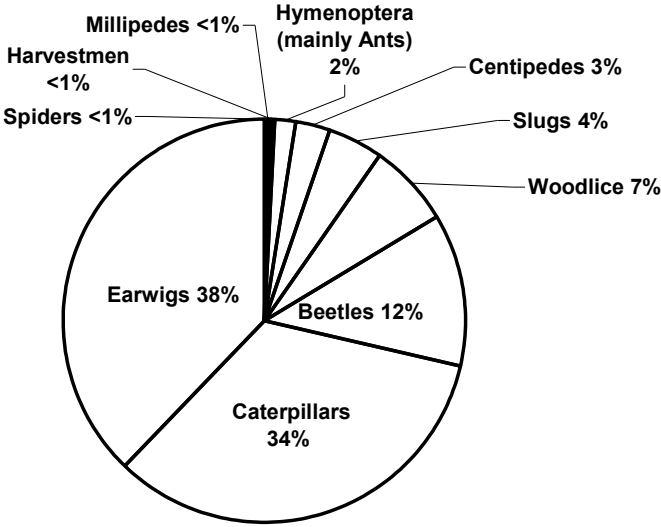


Figure 1: Relative importance of prey categories by weight (excluding earthworms) during the drought summer of 1976.

To illustrate differences in prey taken during and immediately after the drought, Figure 2 shows the numbers or quantities of food items identified in the droppings collected during the ten dates pre- and post-10 September.

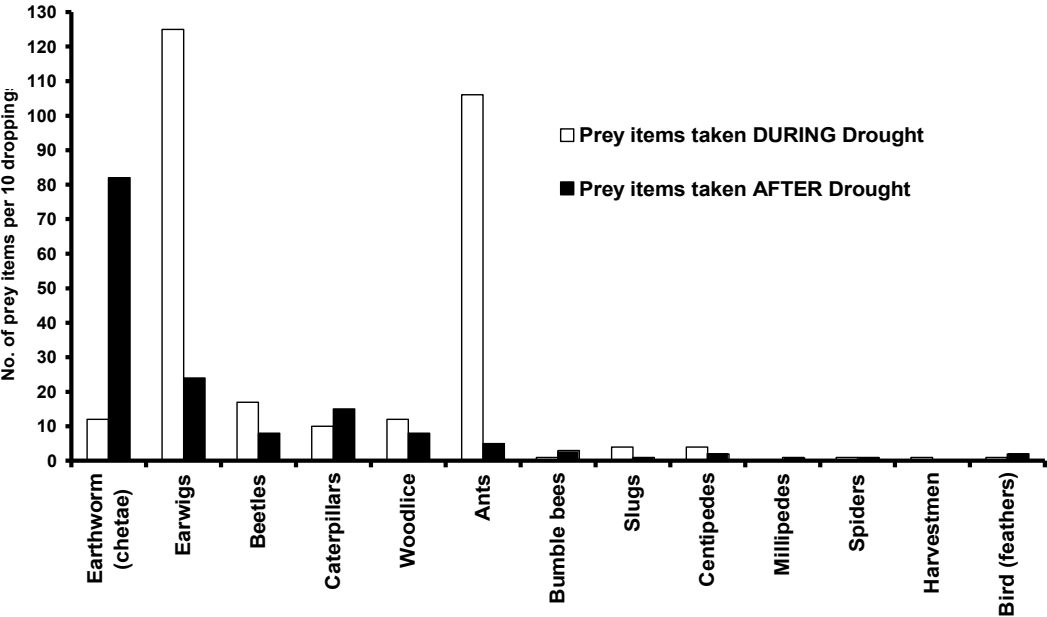


Figure 2: Frequencies of prey types pre- and post-10 September.

Earthworms: Earthworm chetae and accompanying particles of sand were found in 16 (72%) droppings, though the numbers of chetae totalled only 94 for the entire project and ranged from a mere 1 to 12 per dropping. This was a strong indication of the effect of drought and the profound soil moisture deficit which was keeping moisture-dependent soft-bodied invertebrates inactive and well below ground level. Figure 3 shows that the presence of earthworms and the numbers of chetae in each dropping. During the drought the mean number of chetae per dropping was of 1 rising to 8.2 per dropping after the first substantial rain on 11 September. However, even this elevated number was miniscule compared with an estimate of up to 45,000 chetae per dropping (!) encountered by Wroot (1984), who estimated that earthworms contributed about 34% of the total energy intake in his study. Yalden (1976) also considered earthworms to be the most important prey category, providing an estimated 13% of the diet by weight.

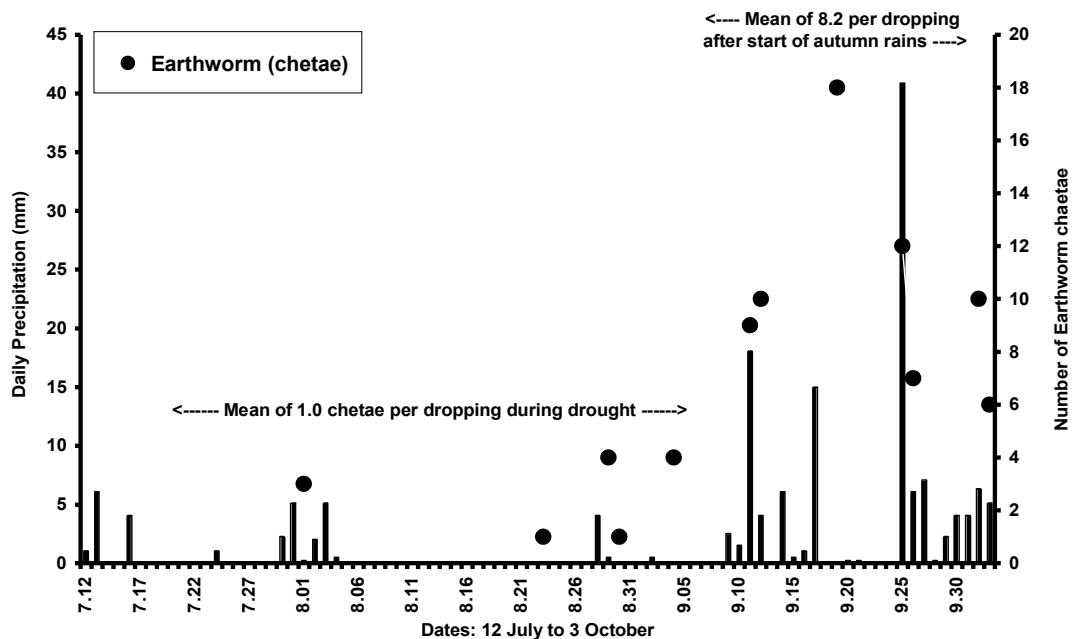


Figure 3: Changing frequencies of earthworms in diets as indicated by numbers of chetae.

Lepidopteran larvae: Caterpillars including larger Noctuidae, possibly Large Yellow Underwing *Noctua pronuba*, were present in 14 (64%) droppings and a minimum of 25 specimens represented 7% of prey items. Mean numbers ranged from a mere 1.0 per dropping during the drought and 1.5 after the first substantial rains on 11 September. In British, German and New Zealand studies lepidopteran larvae have been found to be preferred prey. Wroot (1984) reported up to 56 per dropping and Yalden (1976) reported up to 63 individuals in a single stomach. However, despite their low numbers in this study they still proportionally represented an estimated 34% of prey weight.

Hymenoptera: With the garden being situated on a very light sandy soil, conditions were suitable for the Small Black Garden Ant *Lasius niger*, numerous colonies of which were established along the concrete garden paths and around the bungalow foundations. One large colony developed an entrance into the dining room where attempts were made to control them. Disturbing the entrance portal with a stiff-bristled hand brush caused large numbers of ants to emerge to defend the colony. These were vigorously swept into a dust pan and decanted to a location in the garden. After a series of such attacks through an evening, the colony was temporarily depleted of worker ants.

