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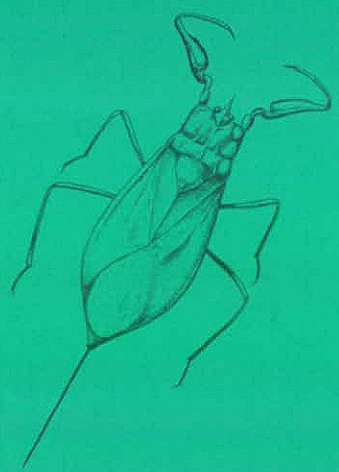
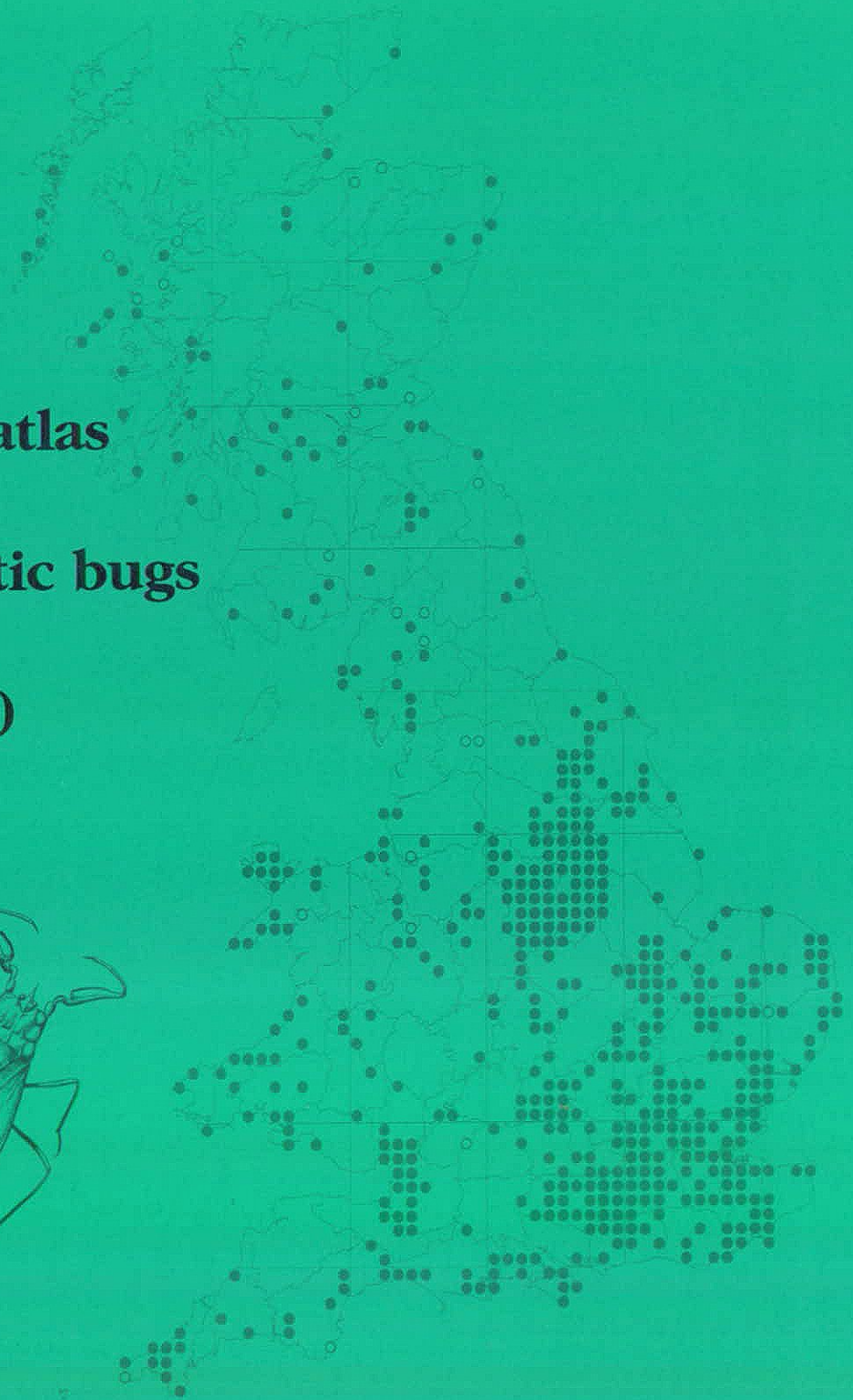
Provisional atlas of the British aquatic bugs (Hemiptera, Heteroptera)

Thomas Huxley





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FOREWORD

Linnaeus, in the tenth edition of his *Systema Naturae*, 1758, named seven species of water bugs, all of which are now recorded from the British Isles. They were placed in three genera, namely *Nepa, Notonecta* and *Cimex*. Linnaeus's work soon stimulated further descriptions of new species and further thoughts on taxonomy. For instance, by 1794, Fabricius had changed the name of *Cimex lacustris* to the familiar *Gerris lacustris*. During the nineteenth century a small number of workers, mainly amateurs, studied the British fauna and described new species or species new to Britain so that Saunders, in 1892, was able to list about forty-four species which we would now accept. Further studies were stimulated by a series of articles by Kirkaldy entitled "Guide to the Study of British Water Bugs" which appeared in the *Entomologist* between 1898 and 1908. Butler, in 1923, listed 54 species and produced the first natural history of Heteroptera including county records for England and Wales with Scotland and Ireland listed as countries. This work was greatly amplified by Southwood and Leston in 1959. Macan, in 1931 and 1941, listed 57 species in his keys to water bugs and later undertook extensive ecological studies of Corixidae. Massee, in 1955, made additions to Butler's county records. However no publications containing comprehensive dot distribution maps appeared until Jansson, in 1986, made maps of Europe which included the British Isles. Thus, this new atlas, containing 61 species, is the first detailed 10 km grid square survey of water bugs in England, Scotland and Wales. I hope the foregoing outline indicates that this atlas deserves a most honourable place in the development of our knowledge of the geographical distribution of water bugs. I commend it to all and am confident that it will stimulate new research.

Alan A. Savage
November 2001

ACKNOWLEDGEMENTS

I wish to thank Dr Alan Savage for his unstinting help and encouragement; also: John Blackburn who instigated the aquatic bug recording scheme and kept it alive through its formative years; Paul Harding for his guidance and help in editing the atlas and overseeing its publication; John Bratton, Peter Kirby and Robert Merritt for detailed comments at many stages, especially drafts of the species maps and accounts; several people for specimens for my reference collection; many librarians; lots of museum curators and managers of biological record centres who have sifted out water bug records from their files; and other people, especially William Penrice and Ross Spalding in Fife Nature, for help with computer problems. All recorders and determiners are listed below. Whether they contributed one record or thousands, they all deserve my grateful thanks.

While not being able to speak for other recorders (although they must surely be of like mind), in field work I have been much assisted by numerous "door-step" permissions from landowners, factors, gamekeepers, tenants and officials to collect on private and public land and I want to thank them.

Finally, I thank my wife Helen for her considerable patience. Without her support this retirement project - both at home and in the field - would not have been possible.

List of recorders and determiners

Some records are attributed to organisations, for example the Environment Agency, rather than individuals, in which case the name of the organisation is listed.

Abbot, A.; Adams, J.H.; Addey, J.E.; Allan, C.; Allen, A.A.; Allenby, K.G.; Allies, K.; Alexander, K.N.A.; Andrews, M.; Appleton, D.; Armitage, P.D.; Arnold, F.N.; Arnold, G.A.; Bachus, M.E.; Bailey, M.P.; Baldwin, S.C.; Balfour-Browne, J.; Bannister, R.T.; Barnes, R.S.K.; Barnett, R.; Barringer, W.L.; Barrington, R.; Bass, J.A.B.; Bazeley, M.E.; Beckett, E.; Beaumont, H.E.; Bell, A.; Bellamy, L.; Berrie, A.D.; Berry Hill Action Group; Bielby, G.H.; Biggs, J.; Bignell, G.C.; Binding, A.E.; Bird, L.M.; Birkett, N.L.; Black, K.; Blackburn, J.H.; Blackmore, D.S.A.; Bland, K.P.; Bloxham, M.G.; Boon P.J.; Bowen, H.J.M.; Bowen, I.; Bowler, J.A.; Bowles, N.; Boyce, D.; Boyce, R.; Boyd, J.M.; Bradford, M.D.; Bratton, J.H.; Bray, R.P.; Brayford, S.; Breckenridge, J.; Brierley, S.B.; Brierley, S.J.; Brind, C.A.; Brindle, A.; Brinkhurst, R.O.; Brittain, J.E.; Britten, R.H.; Broadhead, E.; Bromwhich, D.; Brooke, S.E.; Brookhuysen, G.F.; Brooks, J.E.; Broomfield, P.S.; Brown, A.; Brown, E.S.; Brown, J.M.; Brown, R.; Brunt, R.P.M.; Buckham, A.; Burgess, H.; Burton, J.; Butler, E.A.; Callaghan, S.; Campbell, A.; Campbell, J.; Campbell, J.M.; Carr, R.; Chalkley, A.; Champion, E.J.; Champion, R.J.; Chanin, P.; Chatwin, S.L.A.; Cheeseman, C.; Cheltenham College; Clark, J.; Clarke, S.A.; Clelland, B.E.; Clements, D.K.; Clemons, L.; Clifford, F.; Clifton, S.; Clynes, W.; Cobb, P.R.; Collen, P.; Collie, S.C.; Collinson, M.; Common, A.; Common, M.; Cook, K.; Cooter, J.; Copestake, D.; Corkhill, P.; Cory, A.; Countryside Council for Wales; Cox, G.; Crittenden, M.; Cropper, R.S.; Crossley, R.; Crowle, A.; Crowson, R.; Cuthbertson, A.; Cuthbertson, G.D.; Davidson, W.F.; Day, F.H.; Day, G.M.; Denman, D.; Denton, J.S.; Devereau, M.; Dingle, T.J.; Disney, R.H.L.; Dixon, G.J.; Dixon, H.; Dixon, N.; Dixon, T.; Dobson, R.M.; Dolling, W.R.; Dorey, A.E.; Dorset Naturalist Trust; Doughty, C.R.; Drake, C.M.; Draper, H.; Ducker, S.; Duncan, A.B.; Duncan, P.B.; Dunicliffe, D.; Dunn, D.R.; Durrant, K.C.; Dymott, P.; Edwards, J.; Elliott, M.S.C.; Ellis, J.W.; Ely, W.A.D.; England, J.A.; English Nature; Environmental Advisory Unit Ltd.; Environment Agency; Evans, D.E.; Evans, S.; Ewing, T.; Ewing, A.W.; Extence, C.; Eyre, M.D.; Fawthrop, I; Feakes, K.A.; Felton, C.; Fitton, M.G.; Flavell, H.; Flavell, M.; Flint, J.H.; Fordham, W.J.; Formstone, B.; Forrester, G.J.; Foster, A.P.; Foster, G.N.; Foster, S.; Fowles, A.P.; Fozzard, I.R.; Franklin, B.; Fraser, A.; Fry, R.; Furnival, A.D.; Gardner, A.E.; Garrad, L.S.; Gee, J.H.R.; Gerlach, J.; Gibbs, D.; Gillespie, E.; Gillham, M.E.; Glenkemp Ltd.; Gloucester Invertebrate Group; Goddard, D.; Godfrey, A.; Goldie-Smith, E.K.; Goodson, J.; Goodyear, J.; Gormally, S.; Gowlett, K.L.; Gray, A.; Gray, I.; Gray, J.B.; Green, G.; Green, K.; Greenwood, M.T.; Guest, J.; Gregory, J.L.; Grove, S.J.; Gunn, I.D.M.; Hackley, P.; Haes, E.C.M.; Hale Carpenter, G.D.; Hall, H.S.H.; Hallett, M.D.; Hamilton, J.D.; Hammond, M.; Hammond, N.; Hancock, E.G.; Hardman, J.A.; Hardstaff, M.; Hardye's School; Hart, P.R.; Harvey, M.C.; Harvey, P.; Harwood, E.; Harwood, P.; Haskins, L.; Hawkins, K.; Hawkins, R.D.; Hayton, C.; Heath, J.; Henderson, K.L.; Hewitt, S.M.; Hibbard, J.; Hicklin, A.J.; Hickson, R.G.; Hiley, P.D.; Hill, A.R.; Hill, R.E.; Hill-Cottingham, P.; Hincks, W.D.; Hine, A.T.; Hinton, J.; Hobart, J.; Hodge, P.J.; Hogg, S.; Holman, N.; Holmes, P.; Holyfield, S.; Hopkins, C.; Hopkins, I.J.; Hopson, T.; Hose, T.A.; Howe, B.; Howe, E.A.; Howe, M.A.; Hudspith, P.M.G.; Hunnisett, J.; Hunt, P.C.; Hutchinson,G.E.; Huxley, T.; Hyder International; Hynes, H.B.N.; Institute Freshwater Ecology; Ireland, D.T.; Isle of Wight BRC; Ismay, J.; Jackson, B.E.; Jackson, D.; Jackson, Dorothy; Jackson, E.; Jackson, M.; Jeffries, M.; Jennings, P.P.; Jennison, J.A.; Jessop, L; Johnson, M.; Johnson, M.S.; Jones, A.V.; Jones, D.K.; Jones, J.W.; Jones, S.P.;

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CHECK LIST

The following check list, with synonyms and sub-species where they are likely to be encountered in earlier literature, mostly follows Savage (1989), but there are a few alterations resulting from consultation with him, some having regard to Aukema and Rieger (1995). Species names are generally more consistent than the genera, especially amongst Corixidae. There is, however, one important alteration to Savage (1989). With two exceptions, the ordering of species follows the alphabetical arrangement on Biological Record Centre (BRC) aquatic bug recording card (RA54). The exceptions are *Microvelia buenoi* (=*M. umbricola*) which is now placed first in that genus, and *Notonecta viridis* (= *N. marmorea viridis*) placed last in that genus, after *N. obliqua*. The BRC card includes two species followed by "agg.": *Cymatia coleoptrata* and *Callicorixa wollastoni*. The "agg." may be disregarded as it refers in each species to varieties no longer considered valid.

Kirby (1998) provides a list of vernacular names for British Heteroptera. For example, names for some surface bugs include pondskaters, water measurers, water striders and wherrymen but other authors (e.g. Fitter & Manuel, 1986) write pond skaters as two words and Southwood and Leston (1959), put a hyphen in water-measurer. Backswimmer is to be preferred to greater waterboatman for *Notonecta* sp.

	Synonym
Family MESOVELIIDAE	
Mesovelia furcata Mulsant & Rey	
Family HEBRIDAE	
Hebrus pusillus (Fallén, 1807)	
Hebrus ruficeps (Thomson, 1871)	*Naeogeus ruficeps* (Thomson, 1871)
Family HYDROMETRIDAE	
Hydrometra gracilenta Horváth, 1899	
Hydrometra stagnorum (Linnaeus, 1758)	
Family VELIIDAE	
Microvelia buenoi Drake, 1920	*Microvelia umbricola* Wroblewski, 1938
Microvelia pygmaea (Dufour, 1833)	
Microvelia reticulata (Burmeister, 1835)	
Velia caprai Tamanini, 1947	*Velia currens* (Fabricius, 1794)
Velia saulii Tamanini, 1947	
Family GERRIDAE	
Limnoporus rufoscutellatus (Latreille, 1807)	*Gerris rufoscutellatus* (Latreille, 1807)
Aquarius najas (De Geer, 1773)	*Gerris najas* (De Geer, 1773)
Aquarius paludum (Fabricius, 1794)	*Gerris paludum* (Fabricius, 1794)
Gerris argentatus Schummel, 1832	
Gerris costae Wagner & Zimmerman, 1955	*Gerris costai* (Herrich-Schäffer, 1853)
Gerris gibbifer Schummel, 1832	
Gerris lacustris (Linnaeus, 1758)	
Gerris lateralis Schummel, 1832	*Gerris lateralis* ssp. *asper* (Fieber, 1861)
Gerris odontogaster (Zetterstedt, 1828)	
Gerris thoracicus Schummel, 1832	
Family NEPIDAE	
Nepa cinerea Linnaeus, 1758	
Ranatra linearis (Linnaeus, 1758)	

Family NAUCORIDAE	
Ilyocoris cimicoides (Linnaeus, 1758)	*Naucoris cimicoides* (Linnaeus, 1758)
Family APHELOCHEIRIDAE	
Aphelocheirus aestivalis (Fabricius, 1794)	*A. montandoni* Horvath, 1899
Family PLEIDAE	
Plea minutissima Leach, 1817	*Plea leachi* McGregor & Kirkaldy, 1899
	Plea atomaria (Pallas, 1771)
Family NOTONECTIDAE	
Notonecta glauca Linnaeus, 1758	
Notonecta maculata Fabricius, 1794	
Notonecta obliqua Thunberg, 1787	*N. furcata* Fabricius, 1794
	N. obliqua Gallen, 1787
Notonecta viridis Delcourt, 1909	*N. marmorea* Fabricius, 1803 ssp. *viridis* Delcourt, 1909
Family CORIXIDAE	
Micronecta minutissima (Linnaeus, 1758)	
Micronecta poweri (Douglas & Scott, 1869)	*M. minutissima* (Linnaeus, 1758)
Micronecta scholtzi (Fieber, 1860)	*M. scholtzi* (Fieber, 1847)
Cymatia bonsdorffii (Sahlberg, 1819)	*C. bonsdorffi* (Sahlberg, 1819)
Cymatia coleoptrata (Fabricius, 1776)	
Glaenocorisa propinqua (Fieber, 1860)	
ssp. *propinqua* (Fieber, 1860)	
ssp. *cavifrons* (Thomson 1869)	
Corixa affinis Leach, 1817	
Corixa dentipes Thomson, 1869	
Corixa iberica Jansson, 1981	*Corixa iberica* Anderson
Corixa panzeri Fieber, 1848	*Deltocephalus panzeri* (Fieber, 1848)
	Palus panzeri (Fieber, 1848)
Corixa punctata (Illiger, 1807)	*Corixa geoffroyi* (Leach, 1817)
Hesperocorixa castanea (Thomson, 1869)	*Arctocorisa castanea* (Fieber, 1848)
	Corixa castanea (Fieber, 1848)
	Sigara castanea (Thomson, 1848)
Hesperocorixa linnaei (Fieber, 1848)	*Hesperocorixa linnei* (Fieber, 1848)
	Arctocorisa linnaei Fieber, 1848
Hesperocorixa moesta (Fieber, 1848)	
Hesperocorixa sahlbergi (Fieber, 1848)	*Arctocorisa sahlbergi* (Fieber, 1848)
	Corixa sahlbergi (Fieber, 1848)
	Sigara sahlbergi (Fieber, 1848)
Arctocorisa carinata (Sahlberg, 1819)	*Corixa carinata* (Sahlberg, 1819)
	Sigara carinata (Sahlberg, 1819)
Arctocorisa germari (Fieber, 1848)	*Corixa germari* (Fieber, 1848)
	Sigara germari (Fieber, 1848)
Callicorixa praeusta (Fieber, 1848)	*Sigara praeusta* (Fieber, 1848)
	Corixa praeusta (Fieber, 1848)
Callicorixa wollastoni (Douglas & Scott, 1865)	*Sigara wollastoni* (Douglas & Scott, 1865)
	Corixa wollastoni (Douglas & Scott, 1865)
Sigara concinna (Fieber, 1848)	*Paracorixa concinna* (Fieber, 1848)
	Corixa concinna (Fieber, 1848)
	Callicorixa concinna (Fieber, 1848)

Sigara distincta (Fieber, 1848)	*Arctocorisa distincta* (Fieber, 1848) *Corixa distincta* (Fieber, 1848)
Sigara dorsalis (Leach, 1817)	*Corixa dorsalis* (Leach, 1817) *Sigara striata* (China, 1938) *Sigara lacustris* (Macan, 1954)
Sigara falleni (Fieber, 1848)	*Subsigara falleni* (Fieber, 1848)
Sigara fossarum (Leach, 1817)	*Arctocorisa fossarum* (Leach, 1817) *Corixa fossarum* (Leach, 1817) *Subsigara fossarum* (Leach, 1817)
Sigara lateralis (Leach, 1817)	*Sigara hieroglyphica* (Dufour, 1833)
Sigara limitata (Fieber, 1848)	*Arctocorisa limitata* (Fieber, 1848) *Corixa limitata* (Fieber, 1848)
Sigara nigrolineata (Fieber, 1848)	*Sigara fabricii* (Fieber, 1851) *Vermicorixa nigrolineata* (Fieber, 1848)
Sigara scotti (Douglas & Scott, 1868)	*Corixa scotti* (Douglas & Scott, 1868) *Subsigara scotti* (Douglas & Scott, 1868)
Sigara semistriata (Fieber, 1848)	*Arctocorisa semistriata* (Fieber, 1848) *Corixa semistriata* (Fieber, 1848) *Retrocorixa semistriata* (Fieber, 1848)
Sigara selecta (Fieber, 1848)	*Corixa (Halicorixa) selecta* (Fieber, 1848)
Sigara stagnalis (Leach, 1817)	*Corixa (Halicorixa) stagnalis* (Fieber, 1848)
Sigara striata (Linnaeus, 1758)	
Sigara venusta (Douglas & Scott, 1869)	*Arctocorisa venusta* (Douglas & Scott, 1869) *Corixa venusta* (Douglas & Scott, 1869) *Retrocorixa venusta* (Douglas & Scott, 1869)

In 2000 and 2001, Bernard Nau and Sheila Brooke found a species of *Micronecta* thought to be *M. griseola* Horváth at three locations on the River Great Ouse in Bedfordshire: Felmersham Bridge, Bromham Mill and Odell Mill. A male from Felmersham has been examined by Bill Dolling and the determination confirmed by him. Three males from the other two sites have been compared by Nau and Brooke with the Felmersham specimen and there is agreement regarding crucial anatomical details in the shape of the right paramere. Admission of *M. griseola* to the British checklist awaits formal confirmation.

INTRODUCTION

ABOUT AQUATIC BUGS

General

Aquatic bugs are insects belonging to the order Hemiptera, sub-order Heteroptera. Sixty-one species of aquatic bugs have been recorded as breeding in Britain, which fall into eleven families (Fig 1). Two more species breed in Ireland, thus making sixty-three species for the British Isles. One of these two, a large pond skater, *Limnoporus rufoscutellatus*, has been recorded in Britain as an occasional migrant and it may eventually be shown to breed in Britain. A few publications (e.g. Brown, 1946) include semi-aquatic shore bugs (Saldidae) with aquatic bugs, but most other authors do not and this exclusion is followed in this atlas.

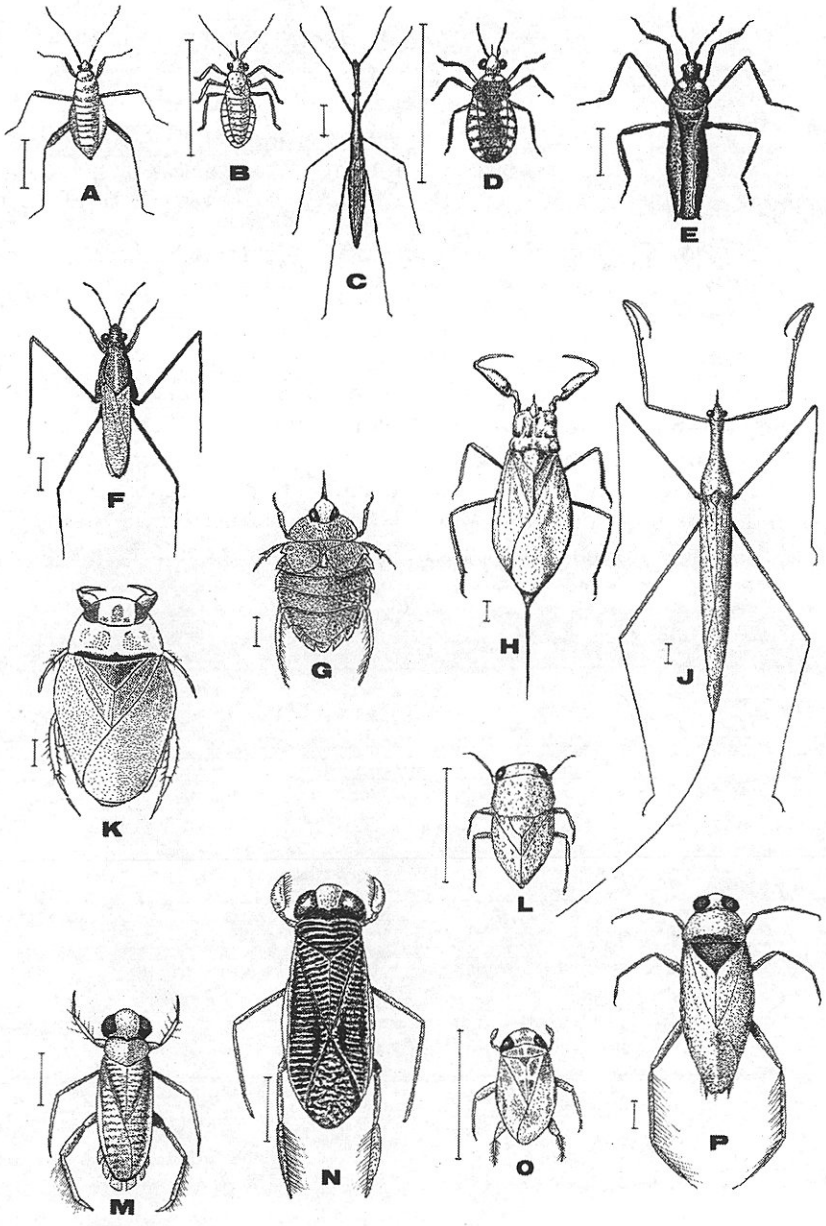


Fig 1: Illustrations of the eleven families of aquatic bugs. **A**: Mesoveliidae; **B**: Hebridae; **C**: Hydrometridae; **D**: Veliidae (*Microvelia* sp.); **E**: Veliidae (*Velia* sp.); **F**: Gerridae; **G**: Aphelocheiridae; **H**: Nepidae (*Nepa cinerea*); **J**: Nepidae (*Ranatra linearis*); **K**: Naucoridae (*Ilyocoris cimicoides*); **L**: Pleidae (*Plea minutissima*); **M**: Corixidae (*Cymatia bonsdorffi*); **N**: Corixidae (*Sigara* sp.); **O**: Corixidae (*Micronecta* sp,); **P**: Notonectidae. The line to the left of each figure = 2mm.

Some species can be identified in the field with the naked eye or with a hand lens. Most require examination under a microscope and some of these need verification by an expert. Access to a reference collection (in time one's own) can be helpful for purposes of comparison. For identification of adults the key to use is Savage (1989) and there is now a key to larvae of Corixidae (Savage, 1999). The illustrated guide to land and water bugs by Southwood and Leston (1959), long out of print and scarce, has recently been made available on CD-ROM. This has much useful information about water bugs which can helpfully supplement the ecological notes accompanying Savage's 1989 key. Details of how to obtain these publications are given in Appendix 6.

Aquatic bugs and water

Aquatic bugs are insects belonging to the order Hemiptera, sub-order Heteroptera. They live mostly in or on water but some species can also be found in the damp terrestrial margins of water, for example when hunting prey or hibernating. There is much variation between families or at certain stages of their life cycles. This can relate to whether they are mandatory air-breathers or can live throughout their lives or for long periods totally submerged. Some of these differences are summarised by Guthrie (1989). The term *neuston* describes animals and plants living at the surface; *epineuston* for those that live above the water but in regular contact with it and *hyponeuston* for those hanging down from the surface. Some aquatic bugs fall into the former category and others into the latter for parts of their lives. The relevance of the foregoing for recording distribution is that in most locations water bugs can be captured with a long-handled net. In summer, for example, when the water is warm, most species come to the surface regularly to refresh their air supply or hang just below the surface where they may be seen. In cold conditions, however, when there is more absorbed oxygen in deep water, they can remain submerged for long periods and thus be netted less easily. However, the river bug, *Aphelocheirus aestivalis*, has an adaptation allowing it to remain submerged throughout its life. The various anatomical modifications that permit these different ways of living in or on water are described by Southwood and Leston (1959) and others.

