

## A STUDY OF RIPARIAN BEETLE SPECIES ALONG SLAPTON WOOD STREAM, DEVON

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Riparian habitats host a wide range of beetle species. Many of these species are quite rare, partly because so many streams are polluted to varying degrees and are frequently modified to facilitate water flow. Slapton Wood stream is neither heavily polluted nor modified. This short article reports on the species of beetle found along Slapton Wood stream and how many of these species forage at the interface between the water and drier exposed riparian sediments.

### INTRODUCTION

A variety of beetle species can be found in riparian habitats. Some of these species are recognised as scarce or rare in the UK (Lott, 2003). A factor driving rarity in these species is that riparian environments contain some of the most threatened habitats in the UK (Broadmeadow and Nisbet, 2004). Quite often, damage to riparian habitats comes through invasive plants species spreading along the channel impacting on native wildlife (Planty-Tabbachi *et al*, 1996; Gerber *et al*, 2008). An additional threat to riparian habitats is that water courses collect water from surrounding fields. As a result of agricultural activities, this water is often dirty, carrying substances such as chemical fertilisers, pesticides and other pollutants, and water quality has a significant impact on biodiversity (Adamek & Jurajda, 2001; Adamek *et al*, 2010). Clean water catchment areas have become rare and a variety of associated plants and animals have developed restricted distributions (e.g. Andersen & Hanssen, 2005; Matern *et al*, 2007).



FIGURE 1. Slapton Wood Stream © N Chadwick ([creativecommons.org/licenses/by-sa/2.0/](https://creativecommons.org/licenses/by-sa/2.0/))

Natural, unmanaged streams are structurally complex (Ice, 2004). The water course snakes through the landscape establishing deeper channels flanked by exposed riparian sediments (ERS) deposited where the flow is slacker. Several beetle species are associated with ERS, some of them are quite scarce or rare at a national scale (Andersen & Hanssen, 2003; Lott, 2003). Slapton Wood stream (Figure 1; Grid reference: SX 822 458) runs through the ancient Slapton Wood on route to Slapton Ley National Nature Reserve (NNR; Figure 2). The stream is unmanaged and retains structural complexity including a convoluted channel with associated ERS (Figure 3). Whilst it collects water from surrounding farmland, repeated examination of the macro-invertebrates in the stream by visiting undergraduate students suggests that the stream is relatively clean achieving a 'excellent' BMWP and ASPT scores (Armitage *et al.*, 1984) as well as an excellent Lincoln water quality index score (Extence & Ferguson, 1989). This finding correlates with a gradual reduction in certain chemical pollutants in the water flowing along Slapton Wood stream and

into Slapton Ley since the 1980s (Burt *et al.* in prep). As far as we know, no study has been carried out on the terrestrial insect species associated with the Slapton Wood stream, in particular beetles.

The aim of the current study was to establish which riparian species of beetles are associated with Slapton Wood stream and where each species can be found relative to the position of the channel.

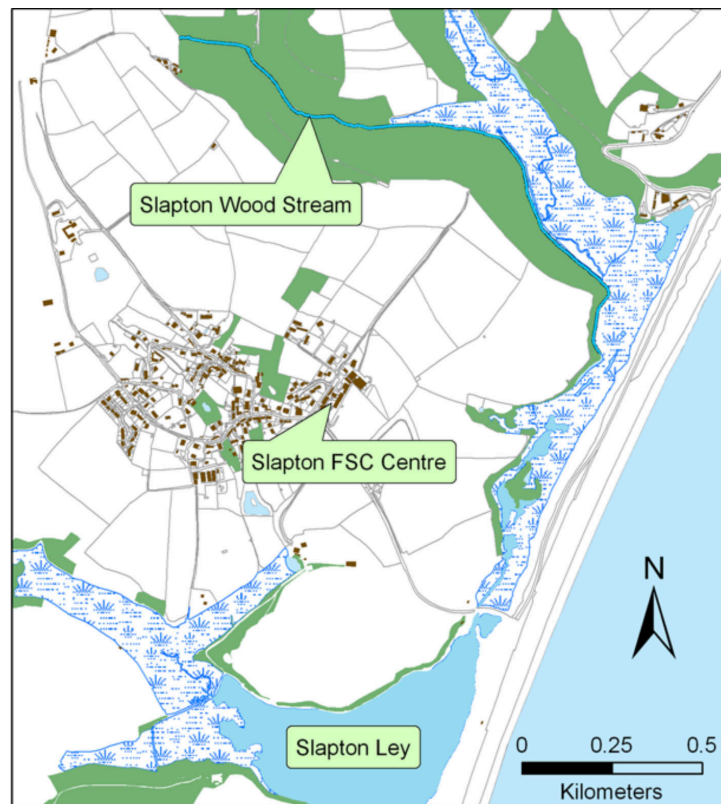


FIGURE 2. Position of Slapton Wood stream relative to Slapton Ley and the FSC Field Centre.