Subsequent to these actions, ant remains were recovered from four Hedgehog droppings. The presence of a woollen carpet tuft which matched the dining room carpet and a long blond hair evidently from my landlady indicated that these ants were refugees from the dining room colony and were therefore being opportunistically preyed on by at least one local Hedgehog. Grosshans (1983), Brockie (1959) and Yalden (1967) also recorded ants but in very small numbers, regarding their presence as incidental. In addition, four single bumblebees, identified from leg fragments, were present in four droppings.

Isopoda: Remains of at least 20 woodlice were identified in eight (36%) droppings with up to five present in a single dropping. These figures are probably an underestimate, with fragments of armoured segment seeming to indicate more individuals than were calculated by counting discernible telsons. Interestingly, incidences of the Common Rough Woodlouse *Porcellio scaber* were exclusively during the drought period with Common Shiny Woodlouse *Oniscus ascellus* exclusively after the drought broke. This may be a function of the differential humidity tolerances of the two species. Reeve (1997) noted that woodlice are never consumed in significant numbers despite being abundantly available, Brockie (1959) reporting that they were always refused by captive Hedgehogs. Yalden (1969) found isopod remains in only 2.2% of stomachs, numbers representing only 0.2% of prey animals and forming only 0.1% of prey weight. By contrast, this study found that woodlice formed 6% of prey items and 7% of prey weight.

Gastropoda: The present study found a total of five slugs in two (9%) droppings; curiously four were on 28 August, within the drought period. Though scarce in terms of frequency and, one assumes, availability, the few taken actually equalled 4% of estimated prey weight. Since structural features of these relatively heavy creatures are difficult to detect in droppings, it is likely that their presence and consequently prey weight may be underestimated. However, with the persistently dry conditions and profound soil moisture deficit, it is likely that slug populations would have been low and their terrestrial activity much reduced. Dimelow's (1963) food preference experiments found that most species were readily accepted and all diet studies have found slugs to be consistently important. Yalden (1969) identified them in 23% of stomachs, representing 5% of prey items taken and 3% of prey weight. Campbell (1973) found slugs in 30% of droppings, Brockie (1959) in 40% and Wroot (1984) in 51%. Reeve (1994) noted that since slugs are more digestible than

arthropod prey, they could be of greater relative importance than occurrence or dietary energy figures would indicate.

Chilopoda (Centipedes): This study found single specimens of *Lithobius forficatus* on 24 July, 30 August, 11 September and 3 October. These represented 2% of prey items and 3% of prey weight. Wroot (1984) found no centipede evidence in 39 droppings, Grosshans (1983) found evidence in only two of 125 stomachs and Yalden (1969) found remains in 1.5% of stomachs representing 0.2% of prey animals and 0.1% of prey weight. Dimelow (1963) suggested their infrequency in diets may be due to their speed and ability to escape.

Diplopoda (Millipedes): Remains of only one example, those of the White-legged Snake Millipede *Tachypodoiulus niger* were located in a single dropping on 14 September, after the rains had commenced, representing less than 1% of prey items and prey weight. Normally these slow-moving creatures seem to be preferred food items and in Dimelow's (1963) food preference tests, larger specimens were immediately seized and eaten. Yalden (1969) found millipede remains in 40% of stomachs, specimens representing 11% of prey items and 3.4% of prey weight. Wroot (1984) found remains in 51% of droppings and Grosshans (1983) in 69% of stomachs. Their scarcity in this study may be related to the drought conditions.

Araneae: Single spiders, possibly of terrestrially hunting wolf spiders, identified from leg and chelicerae remains, were found in two droppings.

Opiliones: Single harvestmen, including one *Paroligolophus agrestis*, were identified from leg and cephalothorax remains in four droppings.

Feathers: Single yellow feathers, possibly body feathers from fledgling Blue Tits *Cyanistes caeruleus*, were found in three droppings. This could be evidence of scavenging on carrion, though Yalden (1967) suggested small feathers in his samples could have come from bumble bee nests raided by Hedgehogs. Since the remains of *Bombus* sp. were present in 4 droppings, one of which also contained one of the feathers, this was a possibility.

Conclusions

The extreme soil water deficit caused by the prolonged drought of 1975-76 seems to have resulted in significant changes in Hedgehog feeding strategies. Reduced availability of organisms which would otherwise have formed the staples in Hedgehog diet was probably ineffectively compensated for by the exploitation of organisms normally difficult to catch and normally avoided through being distasteful or even toxic.

Earthworms should have formed up to 13% of prey weight but were here reduced to a trace. Lepidopteran caterpillars were also substantially fewer than in other studies but, despite only accounting for 7% of prey items, they proportionally represented the second highest diet component. Slugs were also substantially fewer than in other studies, forming

1.45% of prey taken. However, due to their large individual weight relative to most arthropods in the diet, these few formed 4% of estimated prey weight and represented the fifth largest diet component. Ants, which usually only occur incidentally in diets, were here unusually the most numerous prey type due to opportunist feeding on discarded specimens from a pest control action. However, due to their very light individual weights, they only accounted for 2% of prey weight. Though centipedes are normally seldom taken, allegedly due to their speed, their relative frequency in this study may be evidence of food-deprived Hedgehogs working harder to secure whatever live prey items they encountered. Unusually high numbers of Earwigs, giving rise to a prey weight of 38%, the highest diet component in this study, may also be a compensation for the evident scarcity of staple prey types. Presumably due to drought-induced shortages of staple prey, there was evidence of Hedgehogs consuming atypical, distasteful or even toxic organisms. These included the normally avoided Devil's Coach-horse and two potentially toxic ladybirds. Though most woodlice are distasteful and normally avoided by both wild and captive Hedgehogs, here they were taken frequently, forming 7% of prey weight. Possible further evidence of food-deprived Hedgehogs in desperate quest for food was the presence of non-food items in the diets. Featuring abundantly and almost exclusively during drought conditions, they were probably inadvertently swallowed during bouts of intense foraging for prey in moss, grass and garden debris (see also Plate III, centre pages).

Acknowledgements

Thanks are due to the late Dr Peter Skidmore for beetle and Hymenoptera identifications and to John Espin-Hempsall, then Meteorologist at RAF Finningley, for meteorological data. This study is dedicated to my former landlady Annie Naylor, a keen gardener, in whose garden and home this project took place and who tolerated the hoarding of Hedgehog droppings in my bedroom.

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The wasps and bees (Hymenoptera: Aculeata) of two farms, Manor and Hopewell House, in Watsonian Yorkshire

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Manor Farm (SE7665) is situated about 6km south of Malton on the Yorkshire Wolds while Hopewell House Farm (SE3759) is about 2.5km north-east of Knaresborough in the Vale of York. Both are commercial farms with Manor in arable for cereal production and Hopewell House mainly in arable for cereal production with some grazing for sheep and horses.

The field margins and triangular corners at Manor Farm have been tilled and planted with various wild flower and 'tussocky' grass mixtures or natural plant regeneration has been allowed. Hedges divide the fields and wild flowers grow in the uncultivated areas around the farm buildings. These plants (e.g. Hawthorn *Crataegus monogyna*, brambles *Rubus fruticosus*, dandelions *Taraxacum officinale*, White Dead-nettle *Lamium album*, Hogweed *Heracleum sphondylium*, Knapweed *Centaurea nigra*, Spear Thistle *Cirsium vulgare* and Creeping Thistle *Cirsium arvense*) provide pollen for bees, nectar for wasps and bees and attract prey for wasps. Vertical and horizontal dead wood with bramble in sunny situations was found in some field margins, providing nesting sites for aerial nesters as well as sunning and mating areas. The walls of some of the farm buildings had crevices which were also used by aerial nesters. In the spring male *Andrena* bees were observed on mating circuit flights along hedgerows in sunny situations. A nearby active sandstone quarry (Fox Covert Quarry) was observed to have nesting aculeates, particularly *Colletes daviesanus* nesting in large aggregations on the bare faces of the quarry and flying onto the farm field margins for food resources.