Aquatic bugs and flight

Some water bugs have wings, others lack wings, even within the same species. For example, amongst the surface dwelling pond skaters and their allies, the winged condition may vary from none (apterous), to stub winged (micropterous) to partly formed (brachypterous) and fully formed (macropterous). Brinkhurst (1959b) explains the factors determining wing length. Most other aquatic bugs also display different wing lengths or development of wing muscles, the upshot being that many species can fly and are sometimes caught in light traps. Flightlessness is a commonly occurring adaptation to a stable freshwater environment (Savage, 1989), while winged forms allow swift occupation of small temporary habitats and dispersal or migration (both terms can apply). The presence or absence of wings is a subject much studied and often commented upon by aquatic bug recorders, especially when finding the fairly uncommon but distinctive winged forms of *Velia*. However, for the purposes of this atlas the question is more about how far water bugs are able to fly and whether this might lead to apparent anomalies in recording their geographical distribution. The presumption is that it does not; although an individual specimen might be able to fly into one 10 km square from a neighbouring square, on balance this is not a material consideration regarding the accuracy of maps plotted at the scale of 10 km squares. The ability of water bugs to fly and occasionally to be found away from water, for example in mercury vapour light traps or on shiny surfaces, such as car bonnets, demonstrates their ability to disperse and therefore to colonise new sites.

Food

All aquatic bugs except Corixidae are predators, feeding on living or recently dead animals. Corixidae have a modification to their mouth parts which allows mastication of solid food and can be described as omnivores, carnivores, detritivores and algal feeders (Savage, 1989). Guthrie (1989) describes how surface bugs react to vibrations and thereby capture prey which live or fall by chance onto the water surface.

Life cycles

All true bugs (Hemiptera) have an incomplete life cycle of eggs, larvae and adults. Some authors (e.g. Fitter & Manuel, 1986) use the term nymph rather than larva and some recorders the term juvenile. There are five larval instars. Teneral (see Glossary) adults may be lighter in colour than fully mature adults and this may create problems in identification. Oviposition generally takes place under water, the eggs being attached to plants or stones. Characteristic differences in oviposition site, sometimes between closely related species, suggest that the site can be an adaptive strategy of importance to the distribution of species (Savage, 1989).

British species have either one (univoltine) or two (bivoltine) generations per annum. In broad terms (with much variation according to seasonal temperature and location from south to north Britain) mating takes

place in the spring, egg laying and development to the first instar takes one month and successive instars several months, leading to the new generation of adults in early and/or late summer. Thereafter, with the exception of *Micronecta* spp., which generally overwinter as third instar larvae (Southwood & Leston, 1959), aquatic bugs overwinter as adults. The consequence of this time-sequence is that in the months of high summer, particularly July and August, there may be numerous nymphs and few adults, which is inconvenient for entomologists recording distribution when water and weather are warm. Many surface bugs disappear in late autumn, spending the winter in marginal vegetation or in the fissures of waterside rocks, and do not reappear until February or March.

Habitats

Aquatic habitats are distinguished as still (lentic) or flowing (lotic). Generally, aquatic bugs are found in still waters, most of which are small, such as ponds and hill pools. Bugs may also be found in large lakes, but this is usually where there are bays and indentations of the shore which simulate the sheltered conditions of small water bodies. With the exception of species which prefer flowing water, such as the water cricket, *Velia caprai*, the river skater, *Gerris najas*, and the river bug, *Aphelocheirus aestivalis*, where bugs are found in streams, canals and rivers it is usually because the flow is locally impeded; for example in a backwater or partial oxbow. Ditches are often cited as habitats for aquatic bugs, but mostly where the flow is negligible. A negative factor can be the presence of surrounding trees; in general, ponds in woods and forests are poor in aquatic bugs.

It is a common feature of most small still water bodies (Savage, 1989; Brönmark & Hansson, 1998) that they are subject to ecological succession, from open water to marsh and eventually to dry land. The rate of change may depend on water supply, for example from springs or surface drainage, and may also be affected by the topographical situation and level of ground water. The range of possible conditions and causes - often man made - are considerable. The smaller the water body, the more rapid may be the rate of change, for example in temperature, turbidity, water chemistry or complete drying out. These changes may be over a period of years, or annually in relation to growth and die back of vegetation, or diurnally with regard to temperature. Savage (1989) has provided semi-schematic representations and histograms of the relationship between the occurrence of selected species of corixids and conductivity, percentage organic matter in the substratum, size of water body and organic matter in the water. Summaries of his own researches and the work of others in Britain, especially Macan (1938, 1954), can be read in conjunction with the species accounts in Southwood and Leston (1959). The importance of these researches for students of water bug distribution is that they provide a scientifically based framework into which to place their own observations on which species are likely to be present.

However, when one considers what a pond net is actually doing in the generally murky shallows of all but the most ideally simplified water bodies, there will often be uncertainty about the detailed ecological characteristics of the water through which the net passes. Macan (1954) considers the problem of comparing habitat data from a variety of sources: that in certain circumstances catches may be obtained by "sweeping through the habitat of more than one species". He refers to an earlier paper (Macan, 1938) in which "two stations which were barely one metre apart had almost totally different populations," concluding that "there is no evidence that earlier collectors had the same interest in detailed observations of this kind."

Indeed, sixty years later this is still largely true, there being no generally followed system for recording aquatic bug habitats, notwithstanding that there are several systems for classifying fresh waters, for example Maitland (1979) in Britain and Cowardin *et al.* (1979) in the United States. In Britain there is also the "SERCON" system for evaluating rivers for conservation (Boon *et al.*, 1994) and a predictive system for multimetrics (PSYM) has recently been developed for assessing the overall ecological quality of lentic waters (Biggs *et al.*, 2000). The Scottish Environment Protection Agency (SEPA) has a quality classification for Scottish standing waters (Fozzard *et al.*, 1999). Protocols for the standard measurement of freshwater sites have been published by the Centre for Ecology and Hydrology (Sykes *et al.*, 1999). They include sampling methods for macro-invertebrates, mainly for running waters. There is also advice on assessing the ecological quality of ponds in a publication by SEPA (2000), although this is mainly concerned with guidance on good practice in the creation and management of small waterbodies.

Scarce and threatened species

Kirby (1992) provisionally assigned eight species of aquatic bugs as either Red Data Book (RDB) Category 3 or Notable (see Table 1). RDB 3 is defined as taxa with small populations which are not at present Endangered or Vulnerable, but are at risk. Usually such taxa are unlikely to exist in more than fifteen 10 km

squares of the national grid. Notable taxa are defined as those which do not fall within RDB categories 1-3 but are nonetheless uncommon in Great Britain and thought to occur in fewer than a hundred 10 km squares of the national grid. The category of 'Notable' has been replaced by the more widely accepted category of 'Nationally scarce', which is based on similar criteria. Pages 143-150 of Kirby's report provide "data sheets" about eight species of aquatic bug, listed in Table 1. Subsequently, *Hydrometra gracilenta*, the lesser water measurer, has been listed under the UK Biodiversity Action Plan (UK Biodiversity Group, 1999).

Family name	Species name	Category
Hebridae	*Hebrus pusillus* (Fallen)	Scarce
Hydrometridae	*Hydrometra gracilenta* Horvath	RDB 3
Veliidae	*Microvelia buenoi umbricola* Wroblewski	RDB 3
	Microvelia pygmaea (Dufour)	Scarce
Gerridae	*Aquarius paludum* (Fabricius)	Scarce
Corixidae	*Corixa iberica* Anderson	Scarce
	Micronecta minutissima (Linnaeus)	RDB 3
	Sigara striata (Linnaeus)	Scarce

Table 1: Scarce and threatened aquatic bugs in Britain (after Kirby, 1992).

ABOUT THE ATLAS

Purpose

The purpose of this provisional atlas is to provide data about the present distribution of the sixty-one species of aquatic bug known to breed in Britain. It is provisional because there are no records at all from 25% of 10 km squares and also because there must be substantially more species records yet to be obtained and made accessible electronically.

Age of records

It follows from the purpose that the main effort has been to provide a database about recent records, with old records mostly excluded. The terms 'recent' and 'old' are not, however, absolute quantities. The default date before which a record is shown by an open circle is 1970. 'Old' in the most general sense is therefore pre-1970. However, in cases where there is a shortage of records (for a part of the country or for a species) pre-1970 records have been included, occasionally even pre-1940. There are several reasons for this age limitation, the most important being that the older the record the less complete the data relating to it and the more difficult it is to reconstruct what that supporting data should be. The upshot is that, while recognising that historical data can be important in understanding distributional changes, this provisional atlas has to be considered as a baseline for distributional changes in the future, rather than changes that may have already occurred.

Earlier distribution maps of aquatic bugs

To the best of my knowledge, the earliest distribution maps of aquatic bugs are by Macan in Macan and Worthington (1951). *Micronecta scholtzi*, *Callicorixa wollastoni* and *Sigara scotti* are selected to demonstrate the value of such maps as "an essential preliminary to ecological study". The three maps show the vice-counties in which each species was at that time recorded, Scotland being omitted for lack of data. In Leston (1958) there are vice-county maps for twelve species in Ireland. Brinkhurst (1959a) also published vice-county distribution maps - including Scotland and Ireland - for twelve species of *Velia* and *Gerris*. Southwood and Leston (1959) show a dot distribution map for an estuarine saldid, *Aepophilus bonnairei*, but the first such dot-distribution maps for aquatic bugs are by Jansson (1986) showing British species in a European context. BRISC (Biological Recording in Scotland Campaign) published a dot-distribution map of the water scorpion, *Nepa cinerea*, in 1988 in its Newsletter No 5. Savage (1989) has two maps: one shows the distribution of *Sigara dorsalis*, *S. striata* and intermediate specimens in Kent and Sussex, while another shows the distribution of *Corixa punctata* and *C. iberica* in Scotland and Ireland. Nelson (1995) mapped aquatic bugs in Northern Ireland and by now there are probably several biological record centres and individuals who have dot-distribution maps for their areas held electronically. For example Chalkley (1998) has a web site showing distribution maps of nine species of aquatic bugs in Suffolk.

History of aquatic bug recording

A recording scheme for British Heteroptera was begun in 1983 (Eversham, 1983) with separate national organisers for terrestrial and aquatic bugs and separate BRC cards; respectively RA57 and RA54. John Blackburn was the first national organiser for aquatic bugs. I replaced him in 1999. The previous year, in a supplement to the Heteroptera Study Group Newsletter No 13, I provided a two-page summary about progress to map the distribution of aquatic bugs in Britain. In March 1999, a second summary progress report was issued as part of Newsletter No 14, accompanied by an update about Ireland by Brian Nelson. At that date Nelson and I hoped that, in some way, we could combine our efforts and that a published atlas would be for the British Isles. In the event, this has proved too difficult. For the purpose of the atlas, a date had to be decided after which no more records would be accepted. The date decided was 31 July 2001. In fact, a very few records had to be accepted after that date because they provided records of exceptional interest. Fig 2 shows the distribution of 2,132 10 km squares for which there is at least one species record. The total number of records is 31,749. This number includes records placed in category 2 or 3 (see Glossary), excluded when plotting maps.

In the early years of the scheme the Heteroptera Study Group arranged field visits to different parts of Britain but no such visits have been arranged recently. Nor has the scheme any local focus groups; the whole project having mostly depended on a small number of dedicated people, with new recruits enrolled mainly through personally directed letters.

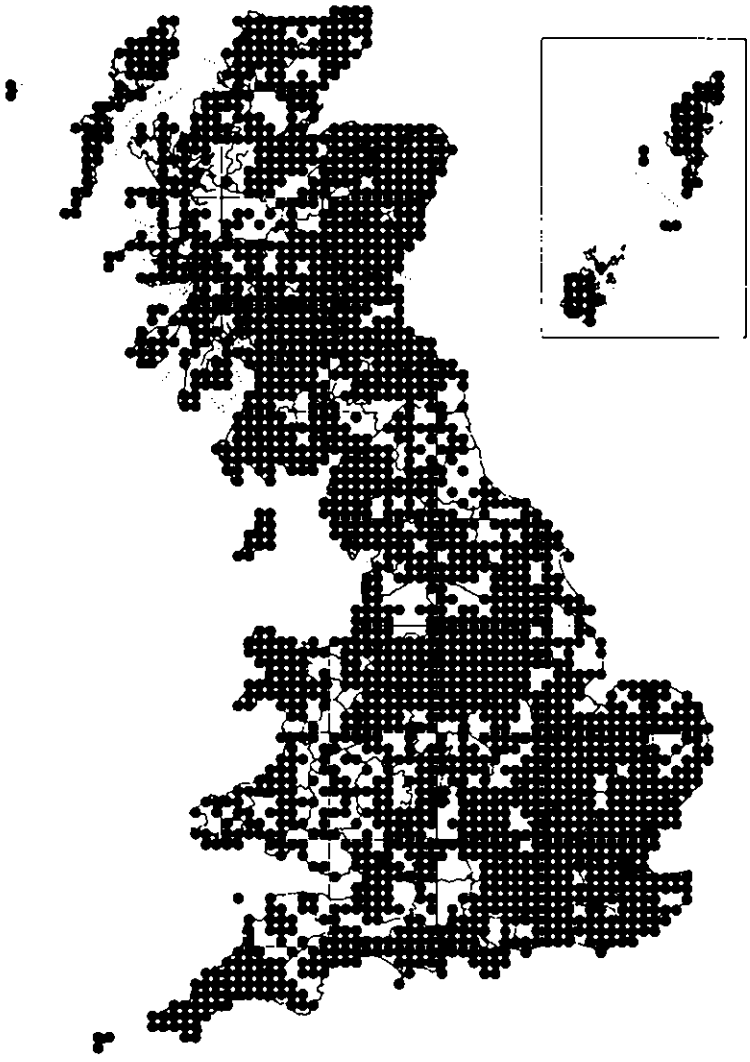


Fig 2: Map showing all 10 km squares for which there is at least one species record at 1 October 2001. No of records: 31,749. No of 10 km squares for which there is at least one species record: 2,132.

Records and their management

Computer software The software used is RECORDER 3.3. The mapping package is DMAP for Windows (DMAPW) from Thurner Automation, recently updated to allow plotting frequency and coincidence maps. DMAPW is used with a programme which links it to RECORDER.

Definition of a record; Evidence of breeding, sex and stage A record is defined as the occurrence of a particular species at a particular location on a particular date. The number of specimens caught is not recorded electronically. With the exception of the following six species, a nymphal stage is not accepted for a record: *Hydrometra stagnorum, Nepa cinerea, Ranatra linearis, Ilyocoris cimicoides, Aphelocheirus aestivalis* and *Plea minutissima*. All of these species are sufficiently recognisable as nymphs by competent recorders that the presence of a nymph only is accepted. Evidence of breeding is not required for a record to be accepted. Records for the other fifty-four species are for adults, notwithstanding the recently published key to the larvae of British Corixidae (Savage, 1999) and the descriptions of nymphs of British *Gerris* and *Velia* species (Brinkhurst, 1959c).

Sources of records These range from BRC aquatic bug cards, RA54, to lists; the latter frequently sent as attached E-mail spread-sheets. Records have also been extracted from museum collections and published papers.

Accuracy of records There has been no procedure for vetting records equivalent to the teams in different parts of Britain employed for the dragonfly scheme (Merritt *et al.*, 1996). In general, I have had to presume that people who submit records know what they are doing, subject to occasional requests for confirmation and examination of specimens. The three feedback reports (Huxley, 1999b, 2000b & 2001) have helped stimulate colleagues to suggest records requiring investigation and three people (Bratton, Kirby and Merritt, see acknowledgements) have been particularly helpful in the final stages.

Examples of output from the data

The software can provide various kinds of data, the chief variable being the completeness of the data entered with each record. Some examples are as follows.

Altitude The common water cricket *Velia caprai* occurs from sea level to high on mountains. Table 2 shows that the maximum recorded height is between 900 and 949 metres, with most records being below 150 metres, which is about what one would expect. However, when similar data are extracted for *Arctocorisa carinata* (see Table 3), a species generally considered to be restricted to high places, the altitude distribution is also fairly evenly spread from near sea-level to the same maximum height as the water cricket. The disappointing aspect of both outputs relates to the inadequacy of the data supplied with records. Out of 1,326 records for *Velia caprai*, only 452 (34%) have altitude data; for *Arctocorisa carinata* the proportion is better but still not good: 43 (60%) out of a total of 71.

Altitude (metres)	No of records
0-49	150
50-99	96
100-149	49
150-199	40
200-249	29
250-299	31
300-349	23
350-399	13
400-449	3
450-499	6
500-549	4
600-649	4
700-749	1
750-799	1
850-899	1
900-949	1

Table 2: Altitude of records for *Velia caprai*

Altitude (metres)	No of records
0-49	3
50-99	5
100-149	1
150-199	5
200-249	5
250-299	4
300-349	2
350-399	3
400-449	1
500-549	2
550-599	2
600-649	5
700-749	3
850-899	1
900-949	1

Table 3: Altitude of records for *Arctocorisa carinata*

Phenology The percentage of records of a species in each month or week can be shown as a histogram. Figs 3 and 4 show the months and weeks for *Microvelia reticulata* 458 records out of a total of 528 were usable for the former; rather less, at 424, for the latter because fewer records give the day date as well as the month. Thus the histograms look different because of the way the values are plotted over a month or week but basically both histograms show the same general feature of most aquatic bug phenology histograms: a bimodal form with peaks in May and September. These data are unreliable evidence of adult bug activity in winter months when there is less recording.

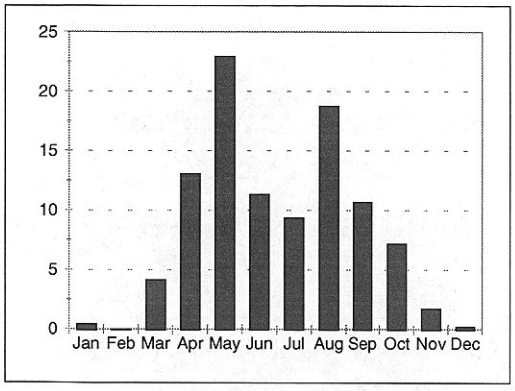


Fig 3: Months *Microvelia reticulata* recorded

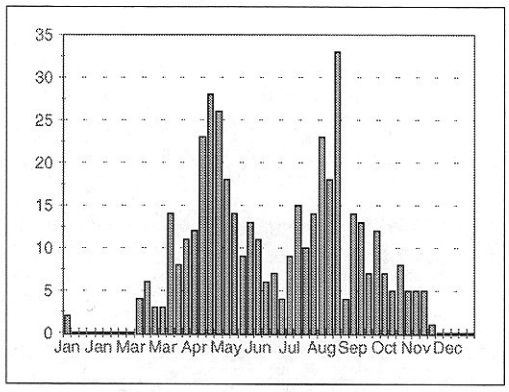


Fig 4: Weeks *Microvelia reticulata* recorded

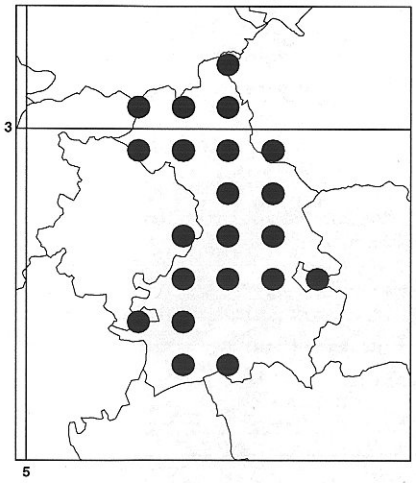


Fig 5: Distribution of all records in VC29, plotted at 10 km centres, 21 dots

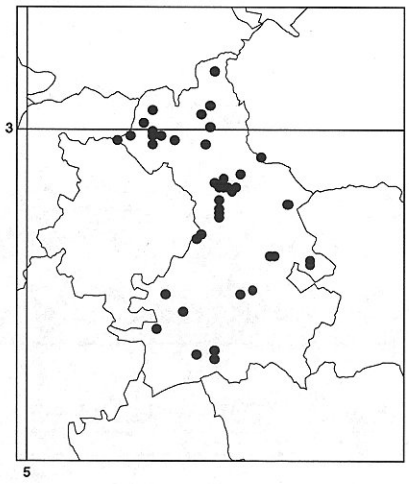


Fig 6: Distribution of all records in VC29, plotted at 1 km centres, 42 dots

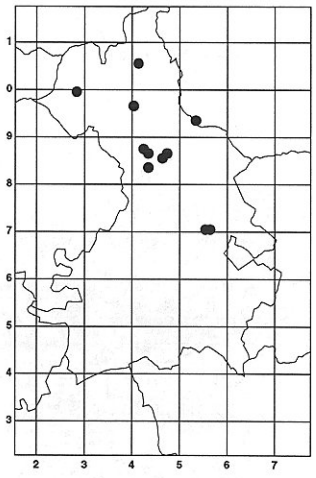


Fig 7: Distribution of records of *Corixa punctata* in VC29, 11 dots

Vice-county maps: Maps can be plotted showing the distribution of records in a vice-county. Fig 5 shows the distribution of 251 water bug records in VC 29, Cambridge, plotted at 10 km centres, with the dots at 5 km diameters; also showing the vice-county boundaries. The same data are plotted at 1 km centres in Fig 6, but with the dots plotted at 2 km diameters. Fig 7 shows records selected for a single species.

Frequency of records Fig 8 shows that for most of Britain, there are fewer than 16 records for each 10 km square for which there is at least one record. The 10 km squares with many more records reflect recorder effort in parts of Cumberland, South-west Yorkshire, Caernarvonshire, Northamptonshire, Hertfordshire, Monmouthshire and East Kent. Some vice-counties neighbouring the foregoing also have 10 km squares with high frequencies of records.

Species coincidence Fig 9 is based on the number of species in each 10 km squares for which there is at least one species record. The map is plotted at equal freqencies. This means that there is roughly the same number of 10 km squares for squares with one species (306) as there are squares with the highest frequency of from 19-41 species (234). Plotted this way, detail is lost at the highest frequencies but the map

shows the important point that in much of Britain relatively few species (e.g. from 1-3) have been recorded. This map may be compared to Fig 10 plotted as equal ranges. In this the smallest symbol represents 10 km squares for which there are only 1-4 species (897) compared to 10 km squares for which 33-41 species are recorded (14).

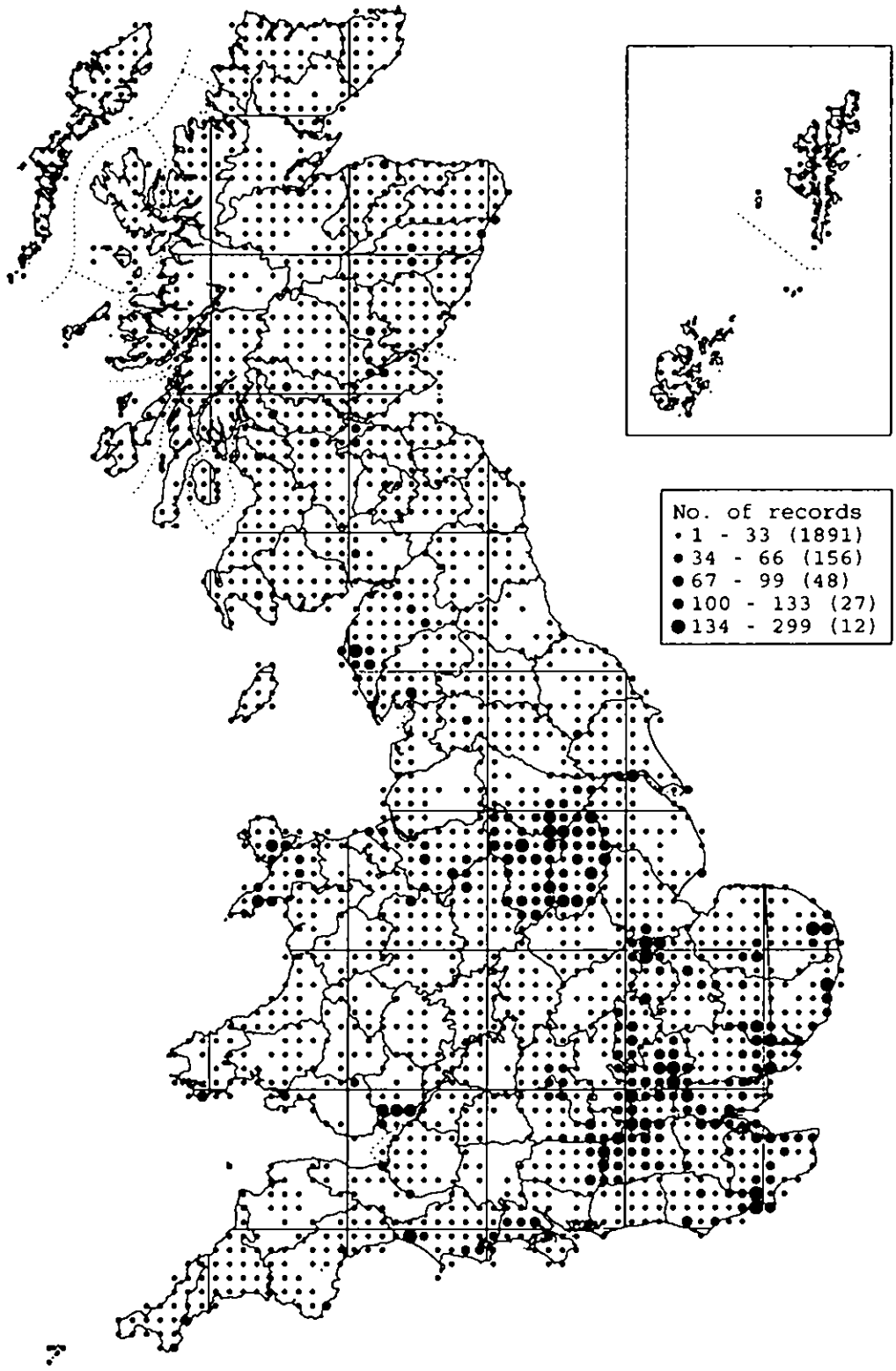


Fig 8: Frequency of records, all species

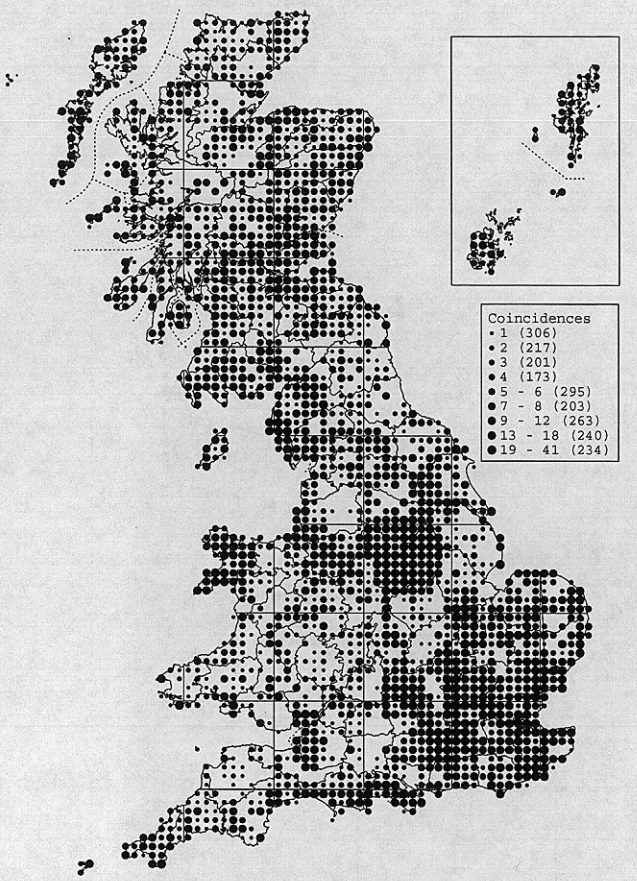
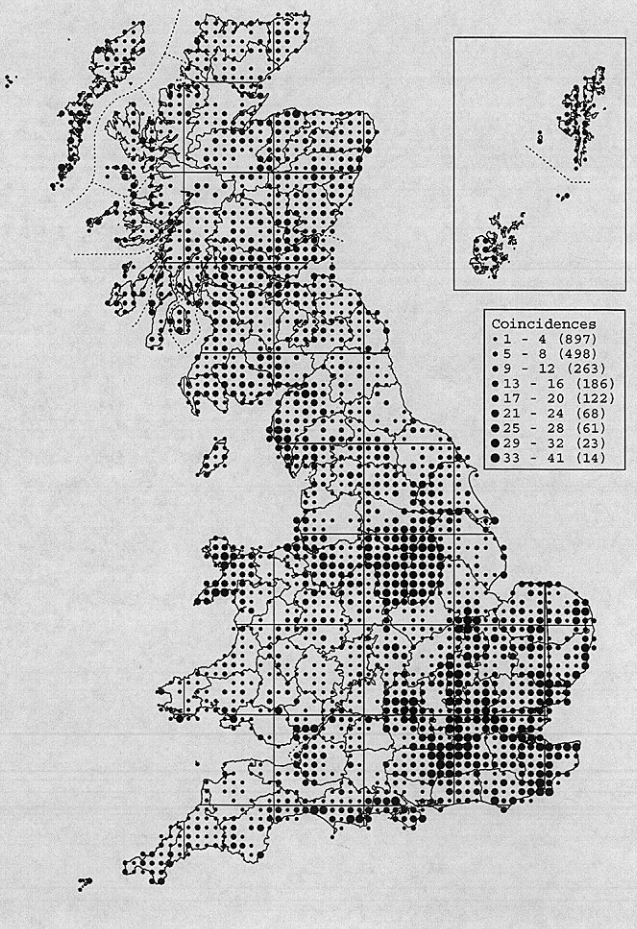


Fig 9: Species coincidence, equal frequencies

Fig 10: Species coincidence, equal ranges



DISTRIBUTION MAPS AND SPECIES ACCOUNTS

The symbols on the **Species Maps** are plotted at 10 km centres, with a closed dot for records from 1970 to 31 July 2001 and an open dot for pre-1970 records. The number of pre-1970 records is simply the number of 10 km squares with open dots shown on the map, for which there are no later records. There may be pre-1970 records in other squares "hidden" by records in 1970 and post-1970 records. There are many other pre-1970 records, in the literature or in museum collections, which have not been included in the data for this Atlas.