FIGURE 3. Slapton Stream showing convoluted course and depositions of sediment either side of the stream (NB: low water level; the stream was carrying more water at the time of the study). © N Chadwick ([creativecommons.org/licenses/by-sa/2.0/](https://creativecommons.org/licenses/by-sa/2.0/))



## METHODS

A stretch of approximately 200m of accessible stream was examined in August 2017. Along this stretch, 12 ERS patches were selected each separated by at least 15m. At each ERS a timed hand search (3 minutes) was carried out at the interface between the water and the ERS (i.e. the stones and sediments were only slightly above the surface of the water). Two people carried out each search along a stretch of ERS, each person searching a stretch of approximately 1m. The sediment was disturbed and turned carefully using garden trowels. Every beetle found was retained and returned to the laboratory for identification. At the end of 3 minutes, a second search was carried out but this time in the centre of the same ERS and well above the level of the water. The same length of ERS was searched (i.e. 2x1m) each time. Chi-squared tests were carried out to search for differences in distributions of beetles between the ERS water interface and the centre of the ERS.

## RESULTS

A total of 54 specimens were found of eight species; the species and the numbers collected are shown in Table 1. Significantly more beetles were found in close association with the edge of the water than in the middle of ERS ( $\chi^2=10.67$ ,  $p<0.001$ ,  $df=1$ ). The largest beetles found were all ground beetles (Carabidae) and these species were located predominantly at the interface between the water and the sediment. *Bembidion tibiale* (Figure 4A), the commonest species discovered (Table 1), was significantly associated with the water-sediment interface ( $\chi^2=11.8$ ,  $p<0.001$ ,  $df=1$ ) as opposed to the centre of the ERS. *Loricera pilicornis* was found exclusively in the water-sediment interface but only two individuals were found. *Paranchus albipes* (Figure 4B) was found mostly in the water-sediment interface; the four that were not at this interface were found all together under one stone above the water line. All of the remaining species found were rove beetles (Staphylinidae) (e.g. *Stenus guttula*; Figure 4C). The Aleocharinae (Staphylinidae) showed no preference for position on ERS. The other Staphylinidae (plus one Hydrophilidae) were caught in small numbers and no conclusion could be drawn.

Table 1. Numbers of each species of beetle found on exposed riparian sediment along Slapton Wood stream at water level and above water level.

Species	Family	At water level	Above water level
<i>Bembidion tibiale</i> (Duftschmid, 1812)	Carabidae	17	2
<i>Bembidion saxatile</i> Gyllenhal, 1827	Carabidae		1
<i>Paranchus albipes</i> (Fabricius, 1796)	Carabidae	7	4
<i>Loricera pilicornis</i> (Fabricius, 1775)	Carabidae	2	
<i>Aleocharinae</i> spp.	Staphylinidae	5	6
<i>Stenus guttula</i> Müller, P.W.J., 1821	Staphylinidae	4	2
<i>Stenus pallitarsis</i> Stephens, 1833	Staphylinidae	1	
<i>Anotylus rugosus</i> Fabricius, 1775	Staphylinidae	2	
<i>Anacaena globulus</i> Paykull, 1798	Hydrophilidae	1	
Total		39	15