At Hopewell House Farm food resources for wasps and bees (e.g. Blackthorn *Prunus spinosa*, willows *Salix* sp., brambles, dandelions) are provided by flowery field margins, hedges with shrubs and trees, a marsh and flowery grassland in sunny situations around the farm buildings. Small vertical banks at the sides of farm tracks and larger vertical banks in uncultivated areas around the farm buildings provide nesting sites for subterranean

nesters. Dead wood in the marshy area around a pond and the crevices in some of the farm buildings provide nesting sites for the aerial nesters.

Methods

Nine visits were made to Manor Farm although, due to poor weather conditions, two visits were extras needed to complete the survey of the farm. Consequently seven surveys (11 April, 4+5 May, 8 May, 9 June, 24 June, 4+7 July, 3 August) were carried out between 2002 and 2009. Six visits resulting in five surveys (23 April, 20 May, 17 June, 5+8 July, 1 August) were made to Hopewell House Farm during 2010. Four visits were made to Fox Covert Quarry (8 May, 9 June, 7 July, 3 August) between 2002 and 2003. All species of aculeate wasps and bees were recorded during each survey and often collected with a hand net for later identification.

Results

Table 1 shows the number of species found and a full list is given in the Appendix. At Manor Farm 21 of the 44 and at Hopewell House Farm 15 of the 18 solitary aculeates were only found during one visit, indicating the difficulty of finding specimens. Most were found at flowers, sunning on leaves or when flying on mating circuits. At Hopewell House Farm chrysidids were found searching crevices in walls in which their host *Ancistrocerus* could be nesting.

Table 1. The number of aculeate wasp and bee species recorded at Manor and Hopewell House Farms.

	Manor	Hopewell House
Solitary wasps	22	7
Social wasps	2	4
Solitary bees	22	11
Social bees	12	9
Total no. species	58	31

Parasitic solitary aculeates including cleptoparasites (e.g. *Chrysis impressa*, *Nomada marshamella*) and social parasites (e.g. *Bombus vestalis*) were found. There were both aerial nesters (e.g. *Ancistrocerus oviventris*, *Trypoxylon clavicerum*, *Osmia rufa*, *Megachile willughbiella*) and subterranean nesters (*Lindenius albilabris*, *Crabro cribrarius*, *Andrena scotica*, *Lasioglossum calceatum*).

Further visits would have found more species. A further six species of solitary wasps and seven species of solitary bees were found at Fox Covert Quarry and some of the solitary bees could probably be found on Manor Farm. Meek *et al.* (2002) added one solitary wasp, two social wasps and nine solitary bees at Manor Farm.

A Yorkshire quality coding for solitary aculeates can be based on the number of 1km squares in which each one has been found. As of 2010 there are four categories of more or less equal numbers of species: Rare (wasps, 1-7; bees, 1-10), Occasional (wasps, 8-23; bees, 11-27), Frequent (wasps, 24-44; bees, 29-68), Common (wasps 45-122; bees, 69-238). The solitary wasps and bees are treated separately since bees are represented by more records. Manor Farm has 31 Common, 10 Frequent and 3 Occasional (*Pompilus cinereus*, *Ectemnius sexcinctus*, *Megachile versicolor*) according to this system and Hopewell House Farm has 15 Common and 3 Frequent species.

For the solitary species Archer (1999, 2002) has developed a national quality scoring system of high and low quality scoring species. High quality species have a Scarce (equivalent to Nb), Rare (equivalent to Na) or Very Rare (equivalent to RDB) status while low quality ones have a Universal, Widespread or Restricted status. According to this national system, only Universal and Widespread species were found at Manor and Hopewell House Farms (Table 2) with a Species Quality Score (SQS) of 1.4 at Manor Farm and 1.2 at Hopewell House Farm (Table 2). If the extra species recorded by Meek *et al.* (2002) are added to the Manor Farm list, then this gives a total of 70 (68 solitary) species but the same SQS of 1.4.

Table 2. Archer's National Quality Scores of solitary wasps and bee species recorded at Manor (M) and Hopewell House (HH) Farms.

National Status	Status Value (A)	No. Species (B)		Quality Score (A x B)	
		M	HH	M	HH
Universal	1	28	15	28	15
Widespread	2	16	3	32	6
Total		44	18	60	21

Species Quality Scores: Manor 60/44 = 1.4; Hopewell House 21/18 = 1.2

All the social species are nationally common and widespread but Heath Bumblebee *Bombus jonellus* at Manor Farm and Barbut's Cuckoo Bee *B. barbutellus* at Manor and Hopewell House Farms could be considered as Rare in Yorkshire (Archer, 2002).

Discussion

Species Quality Scores (SQS) for semi-natural sites are relatively independent of site size (Archer, 1999). Although the number of species recorded on a site increases with its size, the numbers of high and low quality species increase together so that the SQS remains more or less constant (Archer, 1999). The SQS of semi-natural sites studied in Yorkshire can be placed into one of three classes (Archer, 2011): first class, 2.4-2.9; second class, 1.8-2.3; and third class, 1.2-1.7.

Table 3 shows the SQS of three semi-natural sites, two urban areas and the two farms considered in this study. The urban areas of Sheffield and York, despite having a large number of species, only show a second-class grade due to the relative absence of high quality species (Archer, 2009, 2012). These two areas are important refuges for the commoner, but not for the rarer, species. The SQS of the two farm sites show a third class

grade, again because of the lack of high quality species. Farms, like urban areas, have some conservation function for the commoner, but not the rarer, species. Presumably those semi-natural sites with a higher SQS meet the resource requirements of the High Quality Species which have been lost or greatly reduced and isolated in an urban or farm site. The order of conservation importance is semi-natural, urban and farm sites.

Table 3. The species quality scores (SQS) of graded sites in Watsonian Yorkshire

Site (no. species)	SQS	Grade
Semi-natural Strensall Common (98)	2.5	First class
Semi-natural Duncombe Park (71)	2.2	Second class
Semi-natural Cornelian Bay (59)	1.7	Third class
Urban Sheffield (134)	2.0	Second class
Urban York (145)	2.0	Second class
Manor farm (44)	1.4	Third class
Hopewell House farm (18)	1.2	Third class

Conclusions

No species of national importance were found at Manor and Hopewell House Farms. Two bumblebees of regional importance (Yorkshire) were found at Manor and Hopewell House Farms. The conservation interest of Manor and Hopewell House Farms is as refuge areas for the commoner bees and wasps, but in this respect they are of less importance than urban areas.

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Appendix

'M' represents records from Manor Farm and 'HH' from Hopewell House Farm.

Solitary wasps:

Chrysis angustula (M), *C. ignita* (M, HH), *C. impressa* (M), *Trichrysis cyanea* (M), *Pompilus cinereus* (M), *Ancistrocerus oviventris* (M), *A. parietinus* (HH), *A. trifasciatus* (M), Club-horned Wood-borer Wasp *Trypoxylon clavicerum* (M), Slender-bodied Digger Wasp *Crabro cribrarius* (M, HH), *C. peltarius* (HH), *Crossocerus annulipes* (M), *C. cetratus* (M), Blunt-tailed Digger Wasp *C. dimidiatus* (HH), Slender Digger Wasp *C. elongatulus* (HH) *C. megacephalus*, (M), *C. ovalis* (M), *C. podagricus* (M), *C. quadrimaculatus* (M), *Ectemnius cavifrons* (M), *C. ruficornis* (M), *E. sexcinctus* (M), *Lindenius albilabris* (HH), *Mimumesa dahlbomi* (M), Mournful Wasp *Pemphredon lugubris* (M), Horned Black Wasp *Passaloecus corniger* (M), Field Digger Wasp *Mellinus arvensis* (M).