Each **Species account** begins with numbers of confirmed records and numbers of 10 km squares for which the species is recorded, i.e. the number of dots. Records can be placed in three categories (see Glossary). Records placed in categories 2 and 3 do not show on the maps and therefore are not included in the number of 10 km squares recorded, nor in the number pre-1979 only. For example, although there are 126 records for *Hesperocorixa moesta*, nine have been placed in category 2, so the number of confirmed records is 117 and the number of 10 km squares for which this species is recorded is 77, 6 of which are dated pre-1970. It must be stressed that for each 10 km square for which a species is recorded, there may be one or more records for that species in that square.

The first sub-heading in each species account is **Distribution.** This attempts to express in words what the maps show, with particular emphasis on records at the periphery of distribution. With one exception, the sources of all published records or other published information are given in round brackets (...). The exception is Southwood and Leston (1959) which is abbreviated to S&L. All sources of records and other information submitted on BRC cards, on spread-sheets or in other correspondence are given in square brackets [...]. A date is given for records but not for information, e.g. about habitat preferences, and "pers. com." is omitted to save space. A page number is given for references to Savage (1989). The map on p 84 shows vice-county boundaries and numbers, along with a list of the vice-county names and numbers. Comments and statistics referring to 'north Britain' or 'south Britain' are based on arbitrary division of Britain into two roughly equal parts along 100 km northing 5, i.e. along a line from mid Cumbria (e.g. Seascale) to north Yorkshire (e.g. Ravenscar).

The **Habitat** sub-heading should be self-explanatory. For selected species, extracts from the ecological notes in Savage (1989) are included. In the interests of brevity, they assume some prior knowledge about freshwater biology.

Helpful hints deal mainly with identification and collection, supplemented for some species with a sketch illustration. The hints are in no way intended to replace Savage's key (1989) to adult water bugs, published by the Freshwater Biological Association, nor his key to adult Corixidae only published in *Field Studies* (Savage, 1990), the latter being particularly helpful by setting out comparative illustrations of hemielytra and palae across double pages. Anatomical terms used in the text are explained in the Glossary but for their proper comprehension readers must obtain Savage (1989) and acquaint themselves with the several overall illustrations of water bug anatomy (e.g. pp 43, 54 and 65) and, as needed, the numerous annotated text figures.

Here are some other introductory remarks.

- Most species are under-recorded. To what extent this is truer for common than uncommon species is conjecture.

- In some species accounts, numbers of 10 km squares recorded are given for north and south Britain, as explained above.

- With the exception of the eight species described in Kirby (1992), listed in Table 1 above, the status of each species can be derived from the number of records and number of 10 km squares recorded. For status at the vice-county level, the maps should help because they are plotted with the vice-county boundaries showing.

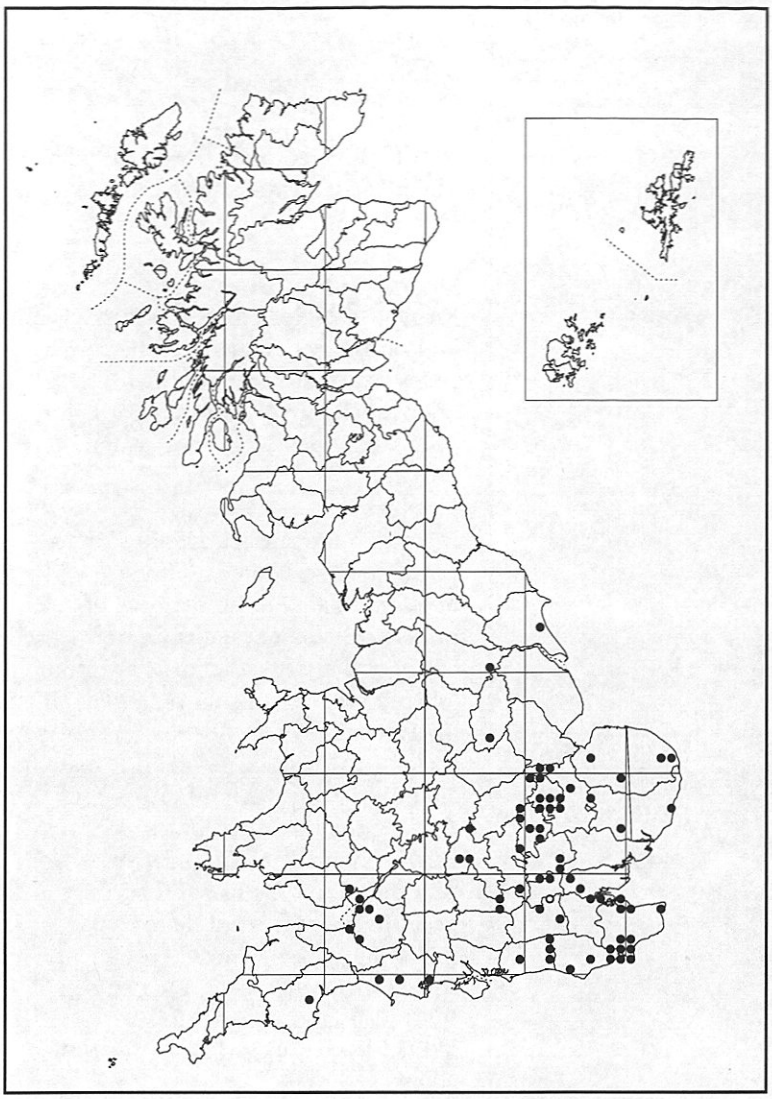
- Maps for some species, especially the common ones, show recorder effort as clusters of symbols. To what extent these clusters will extend outwards, or become merged with other clusters after much more

recording, is conjecture. Complete distribution maps for common species might be interesting in showing parts of Britain providing - or not providing - suitable aquatic habitats for these species, or by suggesting some other distributional limiting factor. For example, Macan and Worthington (1951) suggested temperature as a possible influence on the distribution of *Callicorixa wollastoni*.

The Gazetteer (Appendix 3) lists grid references for all records mentioned in the text for which a grid reference is appropriate. For more general geographical place names, such as Grampian Mountains, refer to the Glossary.

- No vice-county has more than 77% of the British list of aquatic bugs. The actual distribution is 10 vice-counties (9%) with from 1-19 species; 37 (33%) with from 20 to 29 species; 43 (38%) with from 30 to 39 species; and 22 (20%) with from 40 to 48 species. Some of the vice-counties with few species are because they are under-recorded. It is unlikely that many more species will be found in the vice-counties with many species.

- Cheshire holds most species with 48. The number of species for the next ten counties with high species numbers are: Surrey and Hertfordshire with 46 each; East Sussex and East Kent with 45 each; and Dorset, North Hampshire, East Suffolk, Caernarvonshire, Derbyshire and South-west Yorkshire with 44 each. Herefordshire has the least number of species recorded with 7, followed by Peeblesshire with 11. The fact that many of the high ranking vice-counties are in southern England is not surprising. As Kirby *et al.*, (2001) has observed "*Heteroptera* are an overwhelmingly southern group". However, that Cheshire has most species and Caenarvonshire, Derbyshire and South-west Yorkshire nearly as many, is perhaps partly due to recording effort and partly because these vice-counties lie roughly midway between north and south Britain. They thus hold species both at the northern edge of a southern distribution and the converse.



Map 1: *Mesovelia furcata*

Mulsant & Rey

Pondweed bug

No of records: 106
No of 10 km squares recorded: 73
No of 10 km squares pre-1970 only: 1

Distribution

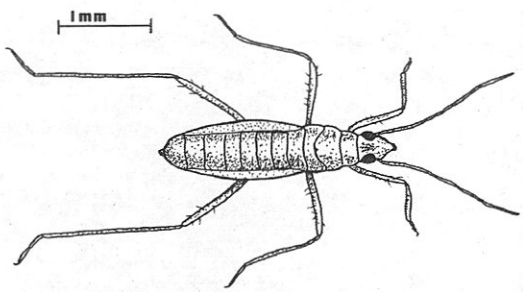
Although S&L report records in Anglesey, Staffordshire and Derbyshire, the most northern recent records are at the Leven Canal, South-east Yorkshire [W.R.Dolling, 2001], Cantley Park, Doncaster, South-west Yorkshire [R.Crossley, 1983] and the Grantham Canal, Nottinghamshire [R.Merritt, 1999]. The most south-western record is at Little Bradley Ponds, South Devon [R.Merritt, 1999]. While clearly a bug mainly of southern distribution, some extension northwards may be occurring.

Habitat

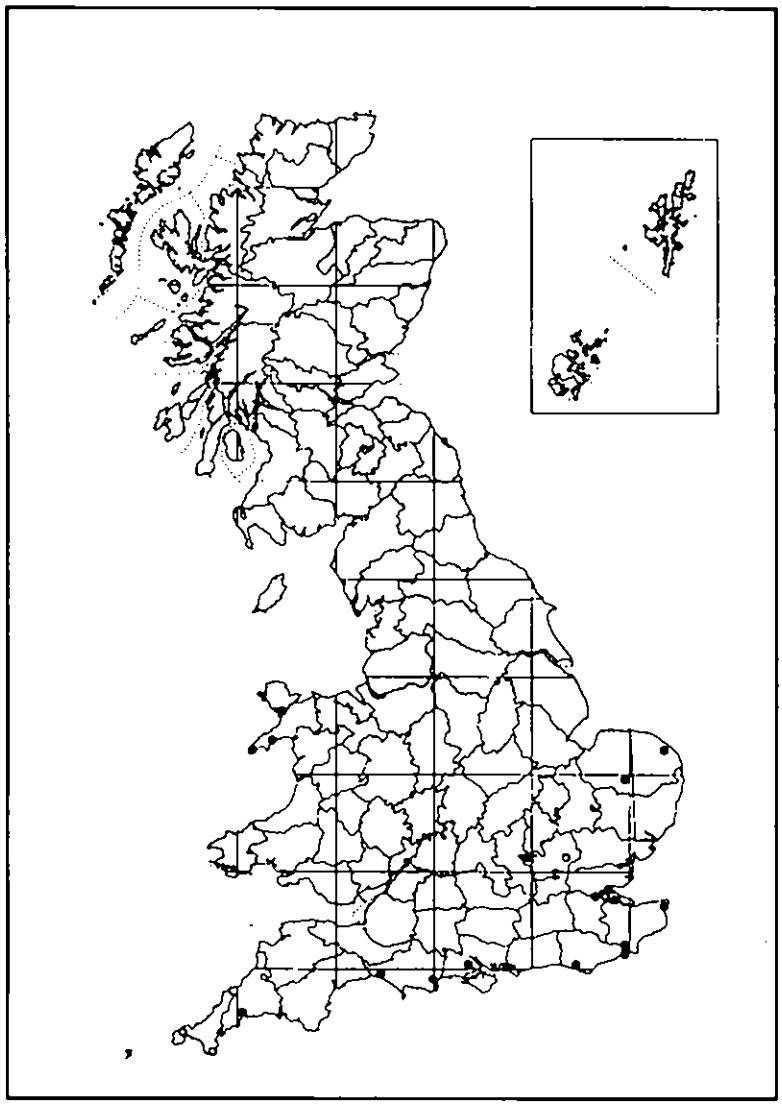
The pondweed bug lives on the surface amongst vegetation in the still or slow flowing waters of gravel pits, ponds and canals. It can be found on floating leaves of macrophytes, such as amphibious bistort, *Persicaria amphibia*, pondweeds *Potamogeton* spp., duckweeds *Lemna* spp. and various water-lilies and on floating mats of filamentous algae [P.Kirby]. S&L state that the bug plays a part in the pollination of some macrophytes.

Helpful hints

The pondweed bug is very small, just 3.0 to 3.5 mm long, and difficult to see except when it moves. In ventral view, all legs are placed towards the centre of the thorax. The upper surface has a greenish tinge with black sutures and scattered markings (Savage, 1989, p 29).



Mesovelia furcata, pondweed bug



Map 2: *Hebrus pusillus* (Fallén)

No of records: 28
No of 10 km squares recorded: 18
No of 10 km squares pre-1970 only: 4
Threat status: Nationally Scarce (Notable B)

Distribution

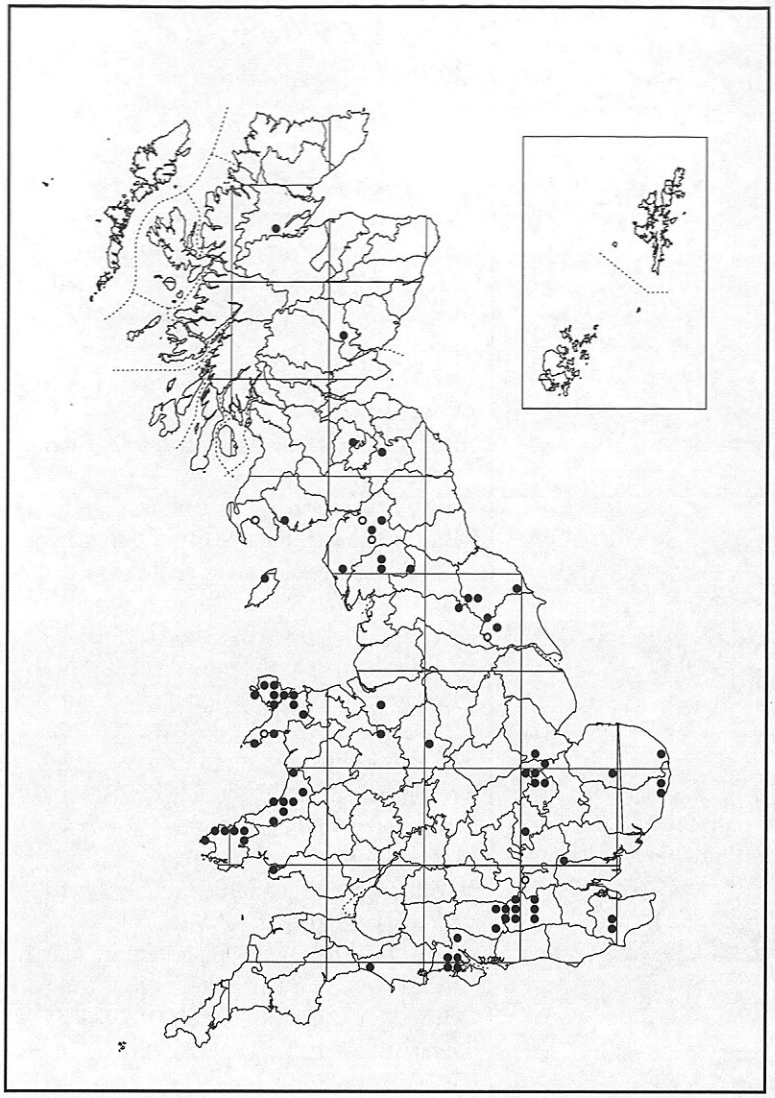
Kirby (1992) describes it as "very local and probably declined". Although he states that there are records for 14 counties, the map shows records for only 9 counties or 11 vice-counties.

Habitat

Found on the surface amongst dense vegetation, sometimes amongst *Sphagnum* and at the margins of acid pools on lowland heaths (Kirby, 1992). Some of the Dorset records are from "slimey trickles on slumping clay cliffs" [J.S.Denton, 1999], "flushes on soft rocks" [A.P.Fowles, 1991] and "marshy area on clay sea cliffs" [R.Crossley, 1969]. One at Pandy Pools, Newborough Forest, Anglesey, is from "the broad, mossy margins of large pond in forested sand dune" [J.H.Bratton, 1999] and there are several from ditches in East Sussex, West Kent and East Norfolk [P.J.Hodge, various dates from 1987 to 2000].

Helpful hints

Careful capture, storage and examination under the microscope are essential for identifying this species, which may occur with its commoner congener *H. ruficeps*. It cannot be identified reliably in the field.



Map 3: *Hebrus ruficeps*
(Thomson)

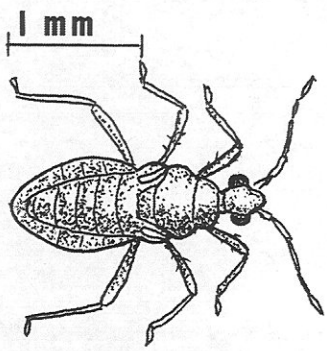
Sphagnum bug

No of records: 131
No of 10 km squares recorded: 82
No of 10 km squares pre-1970 only: 6

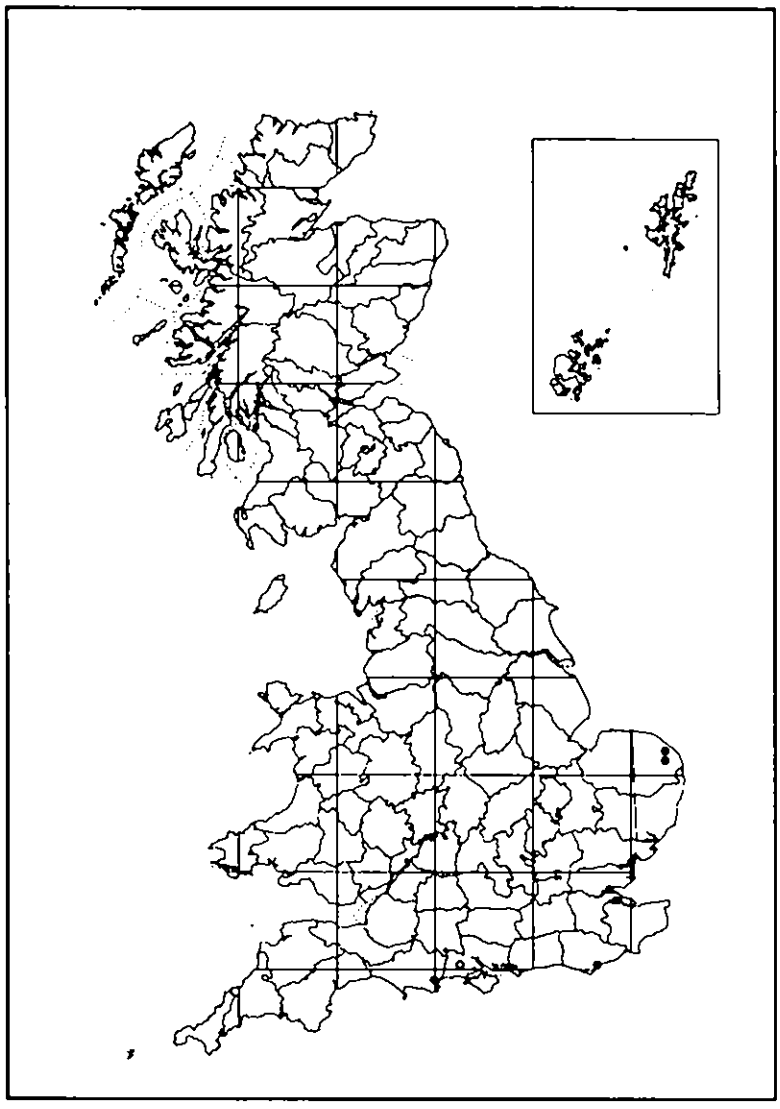
Distribution
Extends from sparse Scottish records as far north as Contin, East Ross [T.Huxley, 1995], southwards to frequent occurrences in the counties of west Wales; and likewise in parts of central and southern England. However, whereas the mapped distribution and Massee (1955) both record it in 11 counties of England (and the map in a further five), Massee also lists it in Lancashire, Cambridgeshire, Hertfordshire, Berkshire, Somerset and Devon.

Habitat
Although said to be confined to *Sphagnum* (Kirby, 1992) in peat pools, fens, bogs and mires, it may also occur in other low vegetation at the margins of acid waters. There are also records at the vegetated margins of non-acid waters and on the bare edges of clay pits [J.H.Bratton].

Helpful hints
The main challenge is to find this tiny bug. Some people collect bagfuls of *Sphagnum* and search them off-site. Others stand or kneel into a wet bog in waders - thus making a small puddle - in the hope of seeing a specimen scurrying across the surface from whence it may be skimmed into the net. However, these small bugs are easily "lost" or bits fall off if stored amongst larger species and much care is needed to get specimens home in good condition for examination. See Savage (1989) for separating *H. ruficeps* from *H. pusillus*.



Hebrus ruficeps, Sphagnum bug



Map 4: *Hydrometra gracilenta* Horváth

Lesser water measurer

No of records: 5
No of 10 km squares recorded: 4
No of 10 km squares pre-1970 only: 1
Threat status: Red Data Book 3 (Rare), listed under UK Biodiversity Action Plan

Distribution

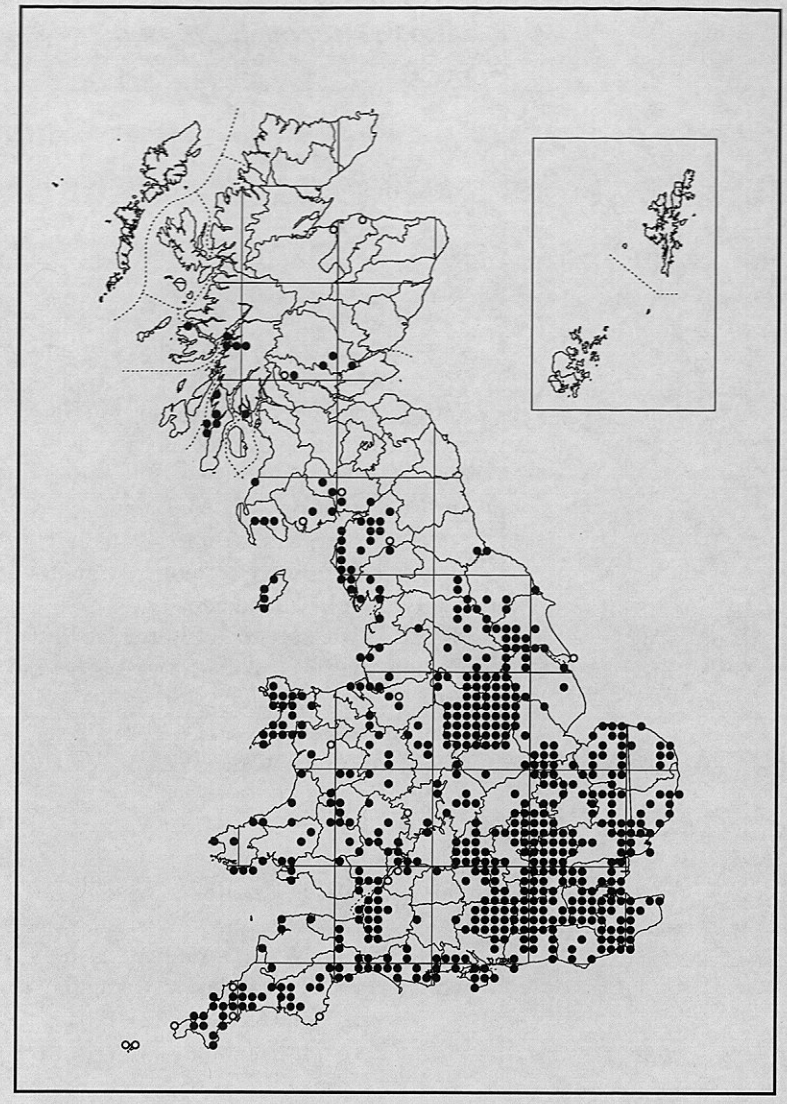
Kirby (1992) gives an account of this extremely local and RDB status Rare bug, first recorded in Britain in 1952 at Barton Broad, East Norfolk (Brown, 1953). In a footnote to that paper Brown wrote "Since this note was written, the writer has discovered *H. gracilenta* in the New Forest (South Hampshire); a more detailed account will appear elsewhere". However, this account does not seem to have been published and the actual New Forest location remains a mystery. The open dot on the map is therefore positioned notionally at SU20. Recent East Norfolk records are at Catfield Fen [M.E.A.Shardlow, 1998], Reedham Marsh [A.P.Foster and D.Procter, 1989] and Bure Marshes [J.H.Bratton, 1999]. The East Sussex record is at Pevensey Levels [P.Kirby, 1988].

Habitat

Brown's Barton Broad record was "under overhanging *Carex paniculata*...some only found when dislodged by shaking the tussocks"; both Kirby's and Bratton's records in well vegetated ditches and Shardlow's in a pitfall trap.

Helpful hints

Compared to the much commoner *H. stagnorum*, a browner colour and differently proportioned head should alert finders to the possibility that a different species is present. Suspect specimens then require careful examination of the characters given in Savage (1989, p 30) and confirmation by an expert; it cannot be identified reliably in the field.