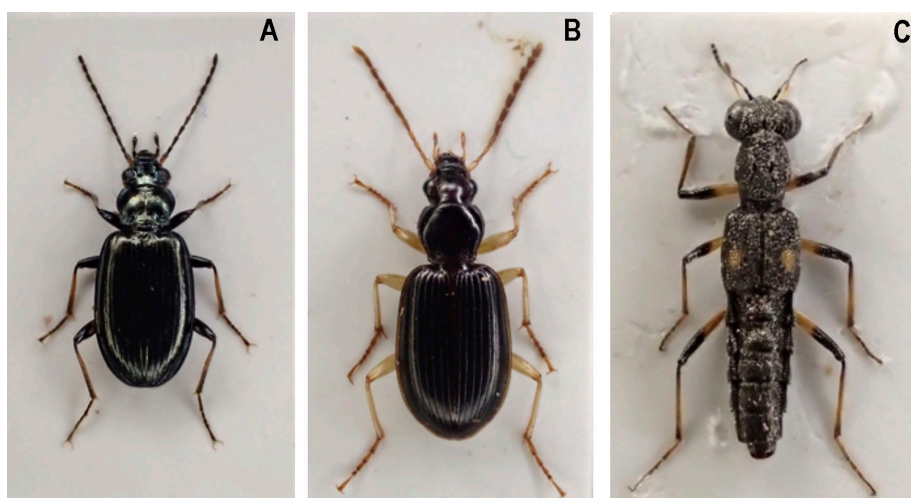


Figure 4. Images of the three commonest species of beetle found along Slapton stream, August 2017 (A, *Bembidion tibiale*; B, *Paranchus albipes*; C, *Stenus guttula*). (G.J. Holloway).

## DISCUSSION

Slapton Wood stream has been extensively used by students to learn how to carry out biotic index assessment. This involves examination of freshwater macro-invertebrates which has shown consistently that the stream is clean and in good condition according to Lincoln Index values (Extence & Ferguson, 1989). As far as we know there have been no studies of the terrestrial Coleopteran species associated with Slapton Wood stream. Streams in good condition have high conservation value for riparian beetle species (Andersen and Hanssen, 2005).

Lott (2003) lists 175 species of Carabidae regularly associated with riparian habitats in the UK. All of the ground beetle species found in the present study are listed by Lott (2003). The genus *Bembidion* features extensively in this list. Andersen (1985) argues that flatter bodied *Bembidion* are those most likely to be found in shingle riparian habitats and under stones. *Bembidion tibiiale* is a flat-bodied species and the ERS associated with Slapton Wood stream is gravelly, containing a range of sediment and stone sizes. *Bembidion tibiiale* can be found alongside streams throughout the year (Kurka, 1975). In Wales, *B. tibiiale* is found in the upper reaches of streams and along smaller tributaries lower down the water course (Fowles, 1989). In both situations, water is likely to be flowing relatively rapidly washing fine sediment away and leaving the courser gravel, similar to the conditions generated by Slapton Wood stream. The other three species of ground beetle found here, *B. saxatile*, *Loricera pilicornis* and *Paraneis albipes* along with *B. tibiialis* are all found routinely associated with riparian habitats (Lott, 2003). The populations of all of them, apart from *L. pilicornis*, are believed to be dependent on wetland habitats. *Loricera pilicornis* is found more widely in semi-natural terrestrial habitats as well as riparian habitats. In addition to the Carabidae, Lott (2003) also lists 422 Staphylinidae species associated with riparian habitats. All three of the species identified here, *Stenus guttula*, *S. pallitarsis* and *Anytolus rugosus*, are listed by Lott (2003) as dependent on riparian habitats.

There was a strong association with the water ERS interface with more beetles found here than away from the water on raised ERS. The most likely reason for this is that the beetles were all foraging for food being carried by the stream but trapped temporarily in the slack water flowing slowly through gravel adjacent to ERS. Aquatic insects form an important component of food for the beetle species found in the current study (Hering, 1998) and larval aquatic insects are frequently caught within the gravel along the edges of ERS. The particle size along the edges of streams is important and strongly influences the community of beetle species found (Hammond, 1998; Sadler & Petts, 2000). Small particle size associated with slower flowing streams would trap fewer aquatic insects, especially the larger species, and provide fewer opportunities for flat-bodied species that require stones and pebbles to hide under. In addition, the Slapton Wood stream flows through dense woodland that casts considerable shade, which is also known to influence the range of species present (Bauer 1974). Lott (2003) lists 50 *Bembidion* spp. associated with riparian habitats. The fact that only two *Bembidion* species were found in the current study, with one species numerically dominant, might suggest that a wide range of species are effectively excluded by the prevailing environmental conditions along Slapton Wood stream. Other studies in different conditions in the UK find a different community of *Bembidion* spp. present (Lott, 2003). For example, Bates *et al* (2007) found that *B. atrocaeruleum* and *B. decorum* varied in abundance on ERS in response to prevailing environmental conditions, including level of shade from overhanging vegetation, distance from the water's edge and elevation.

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