Social wasps: Saxon Wasp *Dolichovespula saxonica* (HH), Tree Wasp *D. sylvestris* (M, HH), German Wasp *Vespa germanica* (M, HH), Common Wasp *V. vulgaris* (HH).

Solitary bees: *Colletes daviesanus* (M), Gwynne's Mining Bee *Andrena bicolor* (HH), *A. barbilabris* (M), *A. chrysosceles* (M, HH), *A. clarkella* (M), *A. denticulata* (HH), *A. fucata* (M), Tawny Mining Bee *A. fulva* (HH), Early Mining Bee *A. haemorrhoa* (M, HH), *A. nigroaenea* (M, HH), *A. lapponica* (M), *A. scotica* (M, HH), *A. semilaevis* (M), *Halictus tumulorum* (HH), *Lasioglossum albipes* (M), Slender Mining Bee *L. calceatum* (M, HH), *L. rufitarse* (M), *L. smeathmanellum* (M), *Sphecodes geoffrellus* (M), Red Mason Bee *Osmia rufa* (M, HH), *Megachile versicolor* (M), *M. willughbiella* (M), *Nomada flava* (M, HH), Gooden's Nomad Bee *N. goodeniana* (M), Marsham's Nomad Bee *N. marshamella* (M), *N. ruficornis* (M).

Social bees: Garden Bumblebee *Bombus hortorum* (M, HH), Heath Bumblebee *B. jonellus* (M), Red-tailed Bumblebee *B. lapidarius* (M, HH), White-tailed Bumblebee *B. lucorum* (M, HH), Common Carder Bee *B. pascuorum* (M, HH), Early Bumblebee *B. pratorum* (M, HH), Buff-tailed Bumblebee *B. terrestris* (M, HH), Barbut's Cuckoo Bee *B. barbutellus* (M, HH), Gypsy Cuckoo Bumblebee *B. bohemicus* (M), Four Coloured Cuckoo Bee *B. sylvestris* (M), Vestal Cuckoo Bee *B. vestalis* (M, HH), Honey Bee *Apis mellifera* (M, HH).

YNU Bryological Section: report for 2012

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Excursions

The following sectional meetings were held in 2012:

Ashberry (VC62), 5 May 2012

The YWT Reserve at Ashberry is well-known for its interesting base-rich flushes supporting Birds-eye Primrose *Primula farinosa* and we were interested to know whether the bryophyte flora was equally rich. We started the day in the vicinity of the flushes, and found *Palustriella commutata*, *Philonotis calcarea*, *Plagiomnium elatum* and *Scorpidium cossonii*, with *Campylium protensum* and *Climacium dendroides* in moist thin turf and wet ground nearby, but we saw none of the rarer species sometimes found in this habitat. However in the adjacent areas of wet woodland we recorded *Riccardia palmata* on rotten wood, a rare liverwort in Yorkshire and apparently new to the Reserve. *Nowellia curvifolia* was also present. *Dicranum montanum* was another notable find in this area, growing as an epiphyte on sallow. Epiphytes, not surprisingly, were much richer than they might have been before the amelioration of SO₂ pollution and several were additions to the Reserve. We noted *Cryphaea heteromalla*, *Metzgeria violacea*, *Orthotrichum pulchellum*, *O. stramineum*, *O. striatum* (one tuft on Ash *Fraxinus excelsior*), *Radula complanata*, *Ulota phyllantha* and *Zygodon conoideus*, among others.

Some time was spent examining the flora in the steep-sided valley of Reins Wood and Ashberry Wood. Among robust members of the ground flora were *Cirriphyllum piliferum*, *Thuidium tamariscinum*, *Plagiochila asplenioides*, *Rhytidiadelphus loreus* and *R. triquetrus*. Some of the shaded rocks and stones showed considerable calcareous influence, with *Taxiphyllum wissgrillii* and *Tortella tortuosa*, but other areas had a more or less calcifuge flora, including *Calypogeia arguta*, *Dicranum majus*, *Hookeria lucens*, *Leucobryum glaucum*, *Plagiothecium undulatum* and (on stones) *Scapania nemorea*. *Isothecium alopecuroides* and *Plagiothecium curvifolium* were noted on tree bases and old logs.

82 bryophytes were recorded in total.

Gisburn Forest, Stocks Reservoir (VC64), 6 October 2012

Stocks Reservoir is one of the classic sites for the pioneer bryophytes that colonise bare mud in the drawdown zone of reservoirs, and the autumn meeting had been organised with this in mind. Unfortunately, after the wet summer and autumn of 2012, the reservoir was brim-full and no ground at all was exposed around the margins. However, there was plenty of interest to see in the adjacent parts of Gisburn Forest. As expected, the epiphyte flora was found to be rich, and we even recorded *Orthotrichum stramineum*, *Zygodon conoideus* and *Cololejeunea minutissima* in the car park on School Lane, the latter on Horse-chestnut

Aesculus hippocastanum and only the second record for the vice-county. Additional epiphytes along the road on both sides of the causeway bridge included *Frullania dilatata*, *Radula complanata*, abundant *Metzgeria violacea* (some with capsules), *Orthotrichum lyellii*, *O. pulchellum* and *Cryphaea heteromalla*. However, the most notable record was *Colura calyptrifolia* on a willow at the edge of the plantation south of the bridge. This liverwort has an oceanic distribution and, until recently, there was only a single Yorkshire record from rock in the ravine at Twisleton Glen, Ingleton, in 1965. In the past two decades it has been spreading eastwards (though still restricted to western regions) and now occurs widely as an epiphyte on trees in humid places, including conifer plantations.

We visited a marshy field at the edge of the conifer plantation but the vegetation was too rank for most bryophytes, although there was a little *Dicranum bonjeanii*. More interesting was some bare ground at the edge of the field, which had *Ephemerum minutissimum* with *Dicranella schreberiana* and *Bryum klinggraeffii*. We then worked up Bottoms Beck to the area where limestone rock is exposed by the track and on the stream banks. There is a lot of plantation here but also some pockets of semi-natural woodland supporting occasional luxuriant patches of bryophytes, with *Plagiochila asplenioides*, *Cirriphyllum piliferum*, *Hylocomium splendens* and *Thuidium tamariscinum*. *Nowellia curvifolia* was on a decayed log. The limestone added to the diversity, both on the track and on the rocks, with *Jungermannia atrovirens*, *Campylium protensum*, *Ctenidium molluscum*, *Gymnostomum aeruginosum*, *Homalia trichomanoides*, *Mnium stellare*, *Neckera complanata*, *Tortella tortuosa* and *Thamnobryum alopecurum*. *Lejeunea cavifolia* was found on a tree trunk by the stream.

A few weedy mosses were recorded in the car park and on the roadsides, including *Bryum ruderales* and, surprisingly, *Didymodon acutus*, which is an uncommon species normally found on bare exposed soil over chalk and limestone.

105 species were recorded on the day.

Records

The list below includes new vice-county records (*) and other records of note. The recorders were: T.L.Blokeel (TLB), G.Haycock (GH), A.J.Hodgson (AJH), S.Knight (SK), H.Lake (HL), D.G.Long (DGL), T.Ottley (TO), J.Turner (JT), C.Wall (CW).

Nomenclature follows the current British Checklist and Census Catalogue (Hill *et al.*, 2008).

***Andreaea rupestris* var. *rupestris*:** (63*) SK195925 very sparse on millstone grit in small boulder field, Abbey Brook (Berristers Tor area), TLB, 27 December 2012.