Map 5: *Hydrometra stagnorum* (Linnaeus)

Water measurer

No of records: 1,403
No of 10 km squares recorded: 609
No of 10 km squares pre-1970 only: 19

Distribution

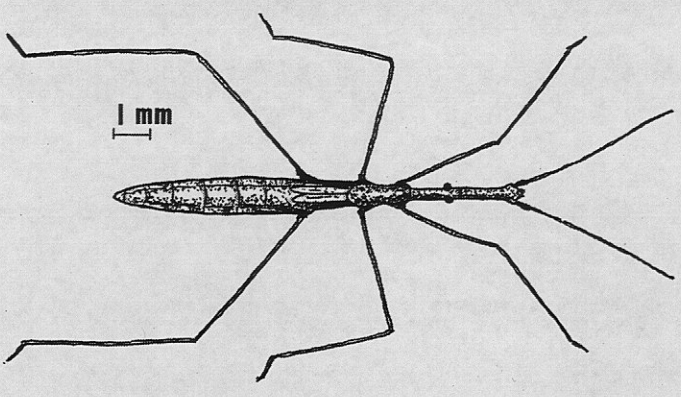
Common in much of lowland England and Wales, but only locally common in parts of Scotland, and apparently absent north of the Grampians, except for a few pre-1970 records in Moray [R.R.Richter, about 1950]. A recent record in Mull [Brooke, 2001] has added another island record of this flightless species, the others being Bute, Lismore, Gigha and the Isle of Man (Huxley, 1996 to 2000c). All these Scottish islands are close to the mainland.

Habitat

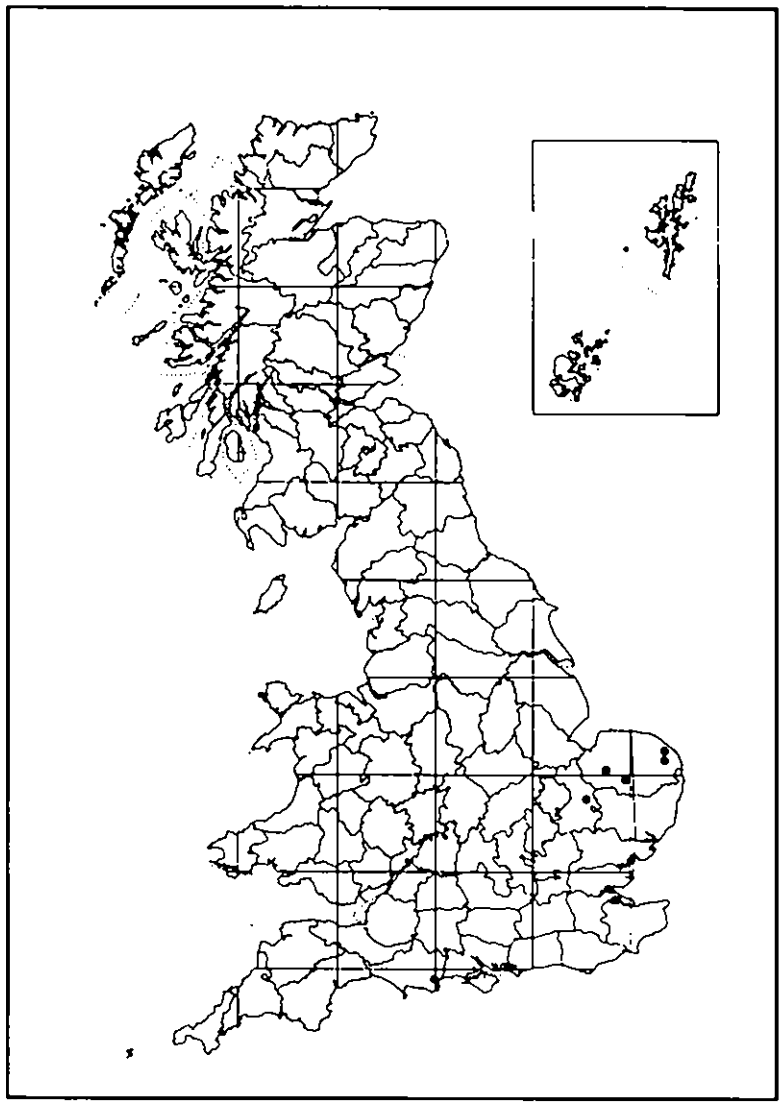
Found on the surface of still or flowing water in many types of habitat, usually where there is tall emergent vegetation, but not invariably so. It may also be found crawling over rocks and the muddy sides of streams.

Helpful hints

The common water measurer has a characteristic elongated shape, about 9 to 12 mm long.



Hydrometra stagnorum, water measurer.



Map 6: *Microvelia buenoi*

Drake*

No of records: 17
No of 10 km squares recorded: 5
No of 10 km squares pre-1970 only: 0
Threat status: Red Data Book 3 (Rare)

Distribution

Very local and of restricted distribution, although widespread in the East Anglian fens (Kirby, 1992). Locations listed by him are: Wicken Fen, Barton Broad, Bure Marshes, Catfield Fen, Sutton Broad and Wheatfen Broad. Some of the mapped records, all from 1988 to 1993, include Thompson Common [J.H.Bratton and B.S.Nau], Catfield Fen, Woodbastwick section of Bure Marshes and Reedham Marsh [P. Kirby, A.P.Foster and D.Procter], Foulden Common [B.S.Nau], other areas in Bure Marshes [J.H.Bratton] and Wicken Fen [J.H.Bratton].

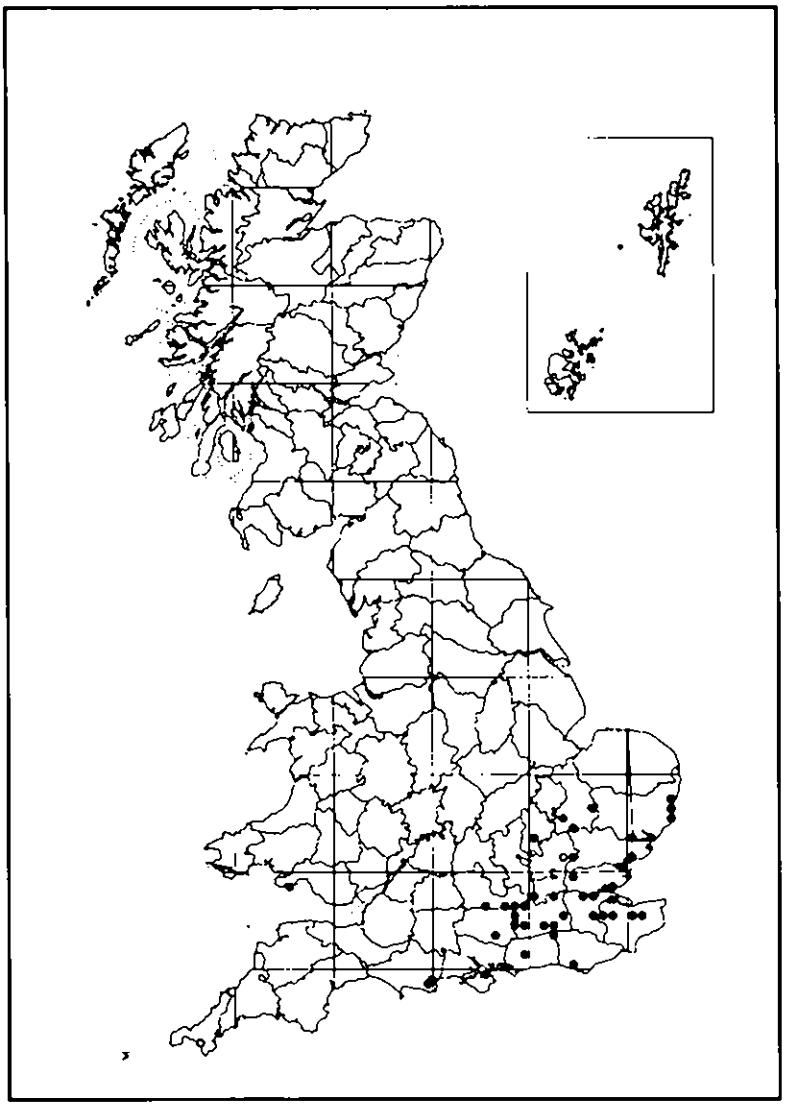
Habitat

This surface bug is confined to still, usually shallow, water where there is dense shading vegetation, such as in the margins of ditches under overhanging clumps of sedge (Kirby, 1992). It has been taken in pitfall traps.

Helpful hints

All specimens suspected to be this species should be confirmed by an expert.

* NB *M. buenoi* was formerly named *Microvelia buenoi* subspecies *umbricola* or sometimes just *M. umbricola*.



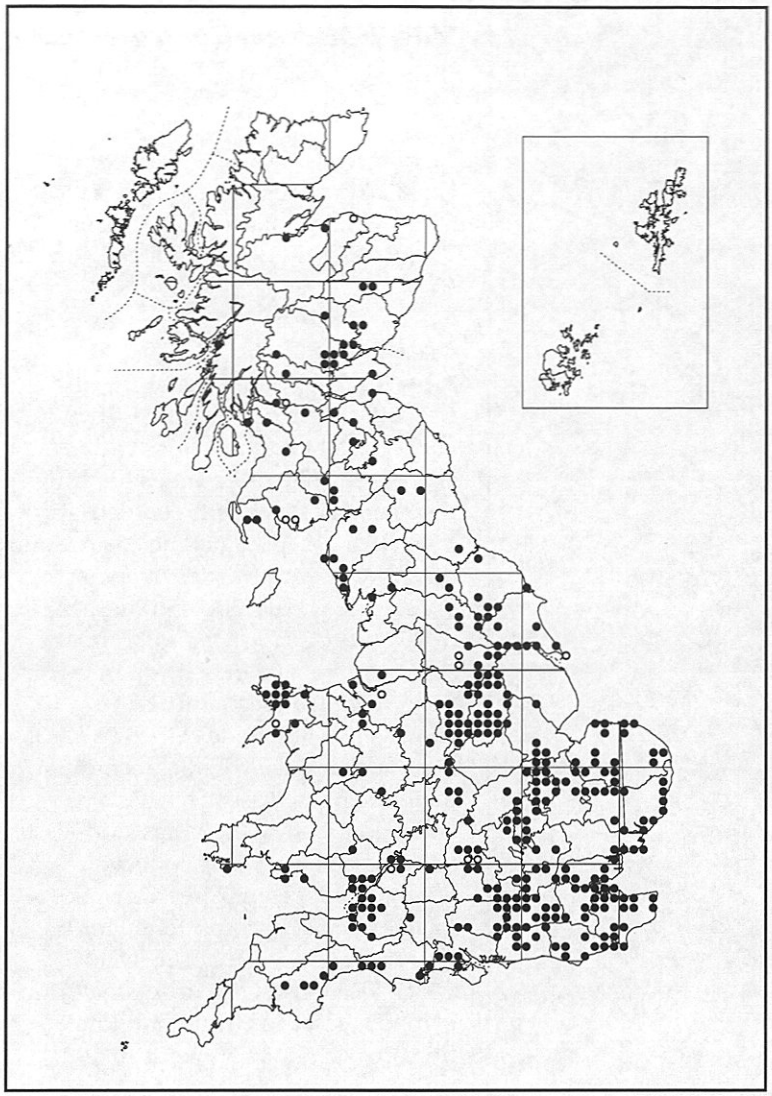
Map 7: *Microvelia pygmaea*
(Dufour)

No of records: 57
No of 10 km squares recorded: 41
No of 10 km squares pre-1970 only: 1
Threat status: Nationally scarce (Notable B)

Distribution
As well as the counties in south-east England shown on the map, Kirby (1992) lists Monmouthshire and Glamorganshire as counties for which this bug has also been recorded. Kirby states that it is possibly increasing, and therefore does not justify an earlier status of Red Data Book 3 (Shirt, 1987). *M. pygmaea* and *M. buenoi* were not separated from the much commoner *M. reticulata* until a paper by G.A. Walton (1939) described two water bugs new to Britain. Earlier records are therefore possibly suspect and a record at Helston, Cornwall, [P.Harwood, 1939] has not been included, along with two other records listed by the Environmental Records Centre for Cornwall and the Isles of Scilly, for which location data are inadequate. The mapped record in Glamorganshire is from Oxwich Burrows [P.Kirby, 1986].

Habitat
A surface bug found in dense vegetation. Weedy ditches are the usual habitat. A few records are in marginal vegetation of larger bodies of still water.

Helpful Hints
Winged forms of all three species of *Microvelia* occur. Specimens that might be this species should be confirmed by an expert.



Map 8: *Microvelia reticulata*

(Burmeister)

No of records: 629
No of 10 km squares recorded: 330
No of 10 km squares pre-1970 only: 12

Distribution

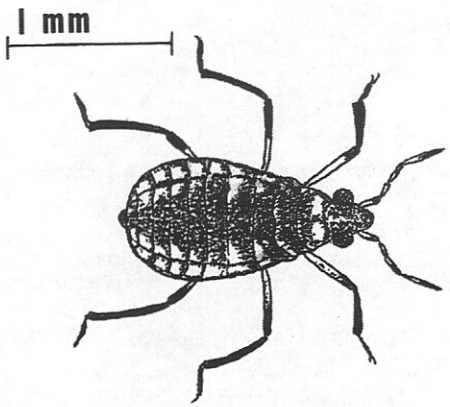
Probably under-recorded in much of Britain, this common species is clearly widespread, although apparently not occurring in the north mainland and Western Isles of Scotland.

Habitat

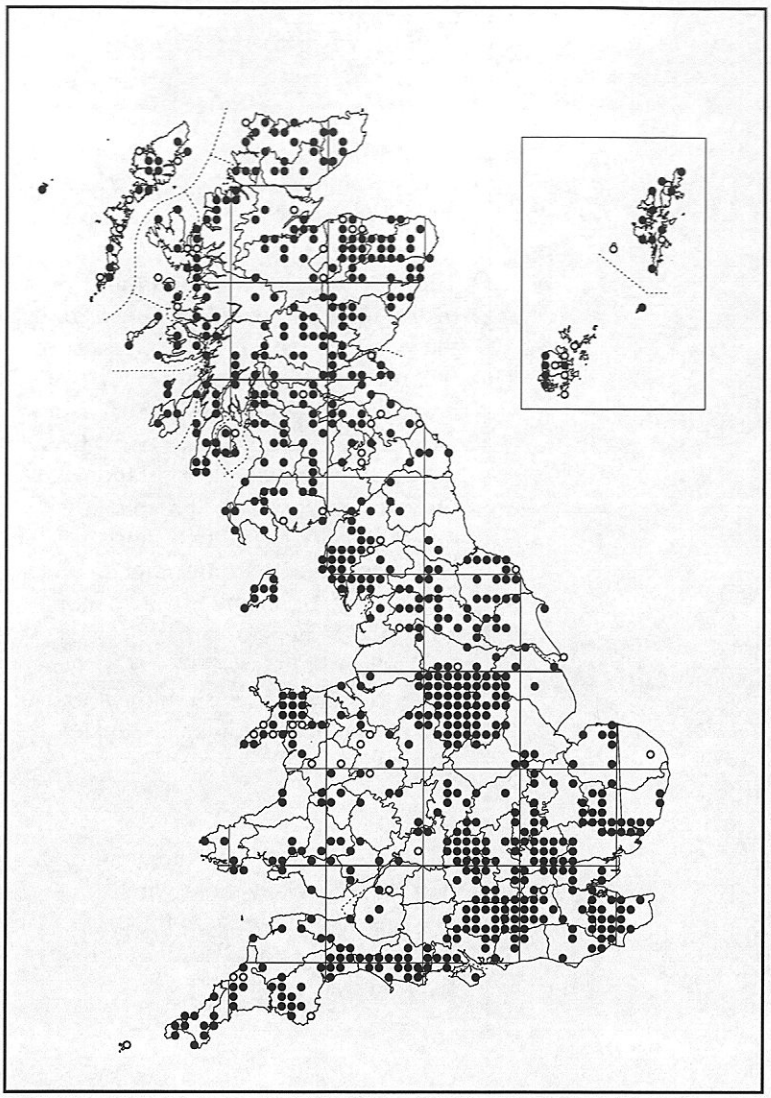
A surface bug found in many types of still water but always amongst marginal vegetation.

Helpful hints

It is sometimes difficult to find *M. reticulata,* even though it is relatively common. Probably the easiest way is to search the net after it has been skimmed through surface vegetation and look for very small black insects with characteristic white dots. If present, *Microvelia* usually show themselves by crawling away from detritus onto the bare parts of a tightly held fine-mesh net. Alternatively, once one has learnt to recognise *Microvelia,* the water surface can be searched in the hope of seeing these very small insects, clearly different from Collembola and other small surface fauna.



Microvelia reticulata. See Savage (1989, pp 38-41) for separating the three species of *Microvelia.*



Map 9: *Velia caprai* Tamanini

Water cricket

No of records: 1,328
No of 10 km squares recorded: 797
No of 10 km squares pre-1970 only: 59

Distribution

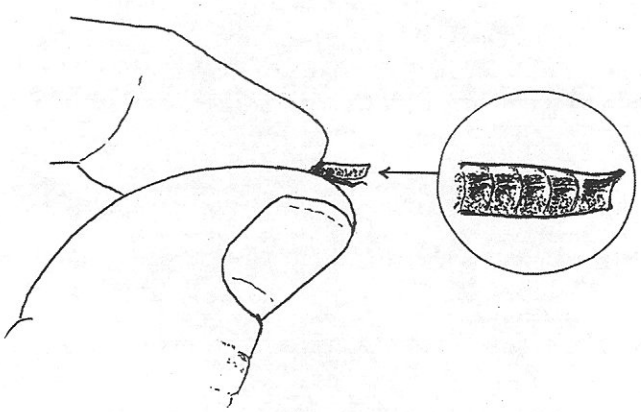
Notwithstanding that there are more records for several other species, *V. caprai* is possibly the commonest and most widespread British waterbug. Its distribution extends from Unst, at the extreme northern tip of the Shetland Isles, to Land's End in Cornwall. It is recorded from many islands, from St Kilda (Hamilton, 1963) to St Mary's in the Isles of Scilly [A.T.Thornley, 1925].

Habitat

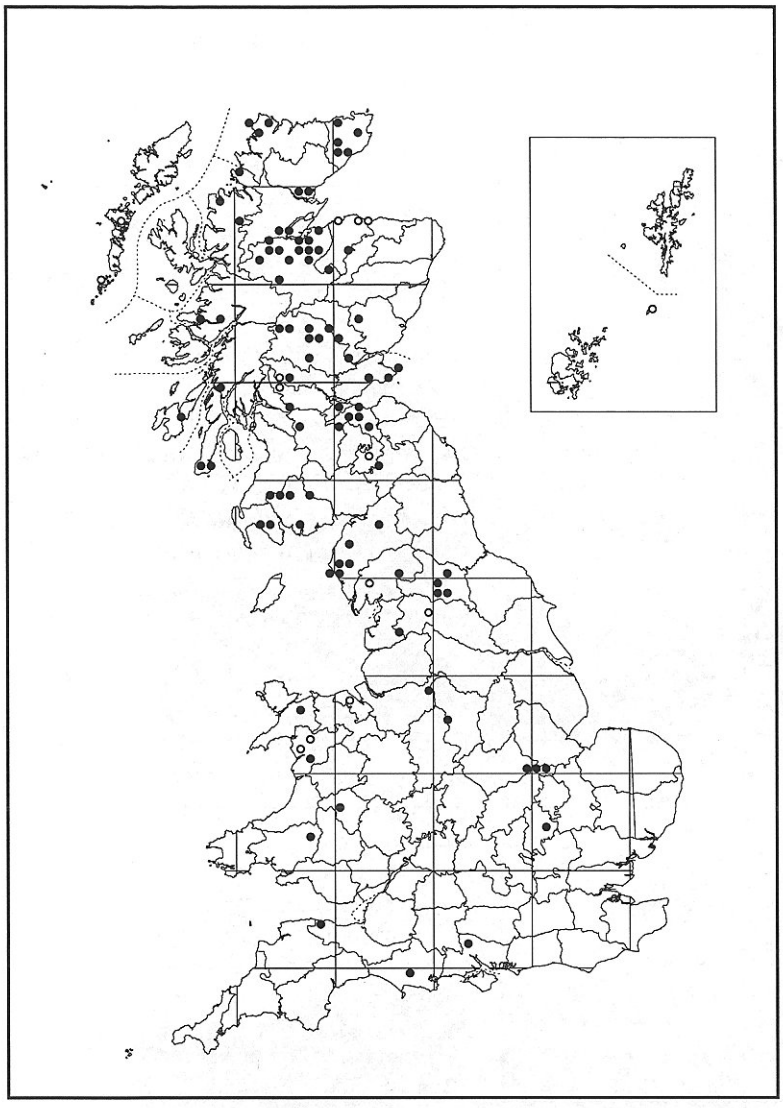
Mainly found on small streams and ponds with some flow, often in colonies of several to many individuals. In moorland areas, it may have to be searched for in the deep shade of streams and drainage ditches overhung by vegetation. It may also be found, although not seen, by running the net through emergent stream vegetation, such as brooklime, *Veronica beccabunga*.

Helpful hints

The crucial thing to look for in the field are spines on the rear femora (males). If spines are present, discard the specimen and look for a female without spines. In females, *V. caprai* is generally distinguished from *V. saulii* by external characters, whereas males cannot be determined without dissection of the genitalia. Catching water crickets can sometimes be frustrating because they are able to squirt a surfactant secretion backwards from the proboscis (Guthrie, 1989), thereby quickly escaping into hiding.



A useful tip in the field is to hold a female between thumb and forefinger and look at the rear end profile from the side. If the tip is pointed upwards then it is probably *V. caprai*, but check carefully with Savage (1989, pp 36-37) for other characters.



Map 10: *Velia saulii* Tamanini

No of records: 152
No of 10 km squares recorded: 105
No of 10 km squares pre-1970 only: 14

Distribution

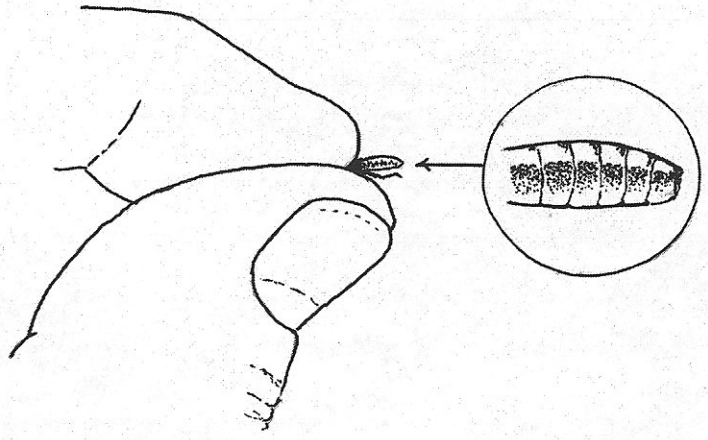
The map shows a more northern distribution compared to *V. caprai.* In the northern half of Britain it is recorded in 84 10 km squares, compared to 24 in the southern half. However, it seems to be absent from the Orkney and Shetland islands and there are only pre-1970 records for the Outer Hebrides. The two most southern records are from the Lower Test, South Hampshire [D.Appleton, 1985] and Waterston Stream, Dorset [M. Ladle and J. A. B. Bass, 1974]. Even in northern Britain, it is seldom found in colonies of many individuals, unlike *V. caprai.*

Habitat

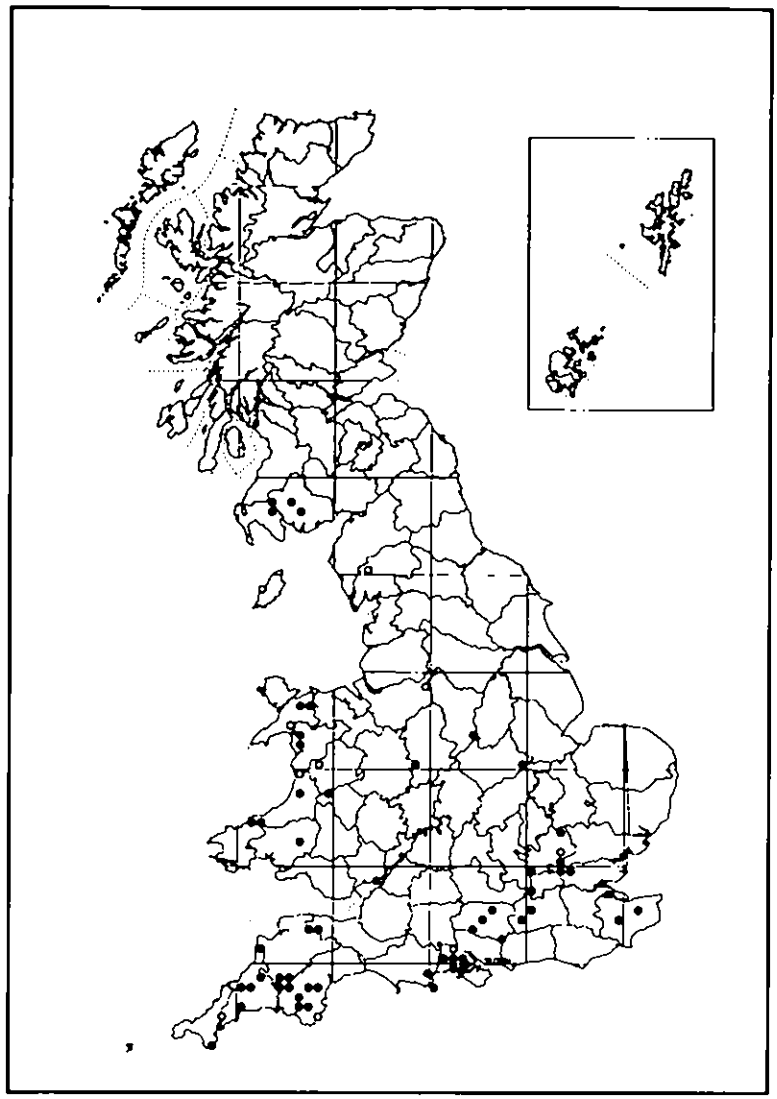
Mostly found on still waters rather than flowing, especially those with stony margins. In south-eastern Britain, however, it may also occur in slow rivers and streams.

Helpful hints

For a quick guide in the field, adult females of *V. saulii* look different to *V. caprai*, both from above and especially in a side view of the rear end, see illustration below. Adult males with spines on the rear femora should be rejected as too difficult! (See comment re *V. caprai.*)



A useful tip in the field is to hold a female between thumb and forefinger and look at the rear end profile from the side. In *V. saulii* the posterior is downturned, but check carefully with Savage (1989, pp 36-37) for other characters.



Map 11: *Aquarius najas*

(DeGeer)

River skater

No of records: 85
No of 10 km squares recorded: 64
No of 10 km squares pre-1970 only: 10

Distribution

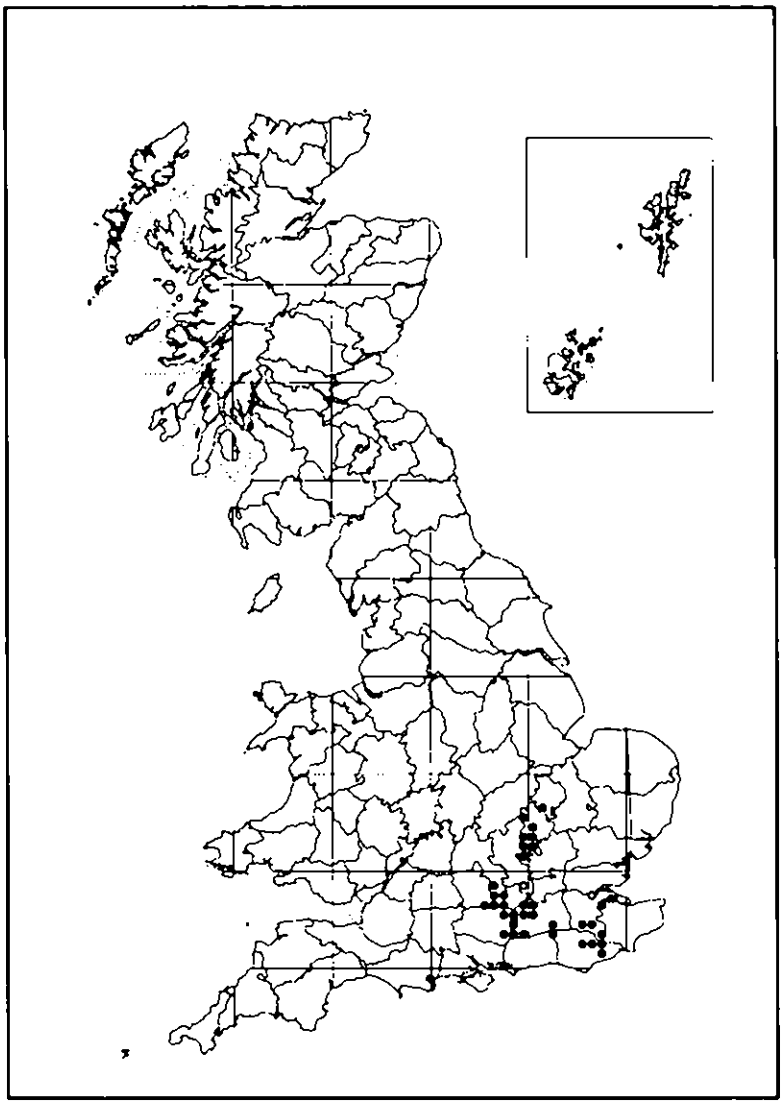
The river skater appears to have a disjunct distribution; common locally in southern England and in Wales but absent from much of northern Britain. Populations in Wigtownshire and Kirkcudbrightshire represent its most northern stations [T.Huxley, 1997 and 1999]. There are old records for Windermere in Cumbria and the Isle of Man, but the bug was not refound when I searched the same places in 1999 and 2000. The records in East Kent are from Great Chart [E.G.Philp, 1989] and Canterbury [P.Kirby, 1976].

Habitat

Usually water bugs and trees do not go well together but the river skater is an exception; many records are of flotillas in the slow stretches of rivers and streams (which may be rapid elsewhere), often under the dappled shade of overhanging trees [P.Kirby]. On parts of the Blackwater of Dee, Kirkcudbrightshire, however, they occur in swirling water between massive granite rocks where there are no trees. Territoriality amongst females has been studied in the field using binoculars (Vepsäläinen & Nummelin, 1985). Males may ride upon the back of females more or less permanently throughout the whole reproductive season and take part of the food caught by the females.

Helpful hints

In the field *Aquarius najas* is readily recognised because of its large size, generally riverine habitat and occurrence in flotillas of many individuals, sometimes mixed with smaller juveniles.



Map 12: *Aquarius paludum*

(Fabricius)

No of records: 61
No of 10 km squares recorded: 36
No of 10 km squares pre-1970 only: 2
Threat status: Nationally scarce (Notable B)

Distribution

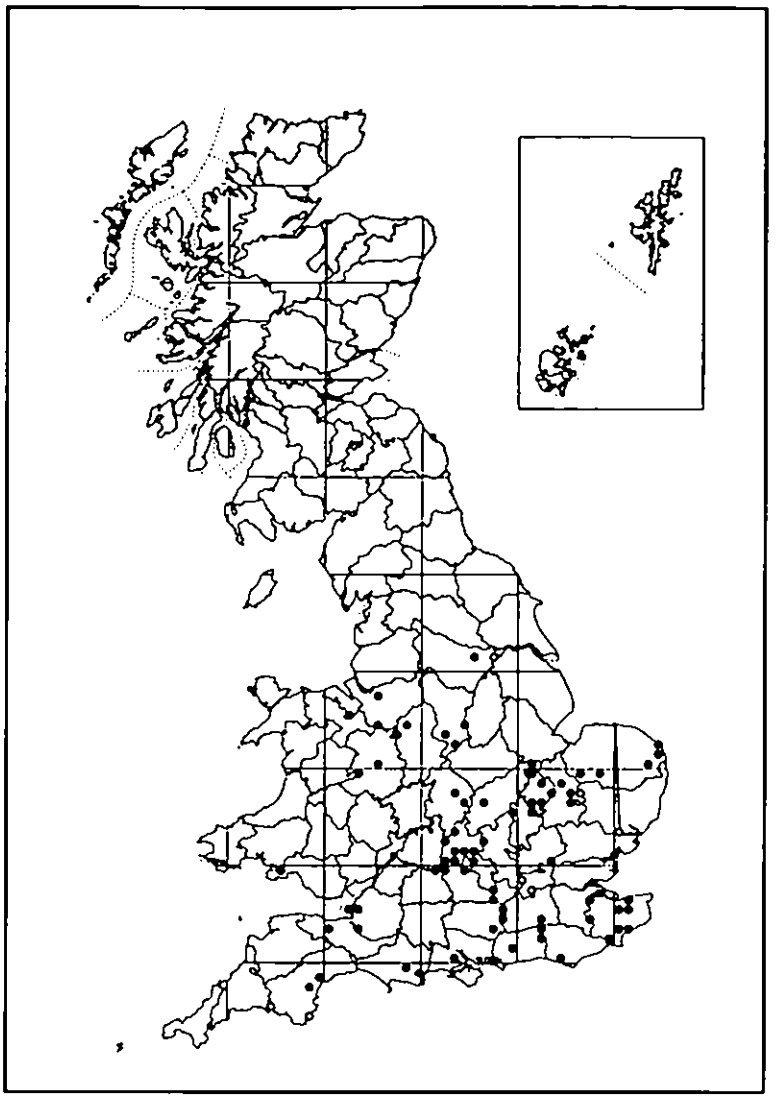
Kirby (1992) states that this large skater is very local, with only a few, mostly old records in Cambridgeshire, Essex, Bedfordshire, Hertfordshire, Middlesex and Oxfordshire. The map shows records in Berkshire, Buckinghamshire, East and West Sussex, North Hampshire, Oxfordshire, Surrey and West Kent, possibly suggesting that some colonies have died out and that some of the old locations need to be resurveyed.

Habitat

S&L state that *A. paludum* lives on "lakes, streams and rivers but is not found in such gregarious masses as *A. najas*". There is a suggestion that *A. paludum* replaces *A. najas* in slow and still waters [P.Kirby]. More coloured accounts aver that *A. paludum* "is a sod to catch...as they cruise about the margins of ponds and lakes always just out of reach" [R.Merritt].

Helpful hints

The lateral spiniform projections extending to, or beyond, the tip of the abdomen are readily seen with a hand lens (see Savage, 1989, pp 47-48).



Map 13: *Gerris argentatus*
Schummel

Little pond skater

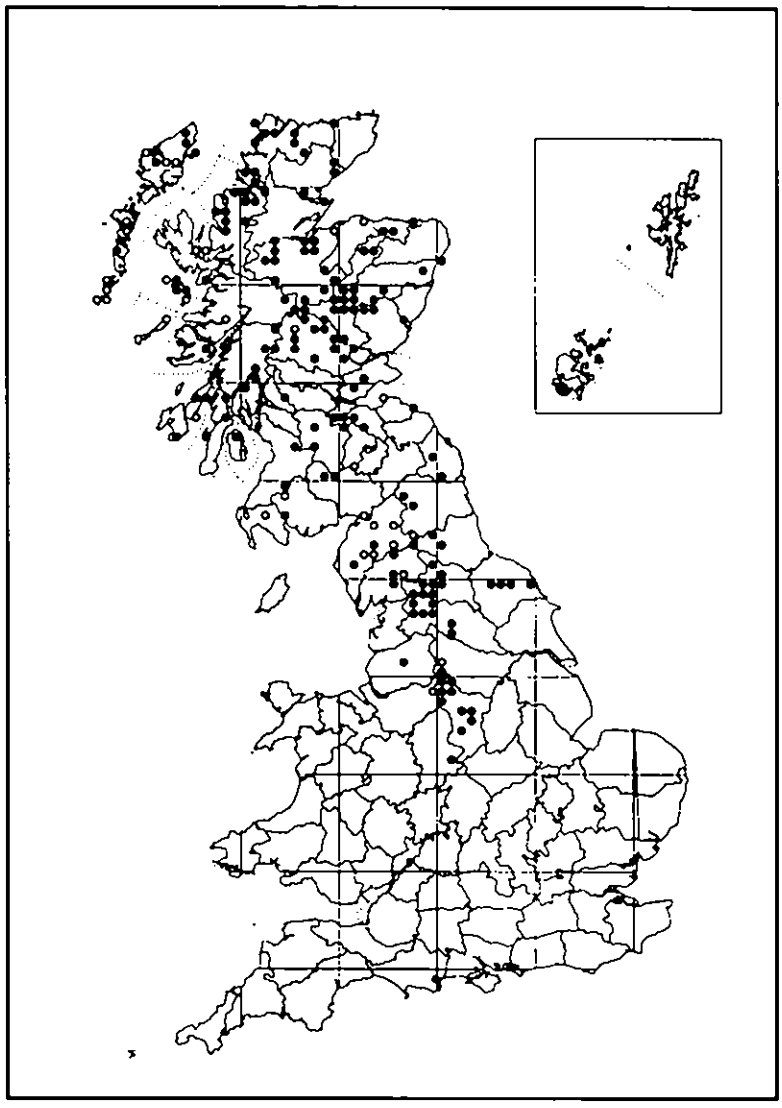
No of records: 100
No of 10 km squares recorded: 77
No of 10 km squares pre-1970 only: 8

Distribution
There are records for this species southwards from Shirley Pool, South-west Yorkshire [W.A.Ely, 1975 and R.Merritt, 2001] and at nearby Thorne Moors [P.Skidmore, 1969]. Most records are in the south-eastern counties. The pre-1970 records in the far south-west of England are from Saltmills, Saltash, East Cornwall [G.C.Bignall, 1906] and the Gara Stream, Slapton, South Devon [Field Studies Council Centre records, 1964]. I found a single male on the Isle of Arran in 1995, [det. A.A.Savage], but as it has not been found again at this location, the record has been put in category 2*.

Habitat
Typically, this species is found amongst fairly thin emergent vegetation close to the margins of base-rich waters.

Helpful hints
Sometimes called "the little pond skater" this is a good name for field recognition because it is indeed really small compared to all other species of gerrid; cf. Savage (1989, p 52).

* See Glossary



Map 14: *Gerris costae*

Wagner & Zimmerman

Moorland pond skater

No of records: 286
No of 10 km squares recorded: 190
No of 10 km squares pre-1970 only: 33

Distribution

Mainly a northern species of moorland areas, *G. costae* occurs in the Outer Hebrides and Hoy, Orkney, but not further north. The pre-1970 record from Gullane Point, East Lothian, looks suspicious but there is a voucher specimen in the National Museum of Scotland [D.K.Kevan, 1958]. The most southern record is in Derbyshire at Derwent Estate [D.K.Clements, 1984].

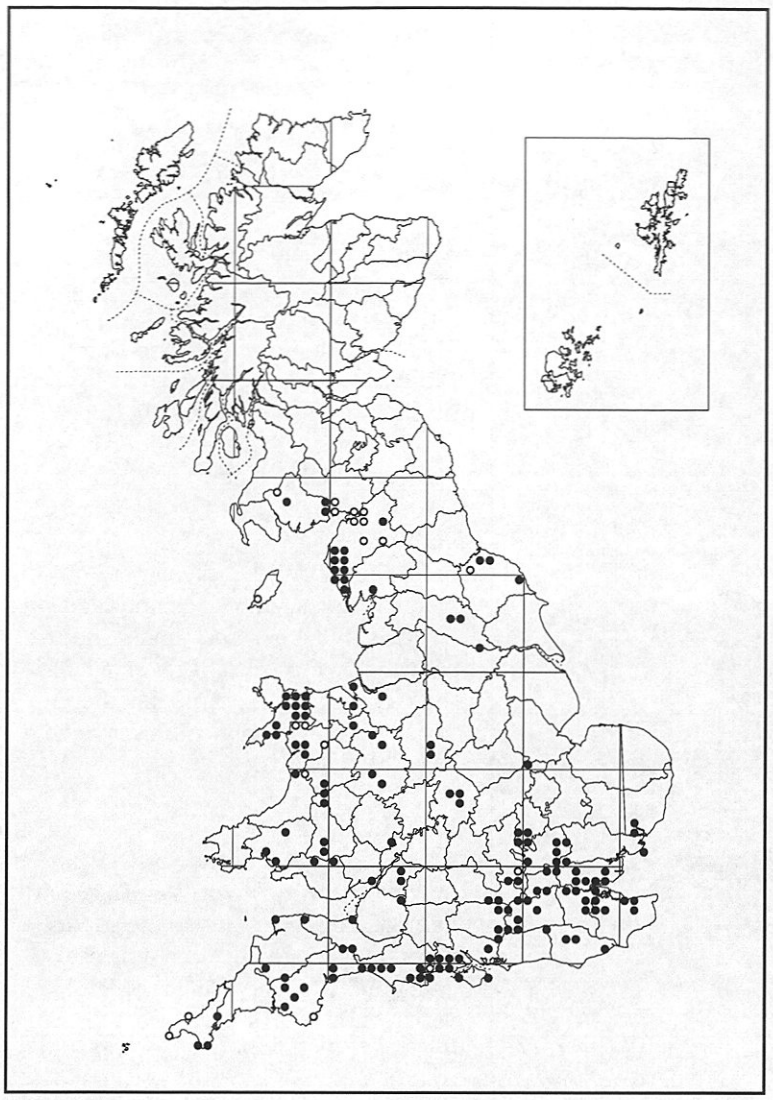
Habitat

Typically an inhabitant of small peat pools, *G. costae* may also be found in roadside ditches and small garden ponds surrounded by moorland.

Helpful hints

This pond skater is easy to catch because it moves slowly. In upland country, one needs to look in every small peat pool and maybe one in ten will hold a few specimens. Females especially are readily distinguished from other gerrids by their large size.

Although often found in assemblies of many individuals in spring and early summer, *G. costae* tends to be one of the first gerrid species to go into hibernation, thus reducing the length of the period when the species is active.



Map 15: *Gerris gibbifer*

Schummel

No of records: 305
No of 10 km squares recorded: 169
No of 10 km squares pre-1970: 20

Distribution

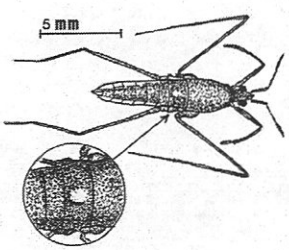
Kirby (1990) describes this species as widely distributed but somewhat local throughout England and Wales, although absent from much of the midlands. Indeed, there is a notable lack of records for the vice counties of Norfolk and Lincolnshire and others nearby. The species is recorded from the following five sites in Dumfriesshire and Kirkcudbrightshire. There are old records by Brown (1946) at Kirkconnel Merse and Lochar Moss, the latter now much altered by afforestation, and it was recorded at Kirkconnel Flow forty years later [J.H.Bratton, 1986]. Further west, it was recorded in the peat pools of the Silver Flowe in 1959 and in 1995 on the nearby Blackwater of Dee [both T.Huxley]. In south Cumbria R.W.J.Read has provided numerous records for this species [1984-2000]; likewise J.H.Bratton in Snowdonia [1998-2001].

Habitat

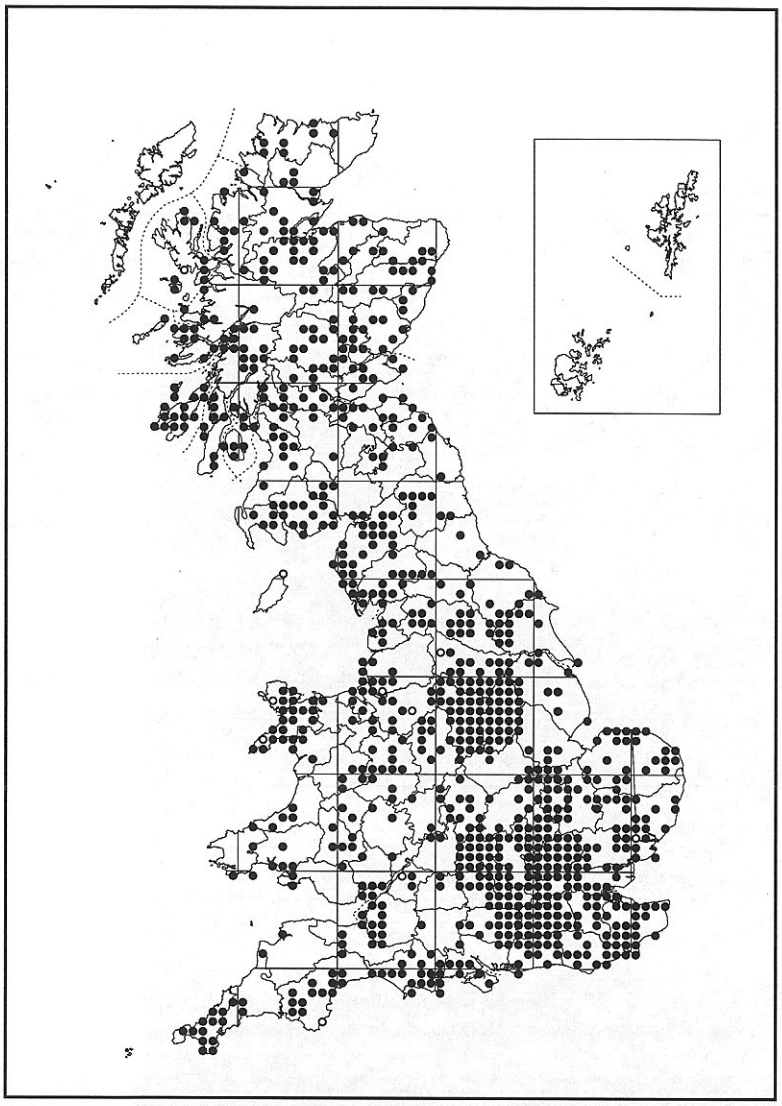
Particularly frequent on acidic, still waters but also found on other types of water, such as small streams and rivers, stony bottomed tarns with boggy margins and, sometimes, woodland pools. It is occasionally found at high altitude. There is a record for a shallow pool at 680 metres, on the east end of Bwlch Tryfan, Caernarvonshire [J.H.Bratton, 2000].

Helpful hints

This is a species for which it is particularly important to retain voucher specimens. Several records had to be placed in category 2 or 3 (see Glossary).



Gerris gibbifer (female): ventral side to show position of yellowish tubercle on the metasternum (see Savage, 1989, pp 48 and 52). It is essential to see a yellowish tubercle because *G. costae* may have what looks like a tubercle on the underside but it is not yellowish. *G. costae* has a reddish disk on the pronotum whereas *G. gibbifer* does not. Confusion can arise because the pronotum of *G. costae* can sometimes be very dark, or the red disc may take a long time to re-appear when drying out specimens stored in alcohol.



Map 16: *Gerris lacustris*

(Linnaeus)

Common pond skater

No of records: 1,877
No of 10 km squares recorded: 883
No of 10 km squares pre-1970: 11

Distribution

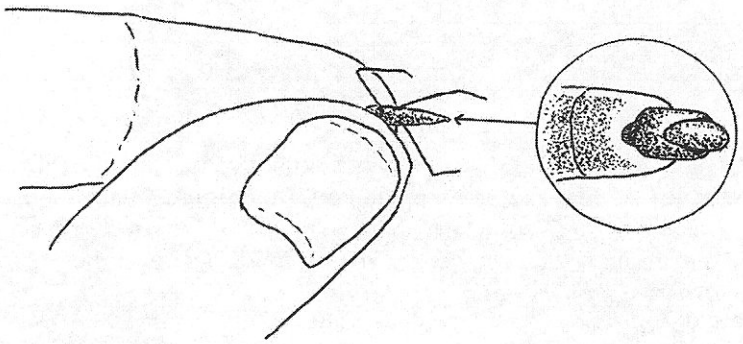
This is the commonest pond skater in Britain. It is widely distributed throughout mainland Britain, but absent from the Outer Hebrides, Orkney and Shetland.

Habitat

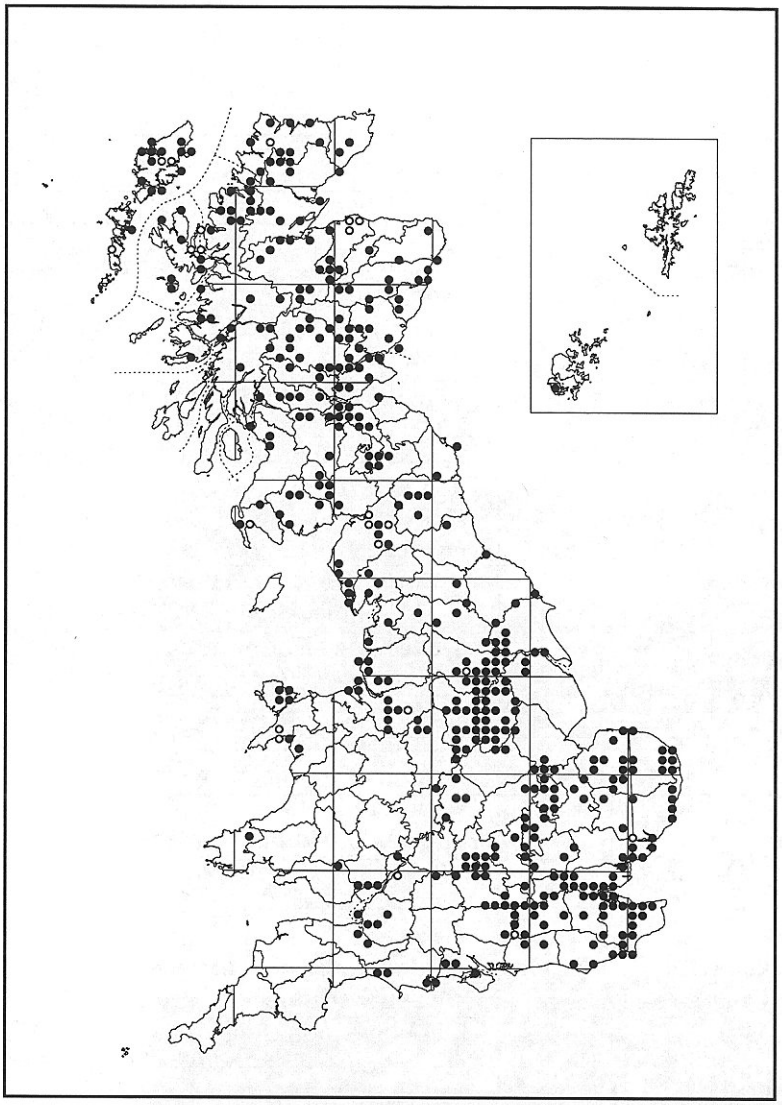
Found in a considerable variety of waters: from small ponds and lake margins to ditches and canals and the slower flowing parts of rivers where there is usually an abundance of vegetation. It rapidly colonises newly available habitats.

Helpful hints

In the field, the presence of *G. lacustris* may be suspected by its small size and habit of jumping about on the surface when lunged at with a net. It is easy to do a quick identification in the field, with a hand lens (see below). This can be helpful in showing whether the population is all *G. lacustris* or if there is a mixture with the similar sized *G. odontogaster*.



Male *Gerris lacustris*. Hold the live animal between thumb and forefinger. First examine the front end to check that the antennae are black, and then the posterior end from below, to see whether there is a small emargination in the seventh abdominal segment, as shown left (male) or clear ridge in the eighth segment (female) (see Savage, 1989, p 49).



Map 18: *Gerris odontogaster*

(Zetterstedt)

Toothed pond skater

No of records: 717
No of 10 km squares recorded: 439
No of 10 km squares pre-1970 only: 21

Distribution

This common species is widely recorded in much of England and parts of Wales and it is not known why there are so few records, or none, in some counties. Advice from the Environmental Records Centre for Cornwall and the Isles of Scilly has demoted two records in that county to category 2*, with the result that there are no confirmed records west of Somerset and Dorset. In Scotland, this species is widespread on the mainland and is found on many islands, but has not been recorded north of Hoy, in the Orkneys [T.Huxley, 1996].

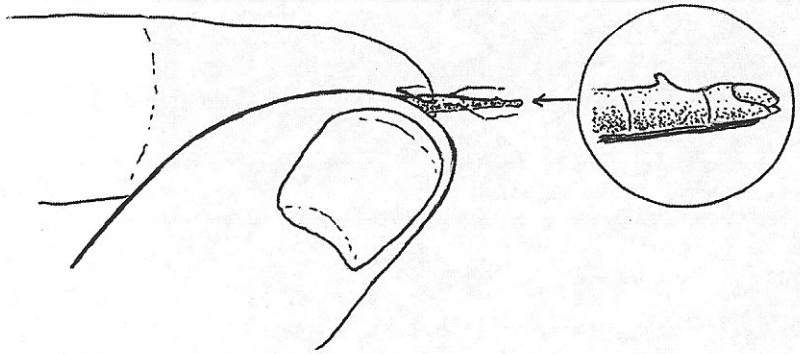
Habitat

Found on various types of still or gently flowing water, it is most often found where the water is acidic, especially in moorland.

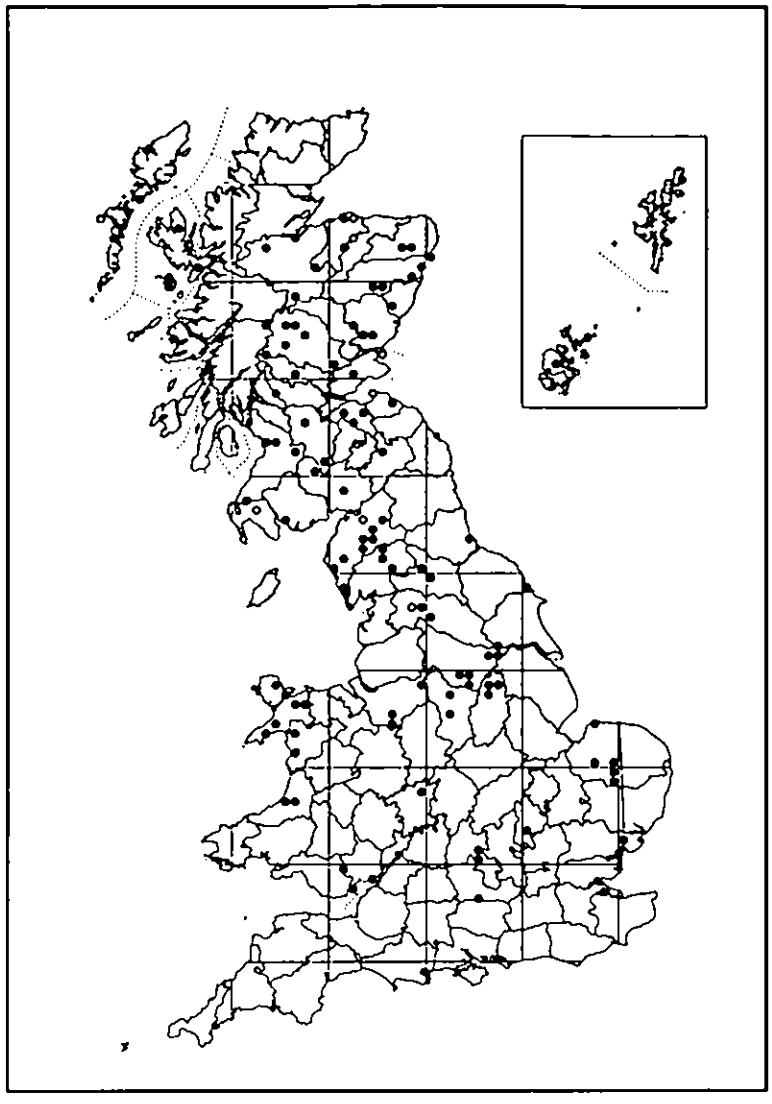
Helpful hints

The English name, toothed pond skater, is because of the two small teeth on the posterior underside of males (see below). Males are so distinctive that it is a good rule to examine specimens in the field to ensure that one has a male and that it has the little teeth.