***Anomobryum concinnatum*:** (64) SD8371 Churn Milk Hole, TO, 20 July 2012. Rarely recorded in Yorkshire and possibly overlooked.

***Bazzania trilobata*:** (64) SE22215168 & SE22785204 Lindley Moor GH, 27 December 2012.

***Brachythecium mildeanum*:** (65) SE1597 in flush, Foxglove Covert LNR, Catterick Garrison, TLB & SK, 13 May 2012.

Bryum radiculosum: (62) SE9490 on wall of bridge, Langdale Bridge, TLB, 6 June 2012.

Campyliadelphus chrysophyllus: (61) SE8646 Cleaving Coombe, Londesborough, CW, 12 October 2012.

Campyliadelphus elodes: (64) SD772784 large patches in calcareous marsh, Salt Lake Quarry, Ribbleshead, TLB & AJH, 23 September 2012. Occurs in calcareous mires but most often in coastal habitats. It has been recorded from the Malham Tarn area but appears to be very rare in the Dales.

Campylophyllum calcareum: (61*) TA0126 at base of chalk cliff, Humber Bridge Country Park, CW, 12 June 2012.

Cololejeunea minutissima: (63) SE0024 Cragg Vale near Mytholmroyd, TLB, and SE0125 Mytholmroyd, TLB & JT, both on willows and both 28 November 2012.

Colura calyptrifolia: (63*) SD9924 on birch and willow, Broadhead Clough, Cragg Vale, TLB & JT, 28 November 2012;

(64) SD7778 on willow, Salt Lake Quarry, Ribbleshead, TLB & AJH, 23 September 2012. The remarkable spread of *Colura* as an epiphyte continues. See the comments above in the Gisburn Forest report.

Didymodon acutus: (63*) SE055166 on calcareous gravel at edge of track, Scammonden Dam, TLB, 11 August 2012 (VC 63 Excursion)..

***Ditrichum flexicaule* s.str.**: (64) SD7778 on limestone boulder, Salt Lake Quarry, Ribbleshead, TLB & AJH, 23 September 2012; SD804655 on limestone cliff, Giggleswick Scar, TO, 17 July 2012; SD856733 on drystone wall, Giant's Grave, Pen-y-Ghent, TO, 15 July 2012.

Encalypta ciliata: (65) SD87538313 on ledges, north-facing limestone crag, Jeffery Pot Scar above Oughtershaw, DGL, 8 April 2011 (on Bradford Botany Society excursion).

Fissidens bryoides* var. *caespitans: (*63) SD974307 on stones in small rivulet, Walshaw Wood near Hardcastle Crags, JT, 3 December 2009.

Grimmia dissimulata: (64) SD797659 on crags, Giggleswick Scar, TO, 15 July 2012.

Hedwigia stellata: (63*) SE1018 probably on a wall, Laund Road, Laund Hill, Huddersfield, HL, 6 January 2012;

(64*) SE097733 on top of gritstone wall, surrounded by *Hypnum cupressiforme*, Studfold, Nidderdale, M. Adamson, 2007. *Hedwigia* is very rare in the Pennines but may be staging a slow recovery following reductions in SO₂ pollution. Nevertheless, the record from the outskirts of Huddersfield is remarkable.

Leucodon sciuroides: (61*) SE9939 on west church wall, Bishop Burton Churchyard, CW, 5 September 2012;

(63) SE001273 on a wall, Top Wood near Hebden Bridge, JT, November 2012; SE36391270 on Ash, Royston north, HL, 24 March 2012. The epiphytic record is particularly interesting as *L. sciuroides* was at one time eliminated from this habitat in Yorkshire by SO₂ pollution.

Lophocolea semiteres: (63) SE0420 on banked wall near garden, Ripponden, A. & N. Bamforth, 24 February 2012; SE3904 Darfield, HL, 11 October 2012; SE6408 in young woodland/grassland, Dunsville Quarry Park, CW, 4 July 2012.

Marsupella emarginata* var. *aquatica: (63*) SE0704 Black Hill, TLB, 8 November 2012.

Microbryum floerkeanum: (63) SE4004 Darfield, HL, 21 September 2012.

Orthotrichum pumilum: (65*) SE1697 on willow, Foxglove Covert LNR, Catterick Garrison,

TLB & SK, 13 May 2012. A nationally rare epiphytic moss.

Orthotrichum stramineum: (61) SE9772 on Beech *Fagus sylvatica*, Butterwick Whins, Weaverthorpe, CW, 30 April 2012; TA0126 on Ash, Humber Bridge Country Park, CW, 12 June 2012. *O. stramineum* is widespread in the Dales but is rarely recorded in the East Riding.

Philonotis caespitosa: (63) SE0018 Baitings Reservoir, HL, 22 September 2012.

Plagiomnium ellipticum: (63*) SK1696 in wet flush by springs on bank of stream, Upper Derwent Valley near Broadhead Clough, TLB, March 1988.

Plagiothecium curvifolium: (61) TA0139 on rotten tree stump, Burton Bushes, Beverley, CW, 3 October 2012.

Ptilium crista-castrensis: (64*) SE10524543 amongst *Hypnum jutlandicum* carpets in dry heath, Ilkley Moor, ADH, 29 February 2012. The first record of *Ptilium* in VC64 since it was reported near Settle in 1840! It is a boreal forest moss which is very rare in England.

Pylaisia polyantha: (63*) SE04941657 on Sycamore *Acer pseudoplatanus*, Scammonden Water (north), TLB, 11 August 2012.

Racomitrium elongatum: (65*) NY8428 Cronkley Fell, TLB & AJH, 4 June 2012; SE0294 Apedale, SK, 26 March 2012.

Racomitrium ericoides: (63*) SD9727 on wall top, Blackshaw Head, near Hedben Bridge, JT, 2010.

Rhabdoweisia crenulata: (64) SD7074 on face of silurian rock on stream bank, Twisleton Glen, Ingleton, TLB *et al.*, 1 December 2012. Rediscovery at the site of the only previous VC64 record, made in 1960.

Riccardia palmata: (62) SE9187 on rotten logs in marsh, Troutsdale Brow, TLB, 6 June 2012.

Scapania degenii: (65) NY8628 at edge of *Scorpidium*-flush, Cronkley (east), TLB & AJH, 4 June 2012. This montane liverwort is very rare south of Scotland and confirmation of its continued presence in VC65 is very welcome.

***Schistidium rivulare* s.str.**: (63) SE0118 Baitings Reservoir, HL, 22 September 2012; SE0218 Ryburn Reservoir, HL, 10 September 2012; SE0717 Outlane, HL, 12 July 2012.

Schistidium robustum: (64) SD7778 on limestone boulder, Salt Lake Quarry, Ribbleshead, TLB & AJH, 23 September 2012; SD835718 on limestone boulder, Pen-y-Ghent: Churn Milk Hole, TO, 20 July 2012;

(65) NY8328 Cronkley Scar, TLB & AJH, 4 June 2012.

Schistidium strictum: (64) SD841733 on boulders below cliffs, Pen-y-Ghent, TO, 20 July 2012.

Schistidium trichodon: (65) NY8328 Cronkley Scar, TLB & AJH, 4 June 2012.

Solenostoma hyalinum: (64) SD749568 on bank at edge of path, Gisburn Forest, TO, 18 July 2012.

Sphagnum girgensohnii: (63) SK284865 on a low earth ledge at side of footpath, Allen Sike, Wyming Brook, O. Pescott, 3 November 2012.

Sphagnum magellanicum: (63*) SE7215 southern canals, Thorne Moors, I. McDonald, 20 August 2012. This is thought to be a survivor of experimental transplants made in the early 1980s. It appears to be spreading slowly.

Sphagnum warnstorffii: (65) NY8628 Cronkley (east), TLB & AJH, 4 June 2012.