*See Glossary.



Male *Gerris odontogaster*. Hold the live animal between thumb and forefinger. First, examine the front end to check that the antennae are black. Then, in side view, with the ventral side upwards, see whether there is a pair of small teeth on the seventh abdominal segment. Females have a poorly developed keel on the eighth segment but with depressions on each side (see Savage, 1989, pp 49 and 52).



Map 17: *Gerris lateralis*

Schummel

No of records: 135
No of 10 km squares recorded: 112
No of 10 km squares pre-1970: 9

Distribution

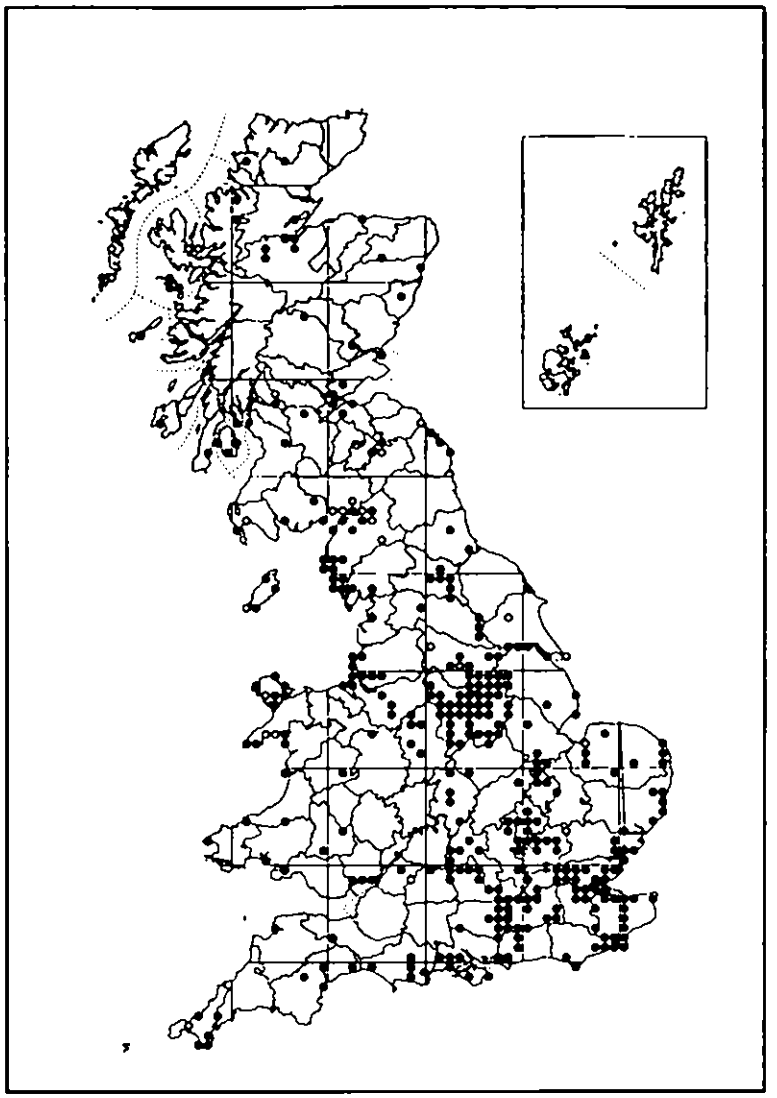
The map shows 67 10 km squares in north Britain, compared to 44 in the south, thus confirming earlier statements (e.g. in S&L) that this species is generally more common in northern Britain. Nevertheless, although there are two records for Orkney and one for Shetland (the only gerrid recorded in the latter), there seems to be a large part of the north Scottish mainland where it is absent. There are several records for south Wales and it extends as far south as Berkshire, where, at Chamberhouse Farm, five specimens were taken amongst the dense emergent vegetation of a narrow stream [P.Kirby, 1997].

Habitat

G. lateralis is particularly associated with very shallow water, often only a thin film, amongst tall swamp vegetation such as bottle sedge, *Carex rostrata* [P.Kirby].

Helpful hints

This is one of the species with a reddish/yellowish pronotum and antennae. Look for the absence of a ventral emargination on the underside of the seventh segment of the abdomen in males and, in fresh specimens, the lateral silvery patches on the undersides of the abdomen (see Savage, 1989, p 50).



Map 19: *Gerris thoracicus*

Schummel

No of records: 534
No of 10 km squares recorded: 348
No of 10 km squares pre-1970 only. 28

Distribution

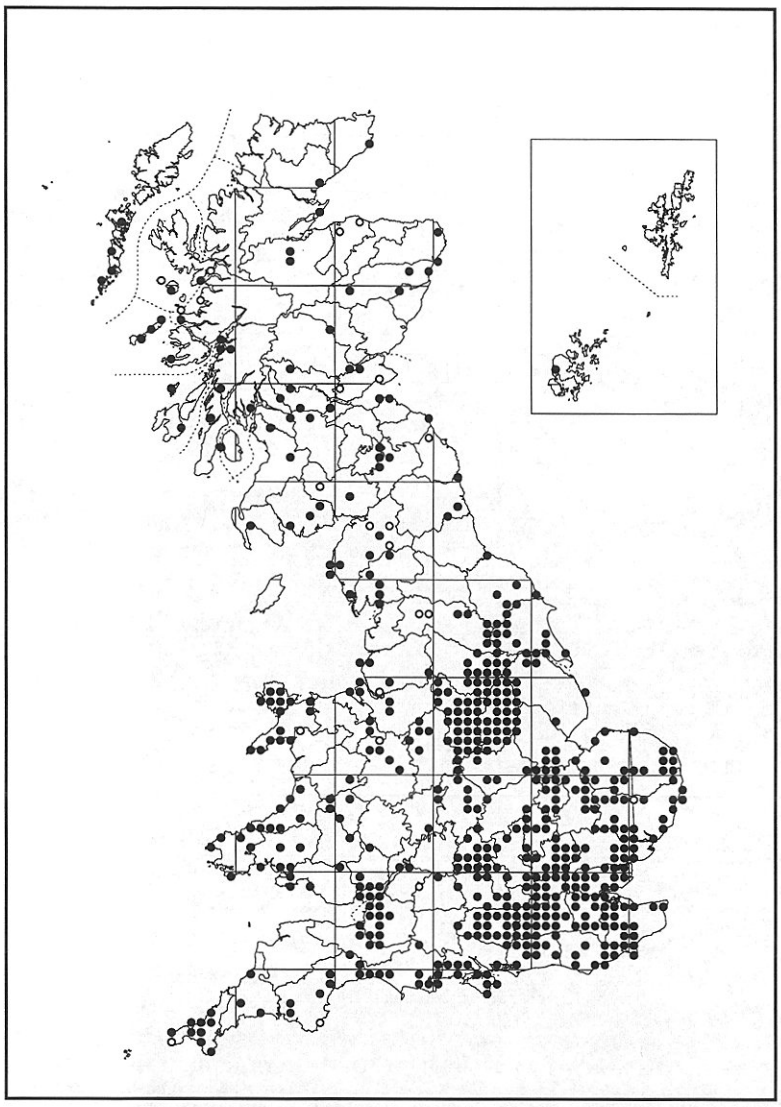
It is widespread and frequent in parts of lowland England and Wales, but with only occasional records in the Highland counties of Scotland.

Habitat

G. thoracicus is typically an inhabitant of shallow, often muddy bottomed, small puddles and ditches, which may be shaded by trees. It may also be found near the coast in slightly brackish water.

Helpful hints

This is another pond skater with a reddish/yellow area on the disk of the pronotum; also with pale (not black) antennae. Collectors unfamiliar with the group seem to have more difficulty separating *G. thoracicus* from *G. costae* than between any other similar pairs. Identification is best begun in the field. Whereas *G. costae* generally lives up to its name of the moorland pond skater, *G. thoracicus* is typically a lowland species. With dead material, card mount flat and then, when examining from above, see whether the parts to which the rear legs are attached (the coxae) are largely hidden (*G. thoracicus*) or clearly visible (*costae*) (see Savage, 1989, p 51). This comparison becomes easier as one builds up a reference collection of both species. When, as often happens, *G. lacustris* is present with *G. thoracicus* then, even to the naked eye, the larger size and reddish spot on the pronotum of *G. thoracicus* mark it out as different from the commoner and smaller all-black *G. lacustris*.



Map 20: *Nepa cinerea* Linnaeus

Water scorpion

No of records: 1,197
No 10 km squares recorded: 543
No of 10 km squares pre-1970 only: 22

Distribution

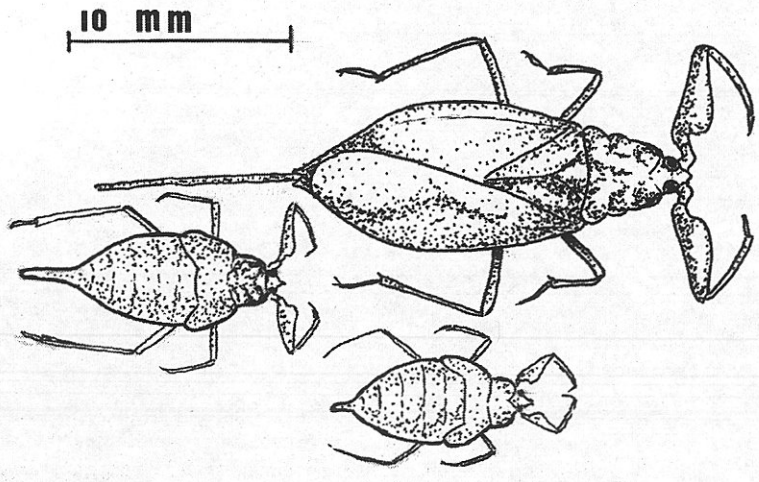
Although probably occurring throughout much of lowland England, there are many counties with few records. These contrast with the dense clusters of 10 km records in the midlands and south-eastern counties which may be as much a result of collector effort as that the species is actually more common in these parts of the country. In places such as the Norfolk Broads, several specimens can be found in one sweep of a net, whereas in northern Britain it is seldom present in large numbers. Exceptionally, however, even at its most northerly recorded station, in a pond at the edge of a bog near Stromness on the Orkney mainland, it was found "in considerable numbers" (Sinclair, 1974).

Habitat

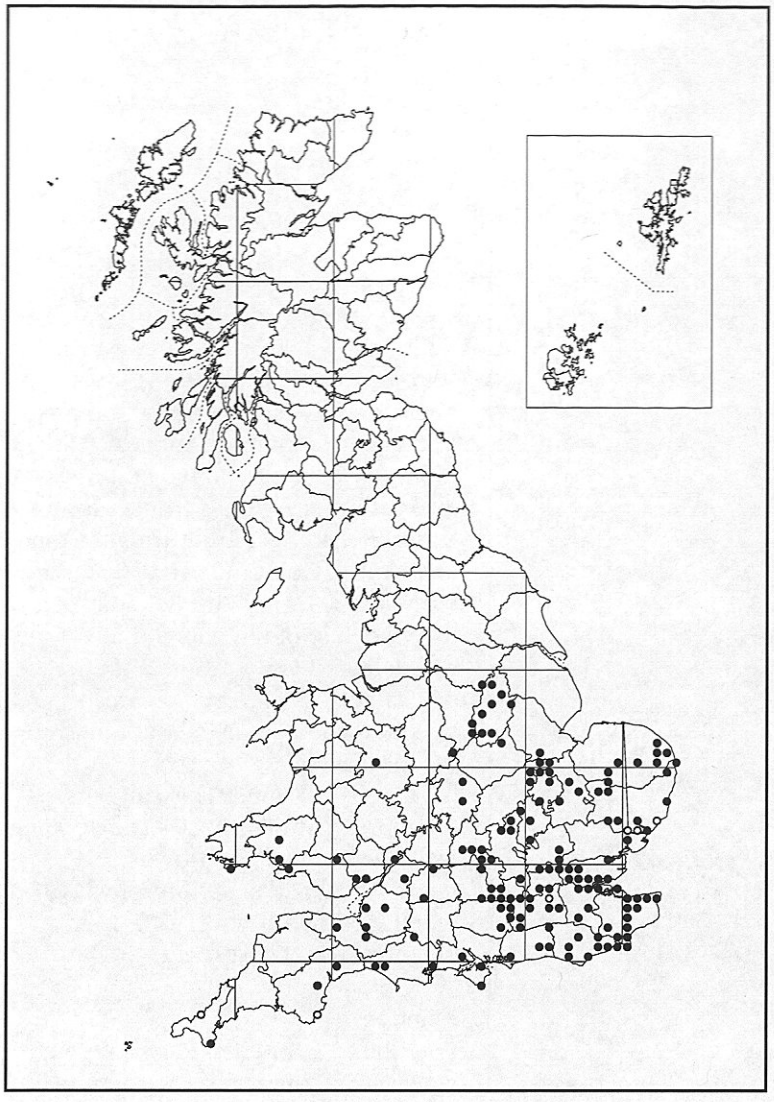
Typically a species of weedy shallows of slow or still water, it can also occur in the sheltered margins of fast streams and in almost vegetation-free new water bodies. Typically, *N. cinerea* inhabits the spaces around underwater plant stems and leaves, but it may also be found under stones at lake margins [P.Maitland] and in detritus and other damp material just above water level. Indeed, there are several accounts of finding it actively searching for food out of water (e.g. Whitehead, 1993 and Chalkley, 1998).

Helpful hints

The water scorpion is a distinctive bug, clearly identified even if found only as a juvenile with a short "tail" (see below).



Nepa cinerea, water scorpion. Adult, above, and two juveniles.



Map 21: *Ranatra linearis*

(Linnaeus)

Water stick insect

No of records: 261
No of 10 km squares recorded: 152
No of 10 km squares pre-1970 only: 6

Distribution

Locally common in parts of southern England and Wales, the two most northern records are near Ranskill and at Gateford Common, Worksop, both in Nottinghamshire [R.Merritt, 2001]. S&L, state that there are also "old records from Merioneth, Flintshire and Yorkshire".

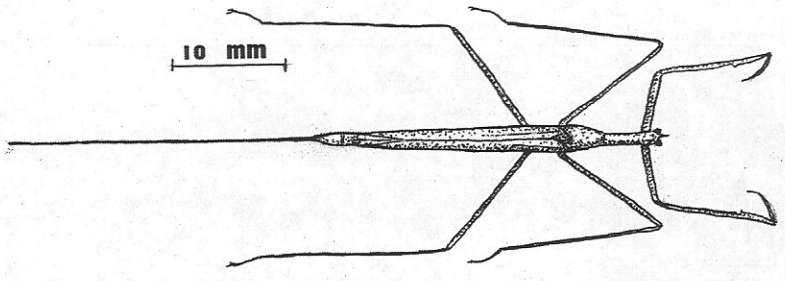
Habitat

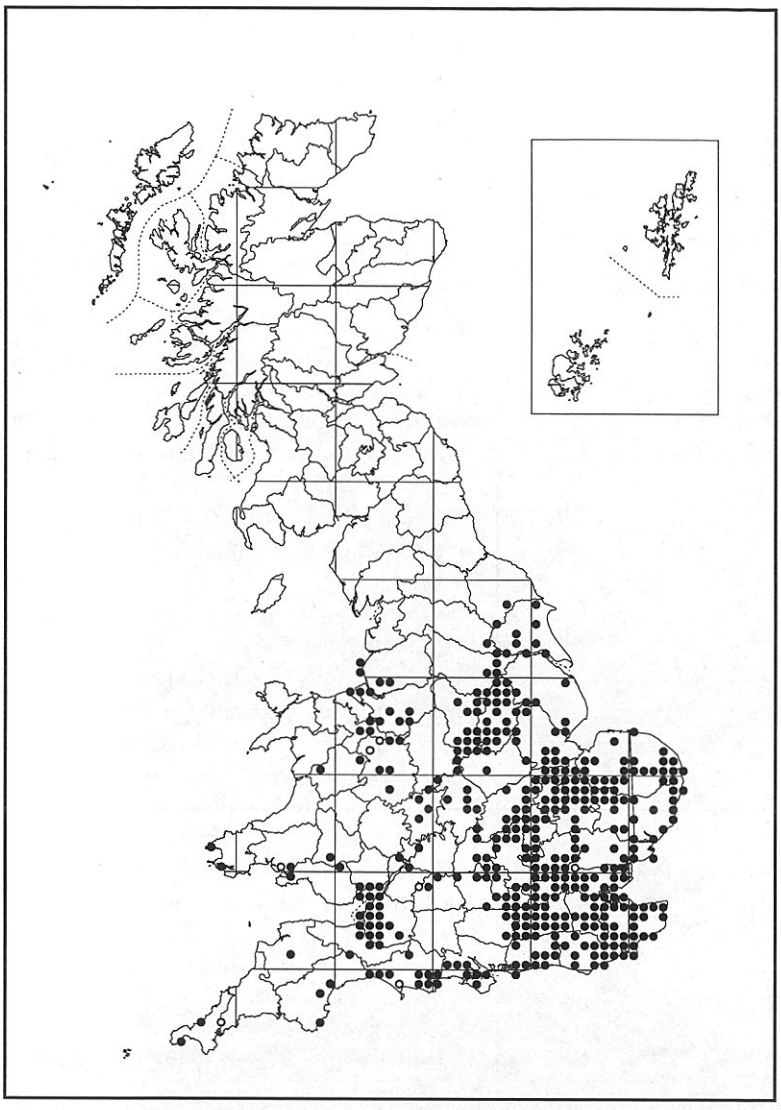
Typically an inhabitant of ponds and canals with emergent vegetation (Kirby, 1990), it can also be quite common in gravel pits of recent origin and even new ponds within a year of excavation. It has also been recorded in submerged grass growing out from the banks of slow flowing rivers, amongst reeds and from a shallow heathland pond with emergent rushes, *Juncus*, and grasses.

Helpful hints

Like the water scorpion, the water stick insect is another distinctive species, both as a juvenile and an adult. It is always exciting, even slightly alarming, to discover movement in a bit of stick-like detritus in the net. There are several reports of it on land, readily leaving the water to hunt (Kirby, 1990); likewise of it in flight, e.g. Chalkley (1998): flapping across a field of strawberries to "land on some black plastic sheeting, presumably mistaking it for the reflective surface of a pond". The witness, Joan Hardingham, said that it flew "holding its body at an angle of 60 degrees, resembling a praying mantis".

Ranatra linearis, water stick insect.





Map 22: *Ilyocoris cimicoides*
(Linnaeus)

Saucer bug

No of records: 866
No of 10 km squares recorded: 387
No of 10 km squares pre-1970 only: 8

Distribution

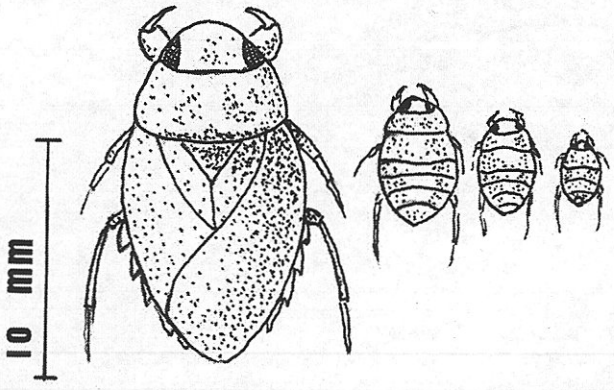
Although earlier accounts give this as "throughout the southern half of England and Wales but common only in the more southern counties" (Kirby, 1990), the records show that it now extends as far north as North-east Yorkshire, at West End Farm, Muston, and Norton Golf Course [M.Hammond, 1998 and 2001] and, further south on the west side of the country, at Ainsdale NNR, South Lancashire. [J.S.Denton, 1990]. There are also several records in the Wirral, Cheshire and nearby dating from the 1970s [Liverpool Museum]. This suggests, therefore, that this species is extending its range northwards. However, a record for Lanarkshire (Murphy, 1901), mentioned by Brown (1948), is an error (see Huxley, 1997a).

Habitat

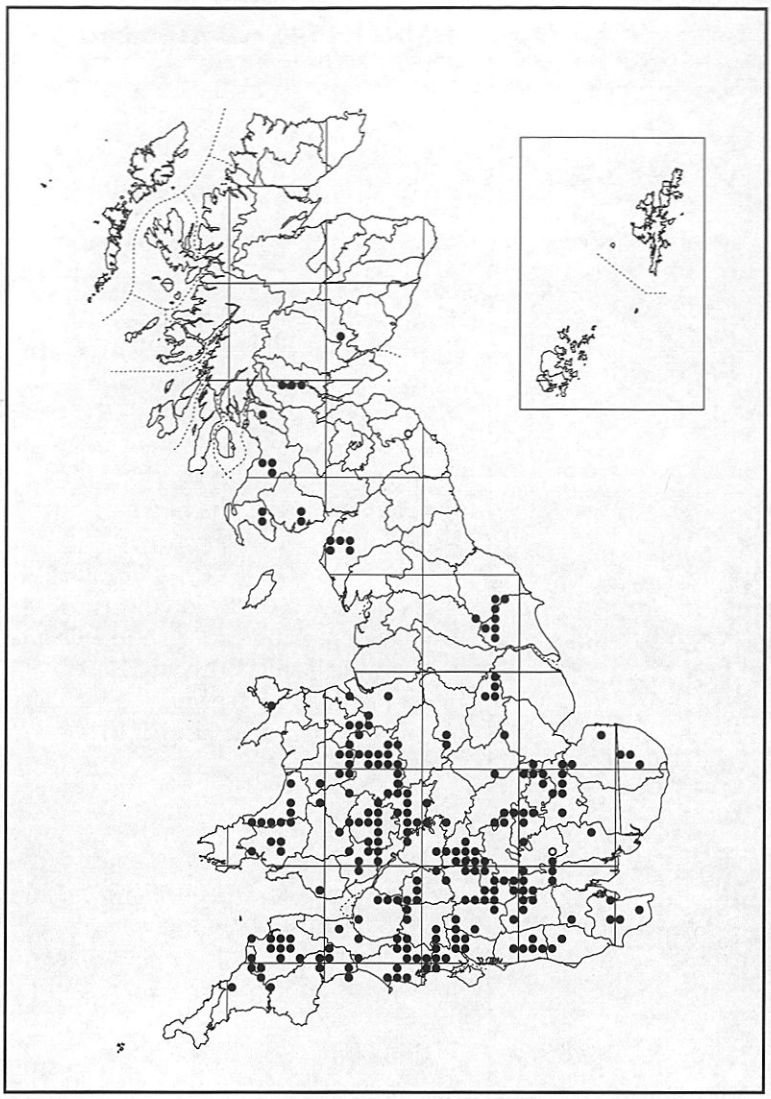
Found in still, often muddy-bottomed water, living on or near the bottom, often amongst dense vegetation. S&L state that, despite its fully developed wings, the musculature of the saucer bug is so reduced as to prevent flying and that dispersal "occurs by nocturnal walking". Because of this, one recorder has speculated that populations are in some way self-limiting; in large numbers where the species occurs yet often absent from nearby waters. Savage (1989, p 140) summarises information about its foraging behaviour.

Helpful hints

Juvenile saucer bugs have the same general shape as adults but need careful examination to be certain (see illustration).



Ilyocoris cimicoides, saucer bug. Adult, left, and three juveniles.



Map 23: *Aphelocheirus aestivalis* (Fabricius)

River bug

No of records: 451
No of 10 km squares recorded: 240
No of 10 km squares pre-1970 only: 2

Distribution

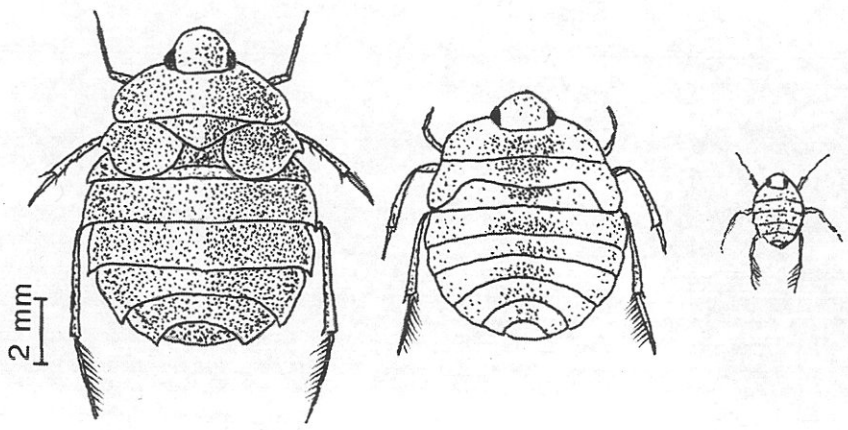
The most northern record is in the Lunan Burn, East Perthshire [B.E.Clelland, 1993]. It is in several other Scottish rivers, including the Teith, Forth and Cree. However, an old record for the Tweed (Limbert & Slack, 1939) in the stomachs of grayling, *Thymallus thymallus,* has not been repeated (Huxley, 1997a). In England and Wales, it is present in many rivers and streams, from Cumbria to Devon, but apparently absent from north-east England, possibly because of industrial pollution.

Habitat

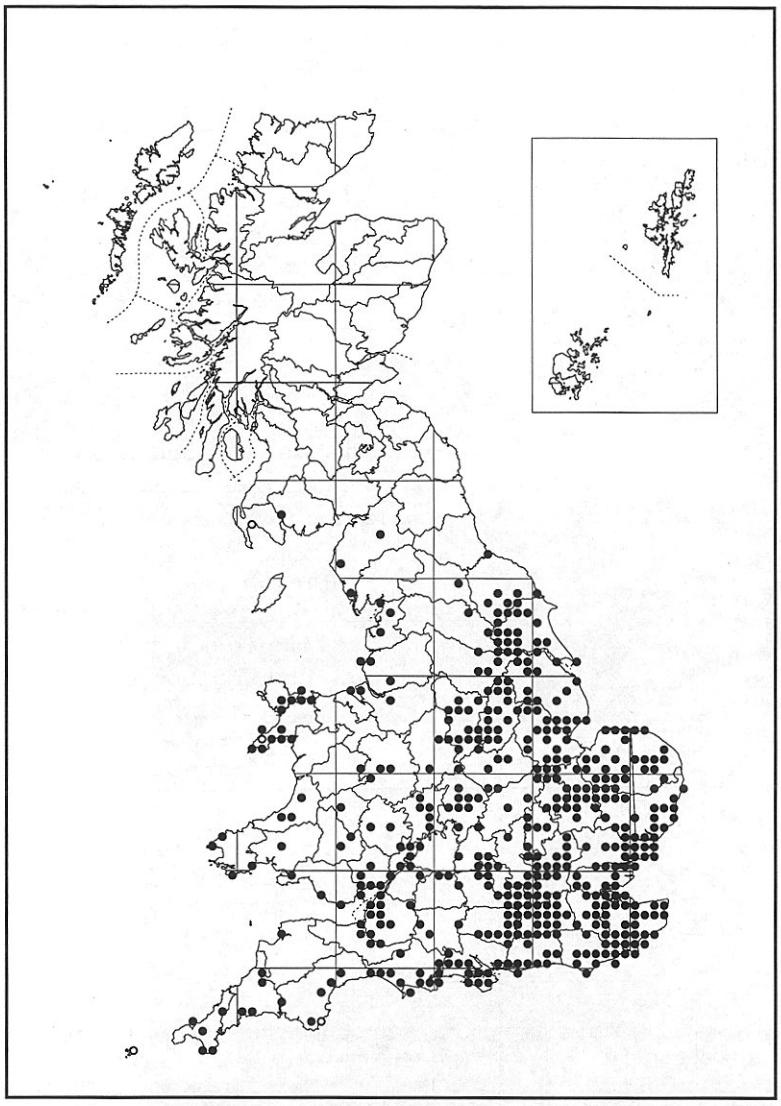
Usually there is some vegetation present, either in the form of overhanging marginal plants or moss covered rocks. However, records from the River Derwent in Yorkshire [Environment Agency] show that the river bug can occur where the substrate is mainly sand and silt, as well as the stony or gravelly bottom mentioned in S&L. Even in sluggish lowland rivers it is worth looking in the white water of weirs, but taking great care.

Helpful hints

Typically, finding the river bug is achieved by kick-sampling stony riffles. Compared with other water bugs, this species is exceptional in having a highly specialised respiratory system, a kind of external gill, which enables it to obtain oxygen by diffusion and so remain permanently submerged.



Aphelocheirus aestivalis, river bug. Adult, left, and two juveniles.



Map 24: *Plea minutissima*

Leach

No of records: 886
No of 10 km squares recorded: 453
No of 10 km squares pre-1970 only: 5

Distribution

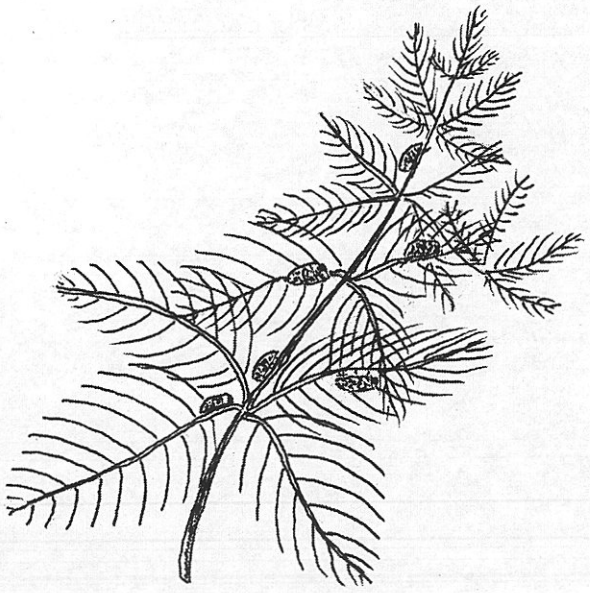
This species is found mainly in lowland England but there is a cluster of records in north Wales and elsewhere in the Principality. There are also scattered records in England as far north as Blackmoss Pool, Cumbria [J.S.Denton, 1999]. The bug may now be extinct at Torrs Warren, in Wigtownshire [T.Huxley, 1960] but it was re-found recently at Lower Glenamour Loch near Newton Stewart, Kirkcudbrightshire (Huxley, 1997c), confirming that, as speculated by S&L, *P. minutissima* does just get into Scotland.

Habitat

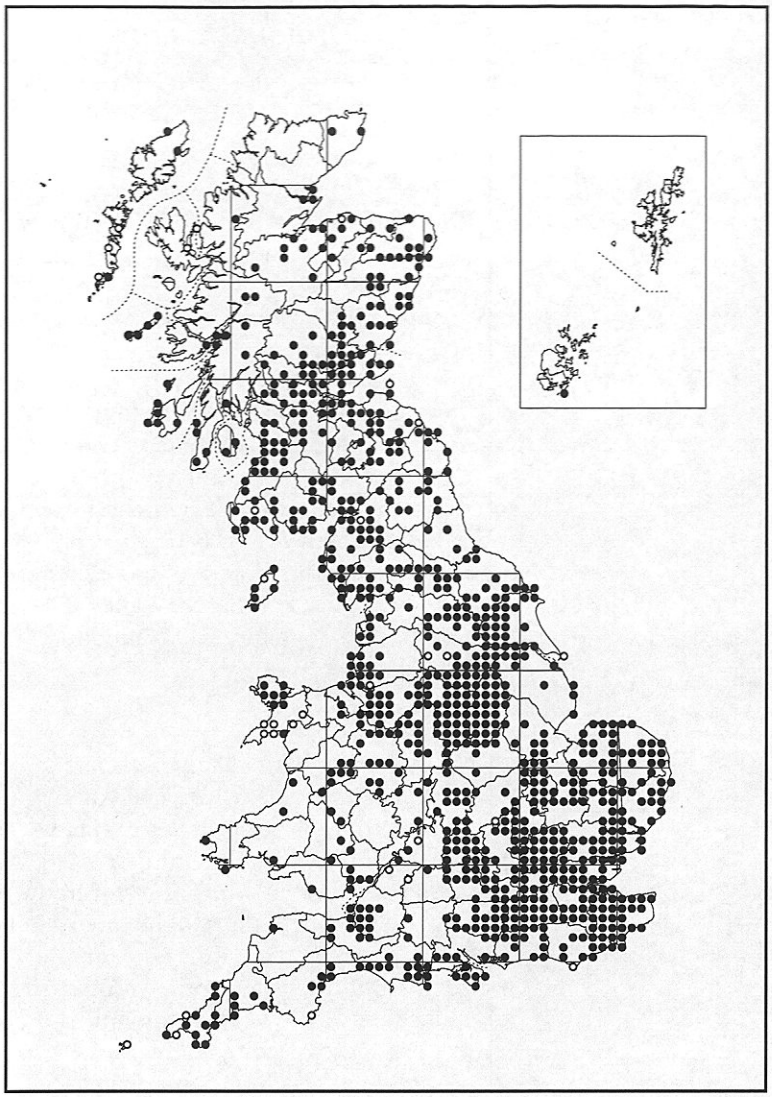
This little predator lives amongst dense weeds in rich lakes, ponds and ditches, mostly where the water is clear and there is little organic matter in suspension.

Helpful hints

This is a species that is most easily collected by shaking out aquatic plants such as waterweeds, *Elodea spp.* into a bucket of water, thereby detaching the bug from the vegetation to which it clings. If kept in an aquarium, *P. minutissima* spend most of their time walking up and down plant stems, but may also swim upside down, like *Notonecta spp.*



Plea minutissima clinging to a fragment of water-milfoil, *Myriophyllum* sp.



Map 25: *Notonecta glauca*

Linnaeus

Common backswimmer

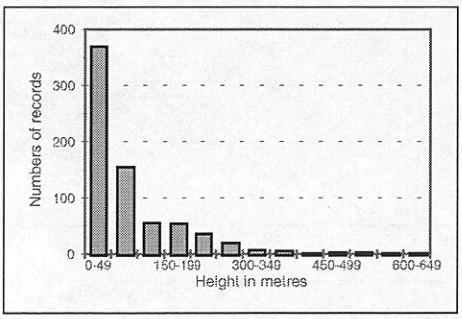
No of records: 2,116
No of 10 km squares recorded: 906
No of 10 km squares pre-1970 only: 30

Distribution

This is the commonest species of backswimmer throughout most of Britain. There is one record for Orkney [South Ronaldsay, T.Huxley, 1996], but none for Shetland.

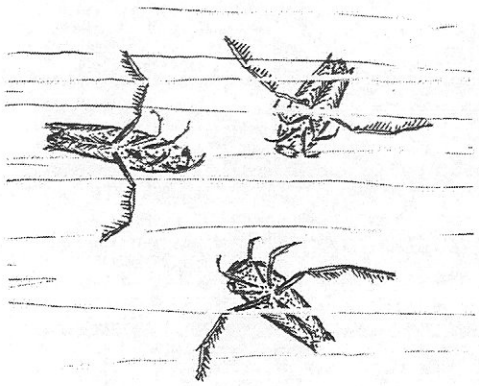
Habitat

S&L state that this species is replaced by *Notonecta obliqua* in acid peaty pools and, indeed, in the northern counties of mainland Scotland there are fewer records of *N. glauca* and more of *N. obliqua*. Although mainly a lowland species, it has been found at over 600 metres (see histogram).

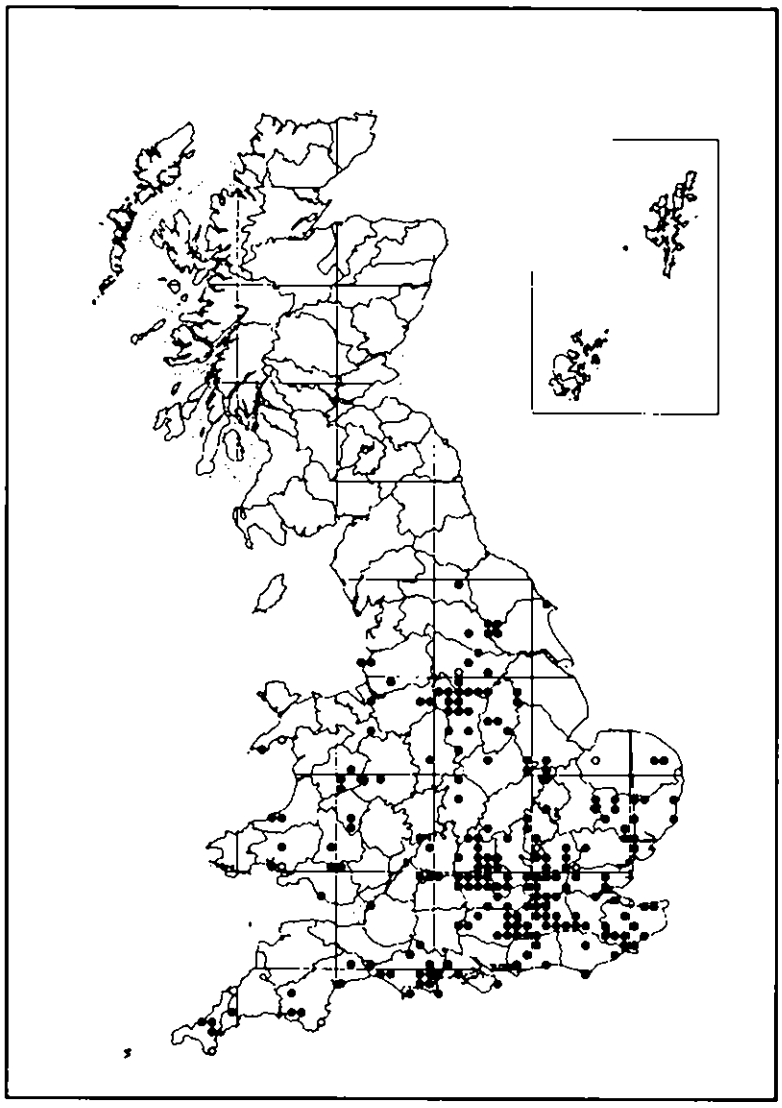


Helpful hints

This species is often subject to rapid changes in population (S&L) with large numbers of juveniles in mid-summer and adults in the autumn, and then sometimes quite scarce in the same pond come spring. Recording may therefore require repeat visits to be sure which species is present, especially because, in southern England, two, three or even rarely all four species of *Notonecta* can occur in the same water body. Savage (1989) reviews the literature about feeding and diet.



In calm water backswimmers can be seen hanging upside-down below the water surface by their front two pairs of legs and the terminal part of their abdomen. When held in the hand they can deliver a sharp pain with the rostrum.



Map 26: *Notonecta maculata*

Fabricius

No of records: 306
No of 10 km squares recorded: 211
No of 10 km squares pre-1970 only: 9

Distribution

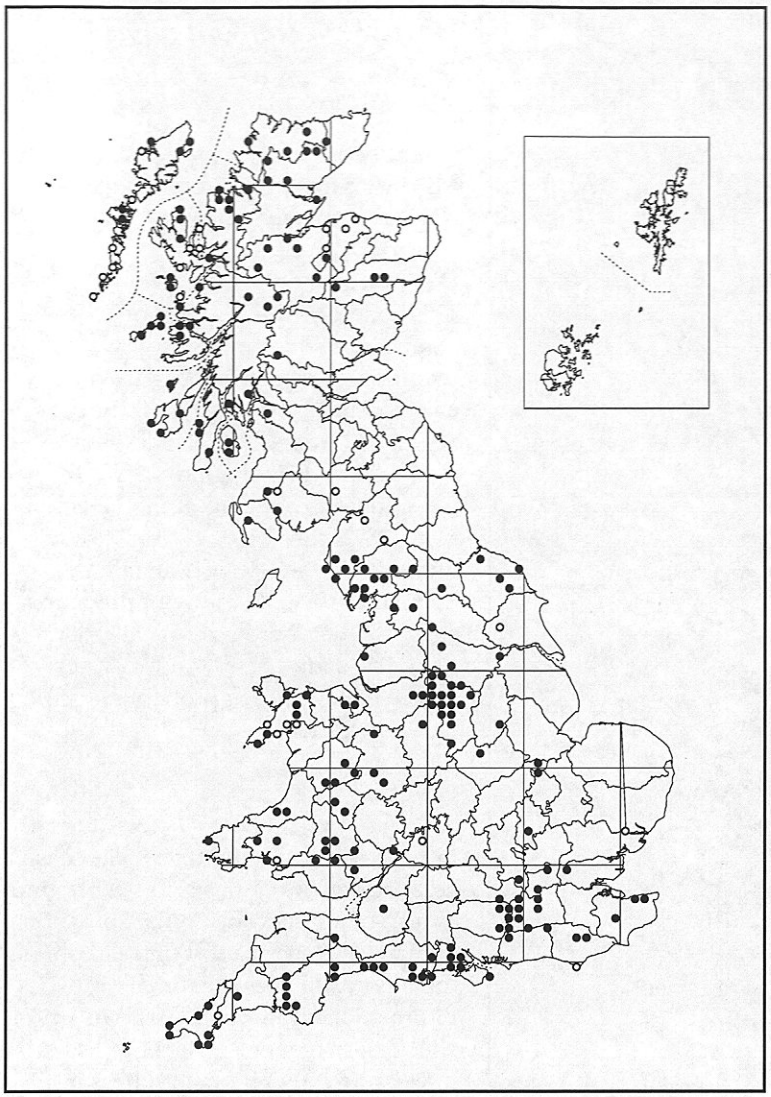
Kirby (1990) describes this species as being fairly common in the south of England and Wales, but rarer or absent further north. The most northern confirmed record is from a gravel-pit pond in Bolton-on-Swale, North-west Yorkshire [R.Merritt, 2000]. The next most northern record is on the east coast in a swimming pool in a derelict Butlin's camp at Primrose Valley, Filey, South-east Yorkshire [M.Hammond, 2000].

Habitat

In still water: particularly associated with barren pools or artificial water bodies with hard substrates and little vegetation, but also found in lower numbers in other types of water body (Kirby, 1990). Cattle-troughs often hold this species and are thus an example of an artificial water body with a hard substrate. However, the amount of vegetation can vary greatly: for example, it was found in a thickly weedy small concrete garden pond at Oaksey, North Wiltshire [T.Huxley, 1994]. *N. maculata* may also occur in natural habitats, such as in a chalk stream following the return of flow to previously dry sections [D.Leeming]. It has also been recorded in silty floodplain drainage channels, quarry ponds and heathland ponds with low levels of organic matter and a bare substrate [R.Merritt].

Helpful hints

Note that teneral *N. glauca* may also have a pale metanotum, with or without black spots [J.H.Bratton]. Careful examination of the genitalia is always needed (see Savage, 1989, pp 60-63).



Map 27: *Notonecta obliqua*

Thunberg

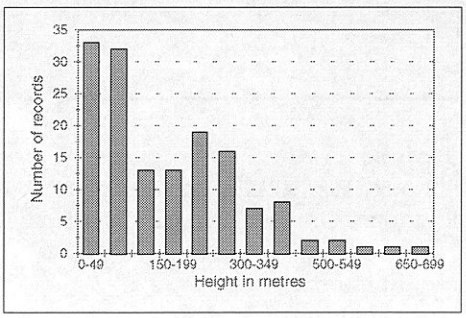
No of records: 338
No of 10 km squares recorded; 228
No of 10 km squares pre-1970 only: 29

Distribution

This species extends from the north mainland of Scotland to Cornwall and is widely distributed in Wales. The map suggests that it is commoner in the western counties of Britain, perhaps in association with its preferred types of habitat.

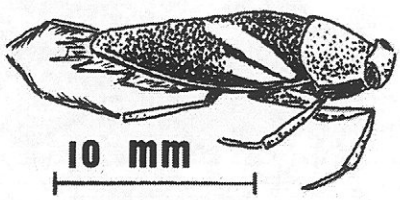
Habitat

N. obliqua is generally regarded as a denizen of acidic, peaty pools in moorland, often at high altitudes. S&L state that it tends to replace *N. glauca* at altitudes above about 150 to 220 metres and, indeed, the histogram below shows a different altitude distribution compared to the similar histogram for *N. glauca*, although both species have been found in high places.

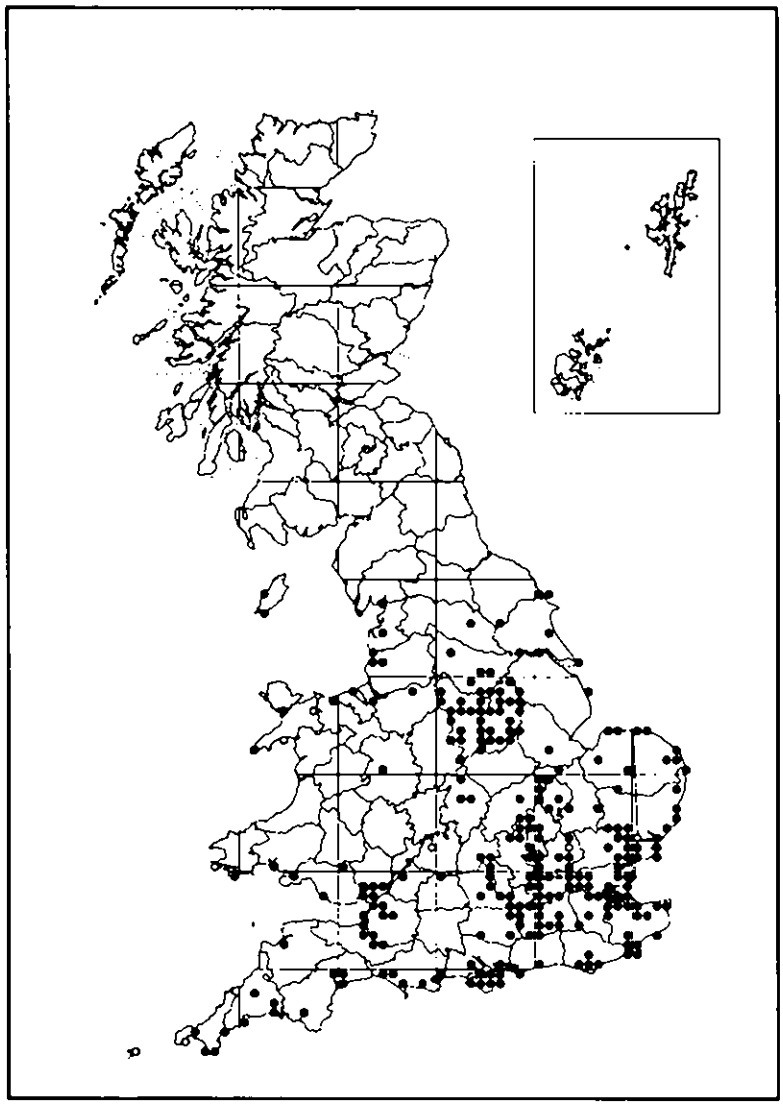


Helpful hints

This is a handsome backswimmer with its distinctive two light stripes on each front wing (hemielytron), making it easy to identify, (see below).



Notonecta obliqua



Map 28: *Notonecta viridis*

Delcourt

No of records: 423
No of 10 km squares recorded: 249
No of 10 km squares pre-1970 only: 8

Distribution

This southern species may be extending its range northwards. The two most northern records are on the east coast in North-east Yorkshire, at Seamer [T.Huxley, 1998] and Filey North Cliff [M.Hammond, 2000]. To the west, there is a record at the Leighton Moss RSPB reserve, West Lancashire and two on the Isle of Man [all T.Huxley, 1998]. Scrutiny of the map suggests that there are several counties in England and possibly also Wales, where the species is probably much under-recorded.

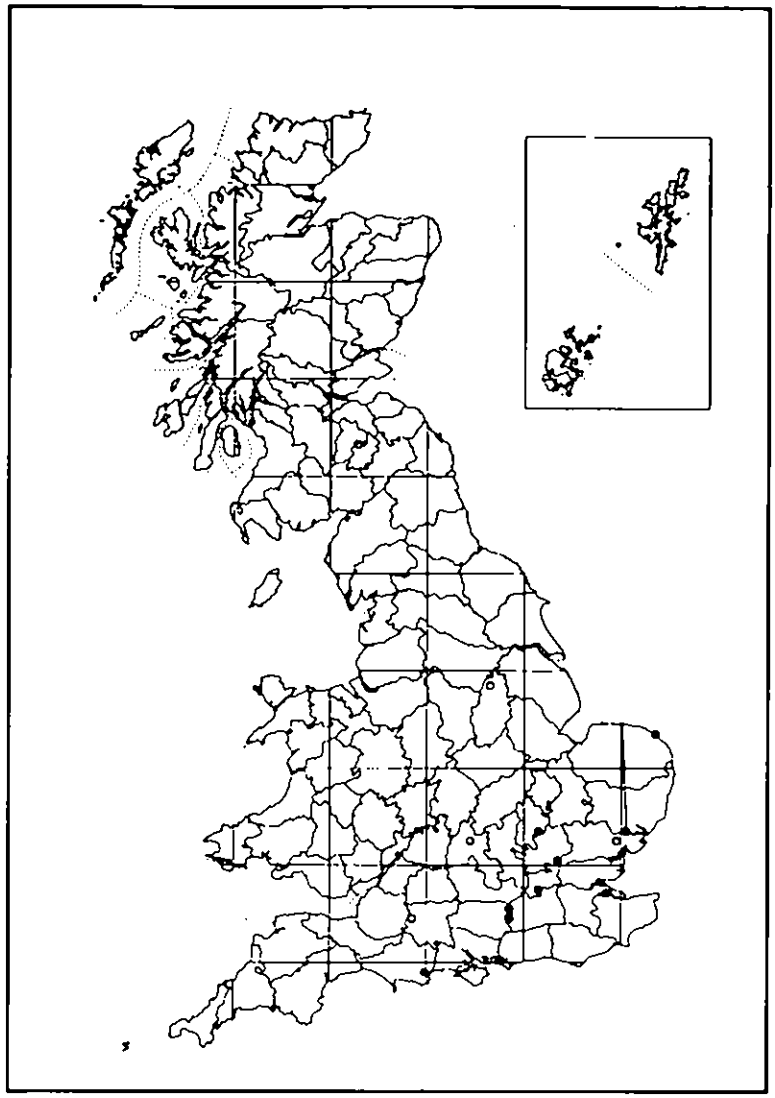
Habitat

S&L state that this bug "is found chiefly in brackish pools and ditches in coastal areas. However, it has also been found in non-brackish pools in the southern Midlands." Examination of a sample of the records that give habitat information shows that less than a fifth specifically mention "brackish", so it is unclear how much brackishness is preferred. There is a suggestion [P.Kirby] that, in recent decades, *N. viridis* may have become more frequent in non-brackish waters, although it is still the species to expect in brackish ditches and pools (often with *N. glauca*). At inland locations, it is associated with non-organic, silt bottomed waters.

Helpful hints

N. viridis is more slightly built when compared with the more robust *N. glauca*, with which it is frequently associated. Specimens need to be checked carefully using Savage (1989, pp 56-63).

NB This is the species called *Notonecta marmorea viridis* in Savage (1989) and in RECORDER, where it is placed (in alphabetical order) before *N. obliqua*. In accordance with the revised name, this order is here reversed.



Map 29: *Micronecta minutissima* (Linnaeus)

No of records: 13
No of 10 km squares recorded: 11
No of 10 km squares 1970, pre-1970 or date unknown: 5
Threat status: Red Data Book 3 (Rare)

Distribution

The British *Micronecta* were reviewed by Walton (1938) and he included *M. minutissima* on unclear evidence, finding the first convincing population in 1943 at Colchester, South Essex (Walton, 1944). Kirby (1992) considers this species to be extremely local and prone to the formation of transitory colonies. Nau (2002) reviewed its distribution. The map is generated from the following data. There are four pre-1970 records by E.S.Brown, notionally positioned in accordance with location data given in Brown and Scudder (1959) at Oxford Canal, Somerton, Oxfordshire, and in the River Lea, Hertfordshire and a nearby lake. A fifth record (for an unknown date, shown by an open circle) is by G.A.Walton in a pond at Longleat Park, South Wiltshire. Brown and Scudder (1959) also describe specimens in the British Museum labelled "Babworth" [1937] in Nottinghamshire, recorder unknown, represented by the most northern open circle*. Although Kirby (1992) states that the most recent record is from 1957, the bug has now been found in the Great Ouse, Bedfordshire; Frensham Little Pond, Surrey; River Lea, Hoddesdon, Hertfordshire [all B.S.Nau, 2001] as well as in some old specimens from Flatford Mill, East Suffolk [B.S.Nau, 1973]. Other recent records are at Eelmore Flash, North Hampshire [J.S.Denton, 2001]; Richmond Park, Surrey [D.J.Leeming, 2001] and Wroxham Broad, East Norfolk [J.H.Blackburn, 2001].

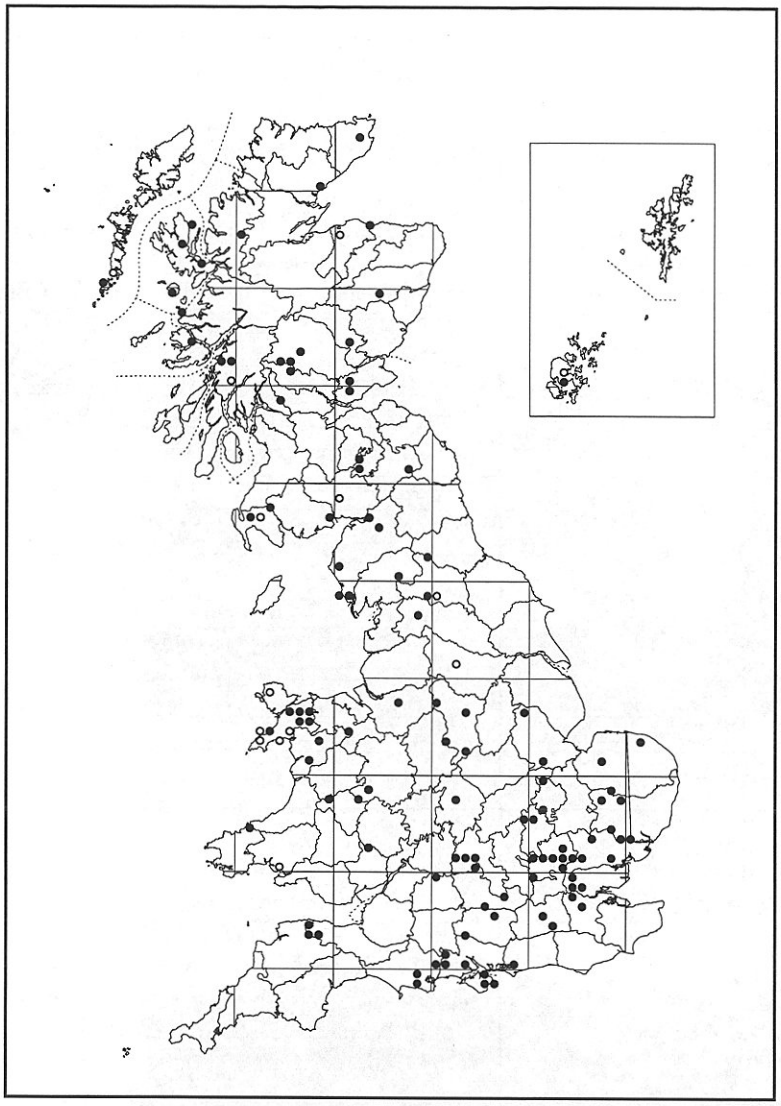
Habitat

It is found in slow-flowing shallow water over a bottom of pebbles or mud with fairly sparse vegetation (Kirby, 1992) and over gravel with some fine silt (Nau, 2002).