Syntrichia virescens: (61) SE7254 on willow, roadside nr. Stamford Bridge, CW, 7 November 2012; SE8150 on Elder *Sambucus niger*, Pocklington Wood, CW, 19 October 2012; SE8245 epiphyte on tree, Hayton village, CW, 12 October 2012; SE9843 on gravestone, Etton Churchyard, CW, 5 September 2012; SE9936 on cherry, Walkington Churchyard, CW, 5 September 2012;

(63) SK2998 on planted(?) tree, Deepcar, HL, 8 May 2012.

Tortella bambergeri: (64) SD7074 Twisleton Glen, Ingleton, TLB *et al.*, 1 December 2012; SD842733 on small rocks below cliff, Pen-y-Ghent, TO, 20 July 2012.

Tortella densa: (65) NY8428 Cronkley Fell, TLB & AJH, 4 June 2012.

Zygodon rupestris: (63*) SK195926 very sparse on millstone grit in small boulder field, Abbey Brook (Berristers Tor area), TLB, 27 December 2012.

Corrections to Report for 2009-2011

This report (Blockeel & Wall, 2012) contained several incorrect grid references caused by a formatting error. They are corrected here:

Kurzia trichoclados: (63) Holme, HL, 28 September 2009, correct grid reference is SE1105.

Lophocolea semiteres: (63) Finningley Sand Pit, CW, 31 March 2010, correct grid reference is SK6697.

Orthotrichum sprucei: (64) R. Wharfe near Weeton, TLB, 1 February 2011, correct grid reference is SE3046.

Orthotrichum stramineum: (63) Slaithwaite, HL, 19 March 2011, correct grid reference is SE0814.

References

Blockeel, T.L. & Wall, C. (2012) Y.N.U. Bryological section: report for 2009-2011. *The Naturalist* 137: 148-155.

Hill, M.O., Blackstock, T.H., Long, D.G. & Rothero, G.P. (2008) *A checklist and census catalogue of British and Irish bryophytes, updated 2008*. Middlewich: British Bryological Society.

Field note: Osprey attacked by Tawny Owl

On 5 May 2013, I was patrolling the trout lake at Bellflask Fishery near Ripon; five anglers were present and at 10.15 an Osprey *Pandion haliaetus* appeared overhead. The surface of the water was markedly rippled by the strong wind. The bird circled the main lake and two other adjacent lakes for 15 minutes, hovering several times but only once making a serious dive into the water, which resulted in it being almost completely submerged except for the tips of the primaries in one wing (Fig.1). The dive was unsuccessful and, after much flapping, the Osprey eventually took to the air without a fish.



Figure 1. Osprey just visible above the water after diving for a fish B.Morland

Whilst circling the lakes, it was intermittently mobbed by two Oystercatchers *Haematopus ostralegus*, Black-headed Gulls *Chroicocephalus ridibundus*, Jackdaws *Corvus monedula*, Rooks *C. frugilegus* (from a nearby rookery), Carrion Crows *C. corone* and Sand Martins *Riparia riparia*.

The Osprey then switched its attention to fishing the River Ure which runs alongside the fishery and where it was free from the attentions of other birds. Immediately to the north the river runs through a gorge, flanked on the closer left bank by a high terrace on which is a large wood, primarily alder carr with a stand of mature conifers covering several acres. The Osprey hovered over the river at a point where the conifers flank the edge of the terrace and where the banking drops almost vertically to the river below. At this point it was only about 20ft above the level of the conifers.

As I watched, the unmistakable rounded shape of a Tawny Owl *Strix aluco* suddenly appeared from the conifers and flew straight at the Osprey, causing it to react instantly to avoid being hit. The owl turned and attacked a second time before returning out of sight into the conifer plantation. The owl attack was completely different from the earlier persistent, but merely irritating, mobbing by the other species and there is no doubt that, had the Osprey not reacted instantly to avoid the owl, it would have been struck violently.

One would assume that the owl had fledged young in the conifers and felt threatened by what must have been a most unusual and unexpected close encounter with a large predator. Following the incident, the Osprey rose to a great height before drifting back downstream and over the fishing lakes again. Osprey activity was noted at Bellflask on nine separate occasions during April and early May this year, a lake full of trout being a great attraction.

Brian Morland Bellflask House, East Tanfield, Ripon HG4 5LW

Book Review

Guide to Freshwater Invertebrates by Michael Dobson, Simon Pauley, Melanie Fletcher and Anne Powell. Pp216. Published by Freshwater Biological Association, Ambleside, 2012. £33.00 hardback.

This is an excellent little book for the serious novice who wants to get a thorough start in freshwater invertebrate identification. It is intended as a replacement for T. T. Macan's *A Guide to Freshwater Invertebrate Animals* and the preliminary pages, outlining the life and work of T.T. Macan, make an interesting and informative opening. The book will fit nicely into a rucksack so that it can be used in the field and will clean up easily if it gets splashed.

There is a good introduction to the responsible collecting and preserving of specimens. It is nice to see a modern book, aimed at beginners, that is not squeamish about the need to kill specimens. The introduction includes a short section on how to look at specimens using microscopes and there are occasional tips in the keys about handling specimens; e.g. 'prodding' snails for the presence of an operculum and caddis larvae for sclerites. There is also a nice simple introduction to the taxonomic hierarchy and how classification works, including an explanation of why some of those annoying name changes occur.

The keys form the major portion of the book and take different groups of animals to different identification levels; generally to family (though in some instances only to phylum); but in some instances genus and even species level identifications are possible. The figures amply complement the text and the use of coloured arrows nicely highlights the specific points being illustrated. The only point in the keys which I thought might cause confusion is the question about the relative lengths of the tarsal segments at the beginning of the stonefly key. The wording of the triplet is ambiguous and requires careful scrutiny of the illustrations. This is something which is very difficult to describe in a few words and requires careful comparison of the specimen with the associated illustrations, which are good. The illustrated glossary at the back is a very useful feature of this book and one which I would like to see in others.

The book closes with pointers to providers of identification training, an introduction to biological recording and a bibliography of guides to the more accurate identification of many of the groups.

The book has been a pleasure to review. As a user (and teacher) of many keys on freshwater life for nearly 20 years, I found the book refreshing, usable, concise and clear. It is a testament to the hands-on experience of the authors and should prove a popular and rewarding book, which should inspire further investigation of freshwater organisms using more in-depth taxonomic material.

SF

Yorkshire Naturalists' Union Annual General Meeting

The YNU AGM will take place in the Farndale Room at the Palm Court Hotel in Scarborough on **Saturday 16th November 2013** from 2.00pm to 4.30pm.

The welcome address will be given by the Whitby Naturalists' Club, who celebrate their centenary this year. YNU President John Newbould will give a Presidential address entitled *What should natural history societies do?* Scarborough Field Naturalists' Society will close the proceedings.

There will be a meeting of the Natural Sciences Forum from 11.30am to 12.45pm, which everyone is welcome to attend, with refreshments available from 11.00am. Please let us know if you plan to attend this meeting so that we can ensure sufficient seating is available – contact the Natural Sciences Forum secretary Paula Lightfoot on p.lightfoot@btinternet.com or 01904 449675.

Venue: Palm Court Hotel, St. Nicholas Cliff, Scarborough, North Yorkshire, YO11 2ES

Transport: Scarborough is accessible by bus and train. There is a multi-storey pay and display car park next to the hotel, which costs £1.40 per hour or £6.60 all day

Lunch: A hot buffet lunch will be provided at 1.00pm in the Palm Court Hotel restaurant at £11.95 per person and will include vegetarian options. If you would like to book lunch at the AGM, please contact the YNU's Administrative Officer Claire Neill on membership@ynu.org.uk or c/o NEYEDC, St William's College, 5 College Street, York, YO1 7JF, or book online at www.ynu.org.uk

YNU Notice

Online recording now available on the YNU website

In the December 2012 issue of *The Naturalist* we reported that the Yorkshire Naturalists' Union had been awarded funding through the OPAL Grants Scheme to add online recording functionality to the YNU website. We are pleased to announce that the online recording pages have now been added to the YNU website and can be found at www.ynu.org.uk/recording_wildlife.

The data entry forms were designed with input from all of the YNU Sections. There was a trade-off between keeping the user experience as straightforward as possible and ensuring that all relevant data fields are captured. It was agreed that there should be three forms:

- A simple 'submit a sighting' form.
- A multi-taxa recording form for the freshwater/terrestrial environment, with two separate tables, one for recording animals and one for recording plants, fungi, lichens and galls.
- A multi-taxa recording form for the intertidal environment.

These recording forms can be used to submit records to the YNU of any species seen in Yorkshire. The records will be stored securely in a database managed by the Biological Records Centre at CEH Wallingford, where they will be made available to local environmental records centres and national recording schemes via the iRecord website (www.brc.ac.uk/iRecord). Once they have been verified, records will be shared via the NBN Gateway so that they can be used to support education, research and environmental decision-making, in accordance with the YNU's Data Policy (*The Naturalist*, 136 239-240).

A training day was held at the University of York in April to enable YNU recorders to use iRecord to access and verify records submitted online. This was attended by ten YNU recorders with expertise in Mollusca, Lepidoptera, Fungi, Orthoptera, Hymenoptera and various smaller freshwater and terrestrial invertebrate orders. We hope to run another training session in the Autumn/Winter and we can arrange one-to-one training in the meantime for anyone who would like to verify records online.

If you have any questions about the site, or suggestions for improvement, or if you would like to verify records of a particular group of species in Yorkshire, please contact Paula Lightfoot on p.lightfoot@btinternet.com.

Letters to the Editors - Scientific names

From **Dr Elva Robinson, University of York:**

I write in response to the Editorial in the April 2013 edition of *The Naturalist*, concerning naming systems used in the publication. I support the emphasis on accessibility put forward by the Editorial Board and agree that the use of English names can be very beneficial in terms of public engagement. However, we must be careful that we do not let this worthy aim unnecessarily limit the wider value of contributions to *The Naturalist*. Two major advantages of the scientific binomial names (very accessibly introduced in the Editorial) are that it is internationally meaningful and that it is stable over time, with changes properly documented. Regarding the first of these, while contributions to *The Naturalist* may be of most interest to those working in Yorkshire, many may also be of use to the wider scientific

community, for example in assessing a reduction or expansion of a species' range across Europe, or in charting long-term abundance patterns. For these purposes, the common names are less suitable. Let us take the example of two well-known birds: the Goldfinch *Carduelis carduelis* and the Bulfinch *Pyrrhula pyrrhula*. In Dutch, our Goldfinch is the *Distelvink*, or thistle-finch, while our Bulfinch is the *Goudvink*, or gold-finch. Such possibilities for confusion occur in many groups but are easily avoidable by using the scientific names in addition to the common names. Secondly, as the Editorial stated, common names may change over time. The NBN Gateway is cited as a source for linking common to scientific names. This is fine currently but, if these records are to be used as historical data in 50 or 100 years time, will this resource still be available and will any changes in the common names be easily traceable? The Editorial finishes by stating the intention to remove scientific names from the Excursion Reports for some groups (e.g. birds) and asking the opinions of the readership on the suggestion to widen this to other groups. My response is that to drop the scientific names reduces the wider and long-term value of the Excursion Reports, whereas using both English and scientific names together allows wider value without significant cost to accessibility.

From **David Baker**, 19 Woodlands Avenue, Tadcaster, North Yorkshire, LS24 9LE:

I read with interest the Editorial in the latest volume 1082 of *The Naturalist* which ended by asking us what we think of the use of scientific names for our Flora and Fauna. Firstly, I thank you for not using the phrase "Latin names", which I hear all too often in Lepidopteran circles. I certainly prefer the present usage of vernacular followed by scientific name in the first instance for all situations and show, I hope, two reasons for my reasoning whilst using the same volume as an example.

The article on page 18 shows lists of "Native species" of vascular plants without any of the long-accepted vernacular names and, to me, was almost unintelligible. For example, I and many non-specialists will be aware of *Geranium* and *Potentilla* as generic names but the specifics are not as well known. I do understand that space was possibly at a premium in the article but the common names of Round-leaved Crane's-bill or Hoary Cinquefoil may well have kept my interest.

Further into the magazine, on page 56 under the Lepidoptera paragraph, line 12 records the sighting of a Muslim Footman *Nudaria mundana*. Perhaps Aladdin was showing in the local theatre? However, joking apart, the use of the scientific name allows a double check for anyone not realising immediately that it was merely the result of a printing or proof-reading error and that Muslin Footman was the macromoth in question. Yes, I have grown up knowing the vernacular names of many of our birds, mammals, flowers and butterflies without having to resort to learning the scientific names. It was not until establishing a more detailed interest in moths that I learnt the scientific names for many more of our flora and fauna and realised their true value.

Please retain the use of both names where the vernacular is commonly accepted, even to the point of using the proposed “new common” names for all the micromoths if the existing proposals are accepted. At least we shall still have a world-wide scientific name to identify our moths by.

Editors' note: In the case of the Red Data Book plant lists, the decision not to add vernacular names was made purely on the grounds of space – it would have been impossible to add an extra column to the tables and still maintain their legibility without putting them into landscape format. This would have been difficult to organise given that each of the many tables had introductory text. As the article was largely aimed at specialist botanists it was felt that it was better, on balance, to publish it as submitted.

Book review

A History of the Whitby Naturalists' Club by **Mike Yates**, written for the Club's 2013 Centenary & edited by **David Minter**. 2012. Pp. 90, incl. numerous b/w illus. Not for sale, but free to Members of the Whitby Naturalists' Club: a membership form can be downloaded from the Club's website at: www.whitbynaturalists.co.uk

An examination of documents in the Club's archives to put on to the internet also resulted in this interesting booklet which encapsulates 100 years of one of Yorkshire's many successful natural history societies. Selecting the material for this publication cannot have been easy as it required reading and photographing more than 6000 pages of Club minutes, reports and *Whitby Gazette* cuttings. As a result, this is a fitting testimony to the many devoted enthusiasts who have contributed significantly to the Club's success and to our knowledge of the natural history, geology and archaeology of one of the county's most iconic landscapes. The text is essentially chronological, the first eight chapters covering the establishment of the Club through to the 1980s, followed by four chapters on the building of the Kendall Memorial Room, the Botanical Section, the Archaeological Section, and relations with the Literary & Philosophical Society, and concluding with two chapters on the period 1987-2012. Members of the YNU will be particularly interested in the biographical details as well as the field meetings contained in this work. Today the Club has ten special interest groups: Amphibians & Reptiles, Archaeology, Botany, Entomology, Fungi, Geology, Local History, Mammals, Ornithology, and Sea & Shore Life. Membership is open to anyone interested in furthering the Club's aims (conservation, maintenance of a library & systematic recording) and activities (exhibitions, field meetings, lectures & workshops).

MRDS

YNU Calendar August – November 2013

Further information can be found at www.ynu.org.uk/events/calendar

Aug	24	Botanical Field Meeting VC65 10:30am nr Leyburn. Meet on roadside at SE105910.
Sep	1	Conchological Section Field Meeting 10:30am-1pm. Meet at the car park on S. side of minor road at NZ931046. 1km recording on the NY Moors near Robin Hood's Bay.
	8	Shore Thing Survey at North Landing. Flamborough. 11am – 1pm. Meet at the bottom of the slipway (TA239720).
	21	Marine and Coastal & Conchological Sections joint Field Meeting 9:30am – 1:30pm. Meet at Sea Cliff Road car park, Scarborough (TA049867).
Oct	5	Marine and Coastal Field Meeting 9:30am – 11:30am. Meet at the bottom of Mill Bank (NZ955040). Joint meeting with the Society of Biology.
	5	Bryological Section Field Meeting 10am – noon. Meet at Ponden, on the roadside at SD984376.
	5	Conchological Section Field Meeting 10:30am – 1:00pm. Meet at the side of the road near the pond in Fridaythorpe village at SE875591.
	6	Marine and Coastal Field Meeting at Boggle Hole 9:30am – 11:30am. Meet at the bottom of Mill Bank (NZ955040) Joint meeting with the Whitby Naturalists' Club.
	12	Natural Sciences Forum meeting 10:00am – 12:30pm at St Chad's, Headingley. The Forum exists to ensure that the YNU achieves its charitable objectives of studying and recording the natural history of Yorkshire and disseminating its knowledge to others. We welcome to meetings any YNU members and guests wishing to contribute ideas for the development of the YNU and willing to take action to deliver them. Contact: Peter Flint via: flintsentomologists@btinternet.com
	12	Entomological Section Meeting 11am. Recorders' Reports, Conversazione. Doncaster Museum & Art Gallery.
	13	Historical Section Meeting 11:00am – 4:30pm at Walton Hall nr Wakefield. AGM and work in progress.
	20	Marine and Coastal Field Meeting Flamborough 10:30am – noon. Meet at the bottom of South Sea Road where it meets the beach (TA230692). Shore Thing survey followed by a visit to Yorkshire Wildlife Trust's Living Seas Centre.
	26	Executive Meeting 10:00am – 12:30pm at St. Chad's Parish Hall, Leeds.
	26	Conchological Section AGM 1pm – 4pm 17 West Park Drive, Leeds, LS16 5BL.
	26	Education Committee Meeting (provisional date)
Nov	16	YNU AGM (2pm to 4:30pm) & Natural Sciences Forum (10am to noon). Palm Court Hotel, Scarborough. See box p156 for details.

Yorkshire Naturalists' Union

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The Naturalist

This publication is issued free to individual members of the Yorkshire Naturalists' Union and to Affiliated Societies. The Editorial Board of *The Naturalist* is currently:

J. Bowers, W. Ely, A. Henderson, A. Millard, P. Simmons, S. West

Notice to contributors

Contributors should indicate whether they wish their manuscripts to be subjected to anonymous peer review. All other manuscripts will be reviewed by the Editorial Board who at their discretion may send them to third parties for comment and advice.

Original articles should be submitted electronically as an MS Word document to Dr A. Millard at a.millard@leedsmet.ac.uk.

Please see *The Naturalist Guide to Consistency* on p77 of *The Naturalist* 1079 and please **avoid** the following:

- using tabs to tabulate information (please use MS Word table format or separate the column entries in a single row with commas and enter a paragraph mark at the end of the row).
- inserting any figures, graphs or plates into the text; indicate their proposed locations in the text and send as separate files.

Good quality, high resolution images are very welcome and should be sent as .jpg files, with a separate MS Word file containing the caption and name of the person to whom the image should be attributed.

If electronic submission is not possible, contributions should be sent to Dr. A. Millard, Woodland Villas, 86 Bachelor Lane, Horsforth, Leeds LS18 5NF (Tel. 0113•258•2482)

Contributors should ensure the accuracy of reference citations. The Editorial Board and Council accept no Responsibility for opinions expressed by contributors.

Copy Dates:

April issue - **14 February**; August issue **14 June**; December issue **14 October**

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Plate I. Species which have changed their abundance of Yorkshire's coast (see p82):

Above: Sea slug *Geitodoris planata*,
A new species to the Yorkshire coast,
From a rock pool near Scarborough.

D. Whitaker

Left: Common Prawn.

P. Lightfoot

Below: Angular Crab.

P. Lightfoot





Plate II. Sparse colonization by trees along the A169, May-June 2011 (see p101). Heather dominates the ground flora between the sheep fence on the left and the Road except for the ditch and mown verge alongside the carriageway;
Left: Birch, Right: Pine.

R.Goulder



Plate III. Hedgehog active during daylight and eating offered food in a garden during a Drought period (see p135).

P.Simmons



Plate IV Tansy Beetle showing its iridescence (see p112).

Geoff Oxford

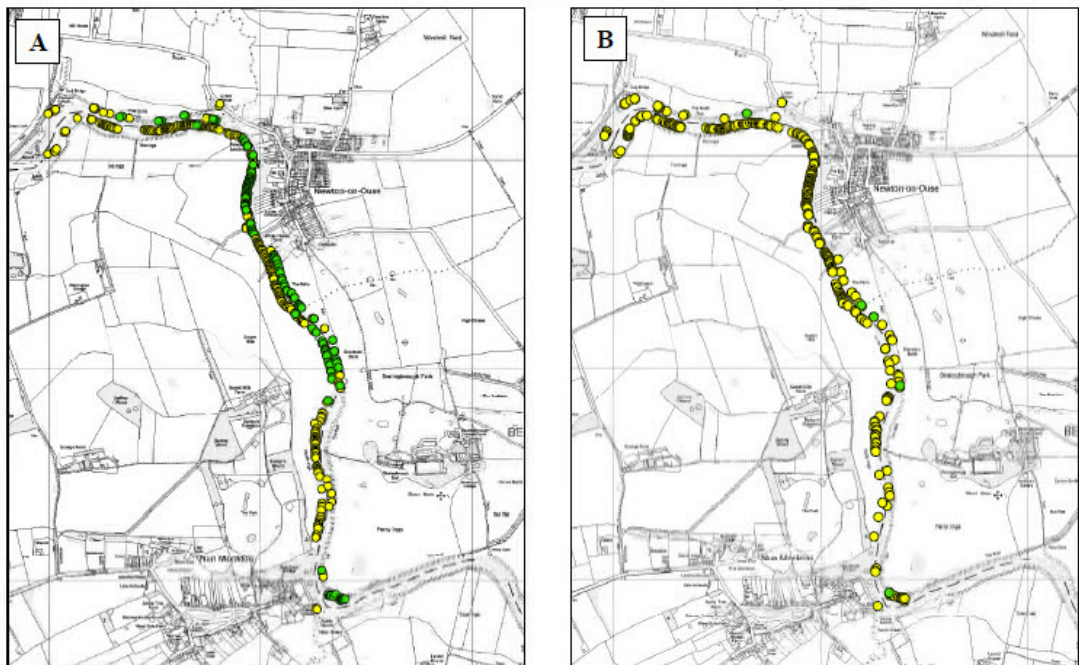


Plate V (Figure 2 - see p115). Comparison of the distributions of Tansy clumps without beetles (yellow symbols) and Tansy clumps with beetles (green symbols) at the northernmost edge of the beetle's range in 2011 @ and 2012 (B). These stretches are represented by the 'Linton Lock to Nidd W' and 'Linton Lock to Nidd E' entries in Table 1 (p117). The village in the centre top is Newton-on-Ouse, and that to the bottom left Nun Monkton. Grid lines are Ordnance Survey one kilometre squares. Map © Crown Copyright/database right 2012. An Ordnance Survey/EDINA supplied service.

Plate VI. Images from
The YNU Flickr webpages
(See p 81).

Clockwise from right:
Treecreeper in the hand.
Ian Andrews
Dog Rose. *Mervyn*
Nethercoat
Bedstraw Hawkmoth,
Kilnsea. '*Petros Pete*'
Male Adders fighting
John Sadler
Figwort Weevil. *Joe Boting*



We know there are many good photos
of Yorkshire wildlife out there - please
add them to the YNU Flickr pages.