Helpful hints

Always have putative specimens confirmed by an expert. Nau (2002) gives supplementary diagnostic characters to those given in Savage (1989, pp 110-111).

*Brown and Scudder (1959) also mention a record by Walton from Eriskay, in the Outer Hebrides (Walton, 1942). This has not been used because there are doubts about the sources of some of the specimens described in Walton's paper.



Map 30: *Micronecta poweri*

(Douglas & Scott)

Water singer

No of records: 169
No of 10 km squares recorded: 126
No of 10 km squares pre-1970 only: 14

Distribution

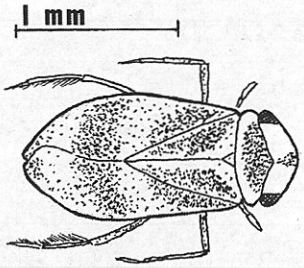
This is the common species of the genus and there are scattered records as far south as North Devon [East Lynn River, J.H.Bratton, 1988]. It has been recorded from Orkney at Loch of Harray [E.Kellock, 1964] and Loch of Kirbister [T.Huxley, 1996] and from Borve Stream, Barra, Outer Hebrides [A.R.Waterston, 1977]. Its distribution is presumably closely related to that of its preferred habitat.

Habitat

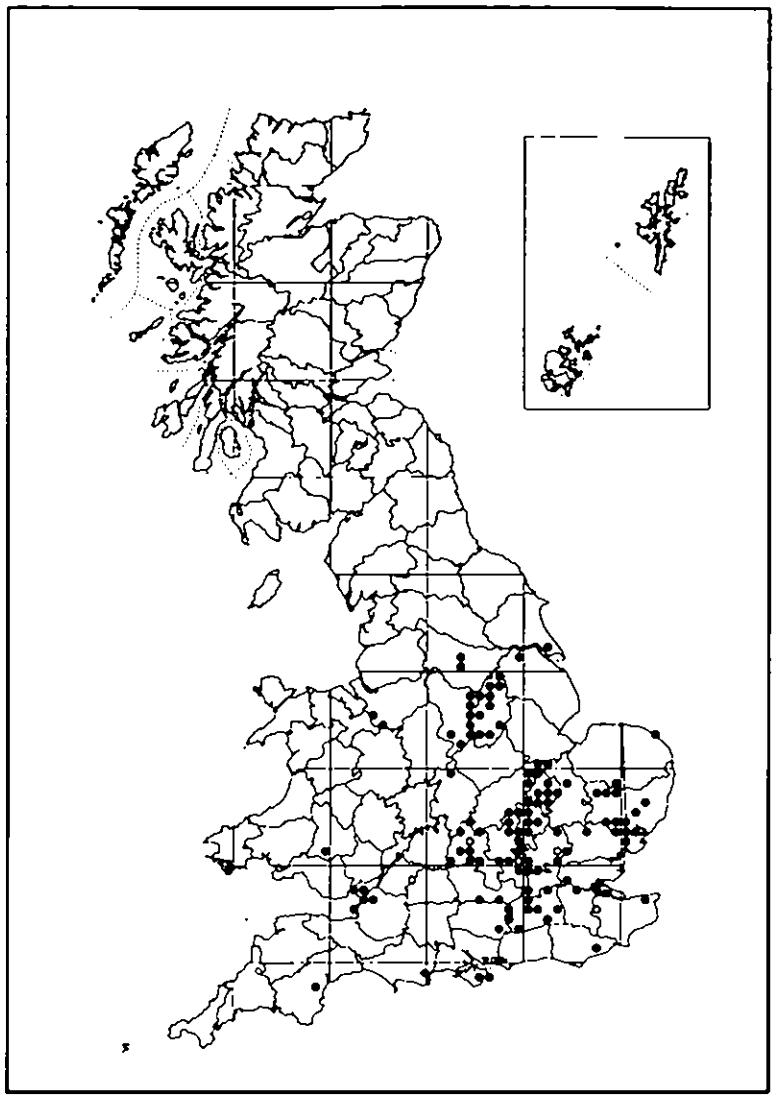
In Scotland, it is often found as juveniles in swarms, in the shallow shores of lakes, especially where there is a lawn of shoreweed, *Littorella uniflora.* However, once adult, the bug may move away from the exposed shore to nearby sedge beds, where their numbers may be much reduced. In south and west Britain, records are often from rivers, such as the record by J.H.Bratton [see above] in "a gravel bedded backwater of a swift stony river". It has been suggested that *M. poweri* prefers more acidic conditions than *M. scholtzi* [A.A.Savage].

Helpful hints

A potential problem about being certain of this species is that, unusually for aquatic bugs, *Micronecta* spp. overwinter as third instar juveniles so spring captures may be immature. If there is no chance of returning to the same place later, a collection of live animals may become adult in a few weeks if kept in a small aquarium. Its common name of water singer refers to it being "noisy" (S&L), but alas it cannot be heard by those 'over a certain age'.



Micronecta poweri, water singer, one of the smallest British water bugs.



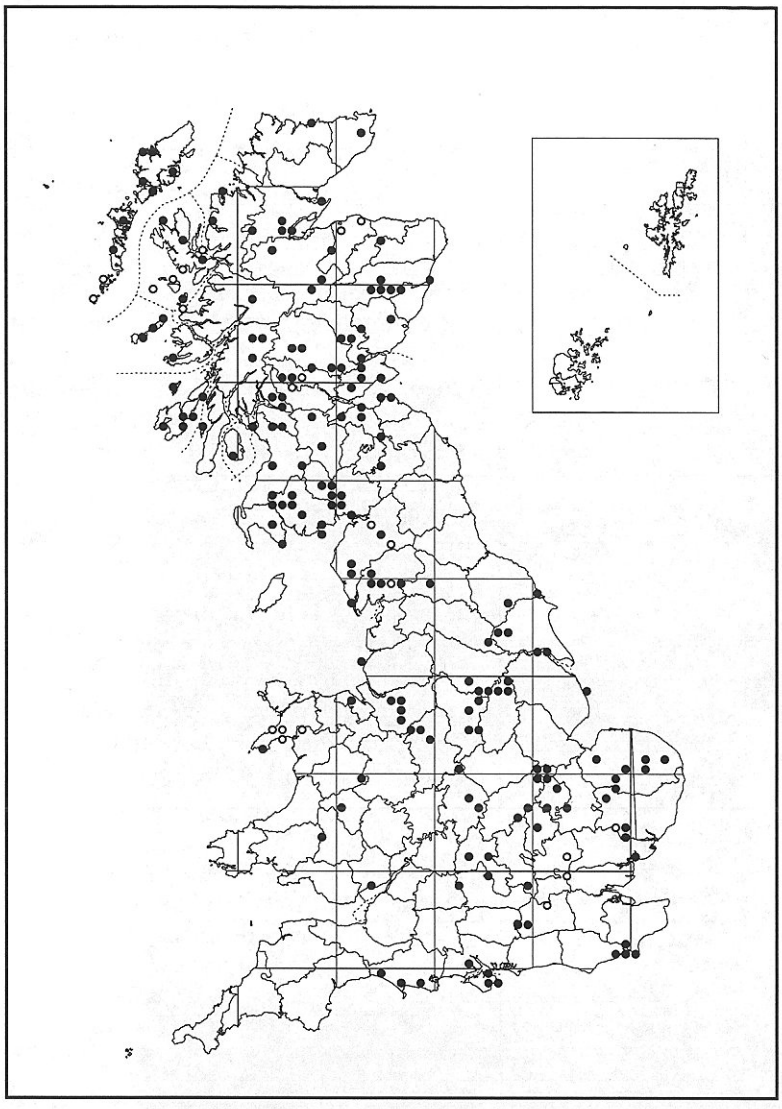
Map 31: *Micronecta scholtzi*
(Fieber)

No of records: 168
No of 10 km squares recorded: 113
No of 10 km squares pre-1970 only: 6

Distribution
Found mainly in southern England, but with two outlying records in south Wales at Bosherston Lakes, Pembroke [S.P.Mundy, 1970] and Afon Llia, Brecon [A.Chalkley, 1991]. There is also a record in South Devon at Little Bradley Ponds [R.Merritt, 1999].

Habitat
This species is found mainly in ponds and lakes with extensive areas of bare mineral bottom, such as the shallows of recent gravel workings [P.Kirby]. Compared to *M. poweri* it prefers more eutrophic conditions [A.A.Savage].

Helpful hints
Difficulties may be experienced in separating *M. scholtzi* from *M. poweri*. If in doubt about a determination, obtain confirmation from an expert.



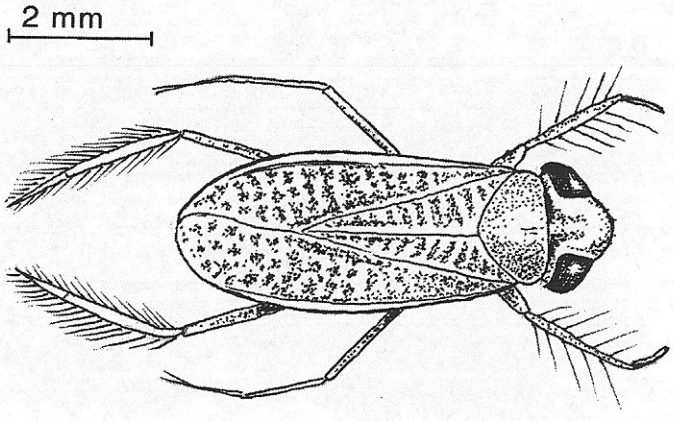
Map 32: *Cymatia bonsdorffii*
(Sahlberg)

No of records: 280
No of 10 km squares recorded: 202
No of 10 km squares pre-1970 only: 22

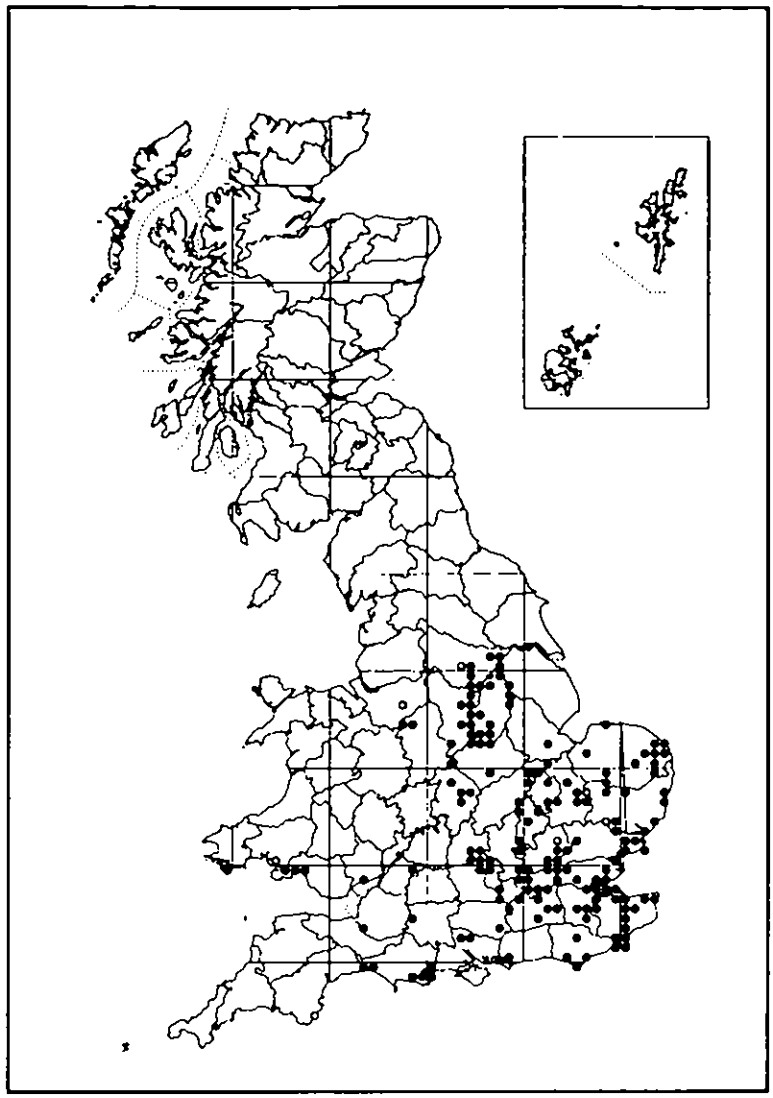
Distribution
Although this species has been described as being commoner in the south and east of Britain (Kirby, 1990), the map shows more records plotted as 10 km squares in northern Britain 114 (56%) than in the south 88 (43%). Possibly this is because of a preference for oligotrophic waters or because such waters are a common habitat of its food, small invertebrates such as crustaceans (Savage, 1989).

Habitat
It is found in still, often acid, water with extensive growth of submerged vegetation.

Helpful hints
Specimens of *C. bonsdorffii* are readily distinguished in the net by their bright green undersides. The front tarsi of *Cymatia* sp. are quite different from those of other corixids, being long and cylindrical, and the palae not flat or triangular (see Savage, 1989, pp 70-71).



Cymatia bonsdorffii. The cylindrical front tarsi are characteristic of this genus.



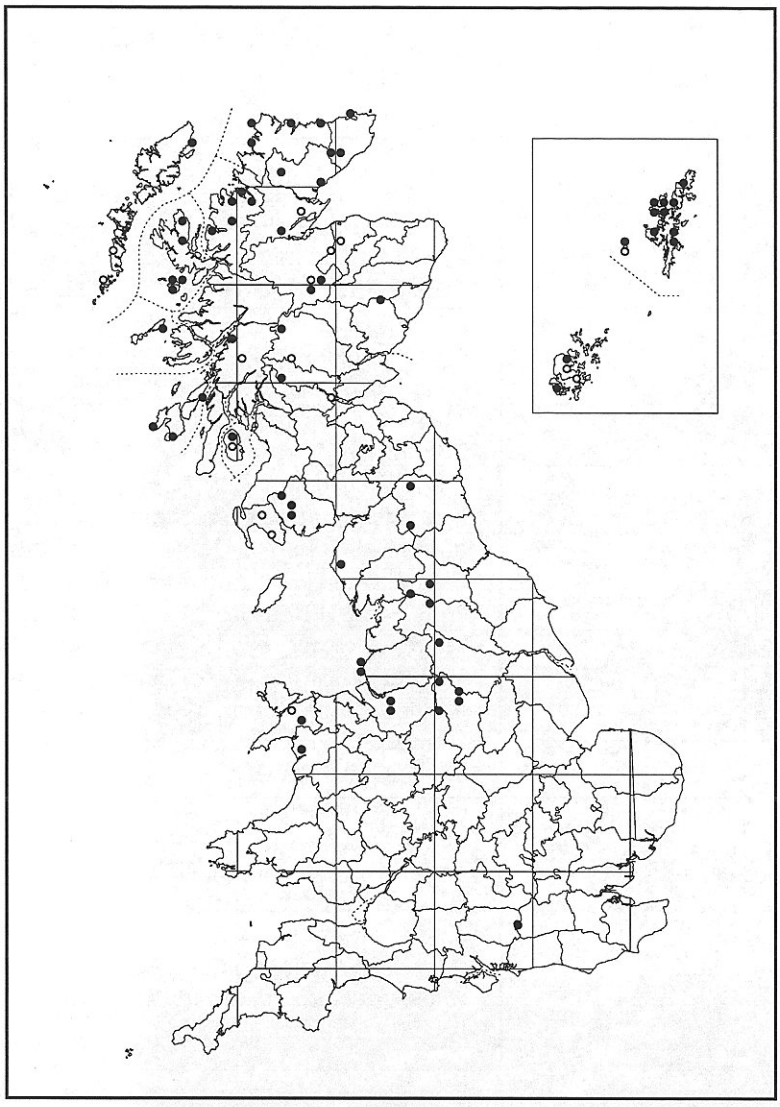
Map 33: *Cymatia coleoptrata*
(Fabricius)

No of records: 298
No of 10 km squares recorded: 164
No of 10 km squares pre-1970 only: 7

Distribution
Mainly confined to southern and eastern England, this small corixid may be extending its range northwards. There are four records in the most northern 10 km square for which the bug is recorded, all in North Lincolnshire at places variously described as Barrow Haven and Barton Clay Pits [M.Hammond and R.Merritt, 2001 and J.H.Bratton, 1983 and 1987]. There are other records from nearby: in a cut-off of the River Don at Braithwaite [R.Merritt, 1998] and in the Humberside Levels at Hatfield Chase [I.D.M.Gunn, 1998]. In south Wales the most western record is in Pembrokeshire at the Bosherston lakes and fish ponds [I.D.Wallace, 1986]. Hebridean record mentioned in S&L is an error (Savage, 1989, p 8). Also not shown on the map is the record of a single specimen taken in the Castle Loch, Lochmaben, Dumfriesshire, probably brought there with live fish bait (Huxley, 1997a)

Habitat
The bug is found in well-vegetated still waters, such as ditches and ponds, and can occur in large numbers in quite dense growths of such open-structured plants as spiked water-milfoil, *Myriophyllum spicatum*.

Helpful hints
The small size, cylindrical anterior tarsi and generally pale hemielytra without light and dark lines across their width are characteristic identification features.



Map 34: *Glaenocorisa propinqua* (Fieber)

No of records: 109
No of 10 km squares recorded: 81
No of 10 km squares pre-1970 only: 16

Distribution

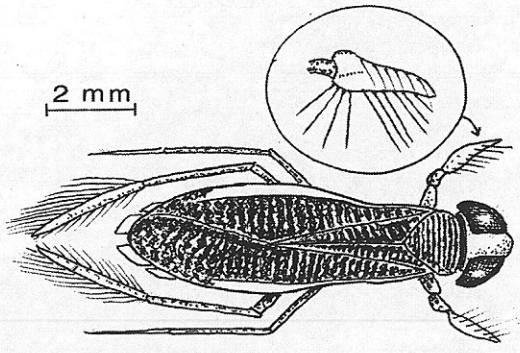
Sometimes referred to as a "glacial relict" (e.g. McCarthy, 1975), this species has been described as local in the north and west of England but rare and extremely local in the south and in Scotland (Kirby, 1990). The last comment is clearly incorrect as *G. propinqua* has been recorded in more 10 km squares in Scotland than in the rest of Britain. There are two records for Moat Pond, Thursley Common, Surrey [K.P.Bland, 1962 and J.H.Bratton, 1983]. They represent examples of an isolated population surviving some 150 miles south of the southern edge of its main distribution.

Habitat

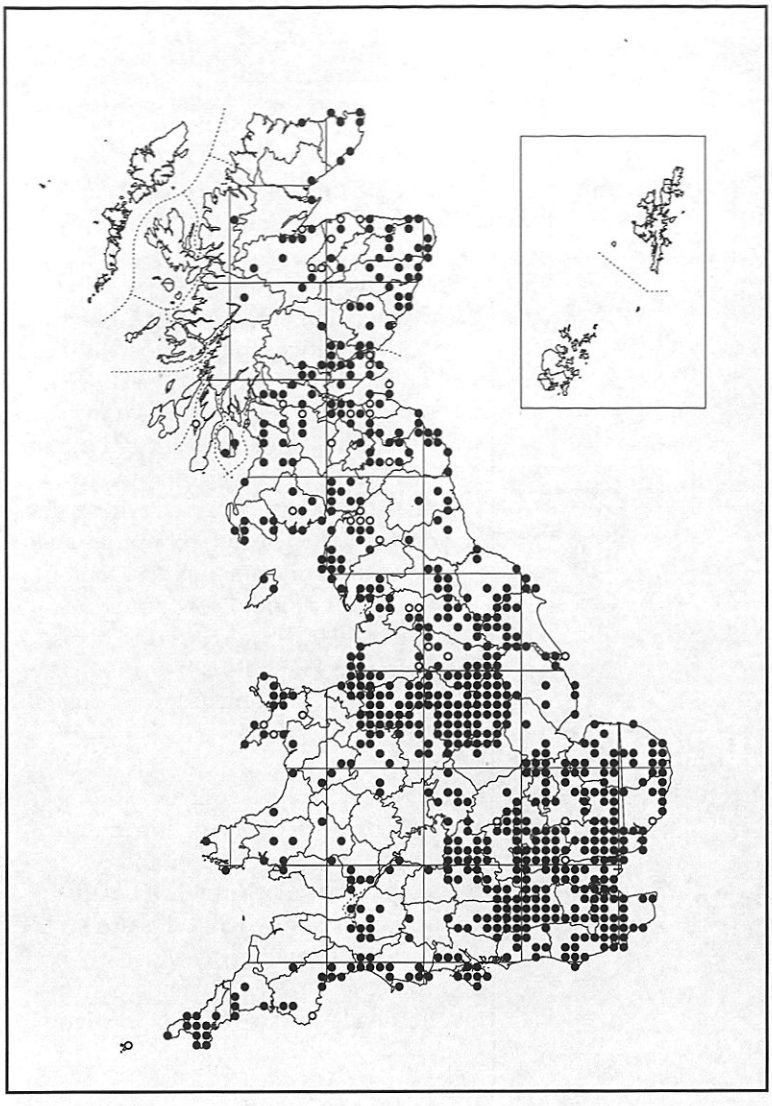
While typically an inhabitant of acidic open-water with sparse vegetation [P.Kirby], I have also found it in a boggy lochan with a thick margin of fringing sedges. A characteristic feature of this species is that it spends much time at considerable depth: Lyle and East (1989) report 6-10 metres. However, *G. propinqua* can also be caught with a hand net from the shore, from where single specimens can sometimes be seen swimming slowly in shallow water.

Helpful hints

G. propinqua is a large, dark coloured corixid with bulging eyes and long rear legs (see Savage, 1989, pp 94-97). Records do not generally distinguish between the two sub-species, *G. propinqua propinqua* and *G. propinqua cavifrons*. However, Savage (1989, Table 3, p 128) indicates that *cavifrons* is the sub-species found in the Scottish islands and this accords with my own few records: two each for Shetland and Orkney and one for Handa Island, West Sutherland. Both sub-species are recorded in other parts of Britain.



Male *Glaenocorisa propinqua*. Inset, left pala to show exceptionally long bristles characteristic of both sexes.

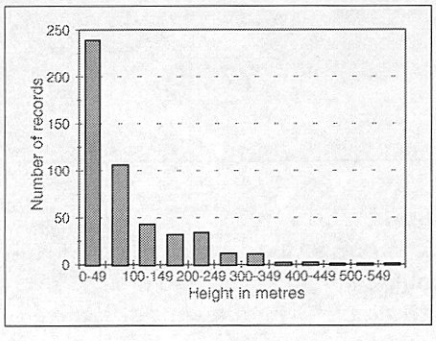


Map 39: *Corixa punctata*
(Illiger)

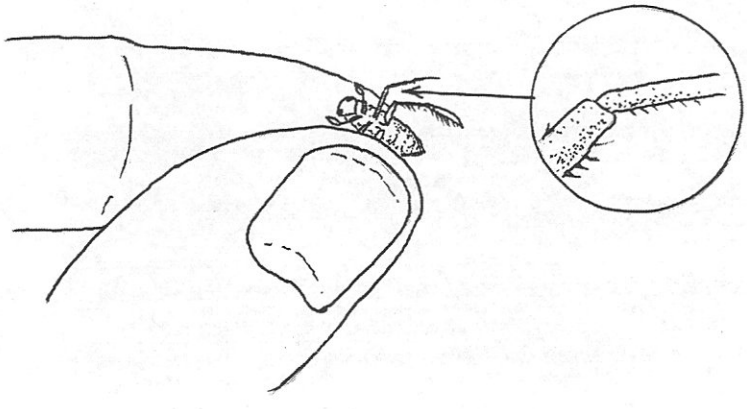
No of records: 1,561
No of 10 km squares recorded: 740
No of 10 km squares pre-1970 only: 38

Distribution
This common large corixid is widely distributed throughout most of Britain but absent from most of the Scottish islands, where it is replaced by *C. iberica*. There are several counties with few records where this species is probably present much more widely than represented by the map.

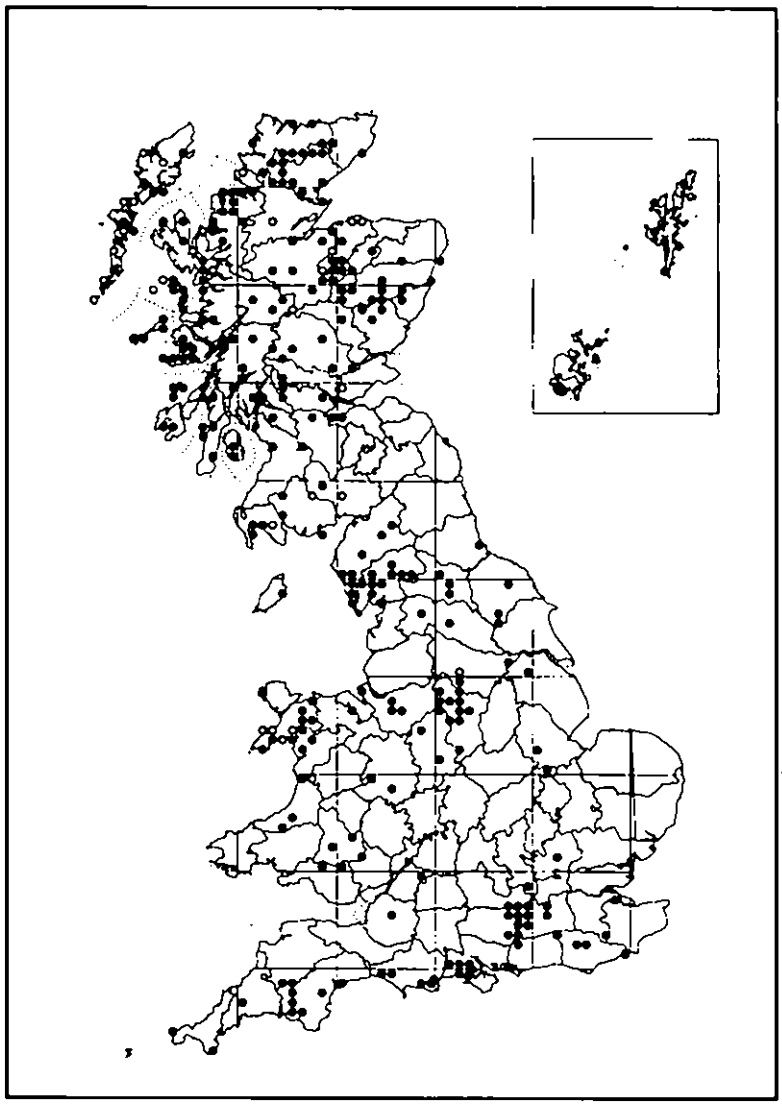
Habitat
This species is typically found in thick vegetation such as floating grass and dead stems of rushes, both in small, shallow muddy ponds and large water bodies where there is suitable marginal detritus. It may occur in the uplands as well as the lowlands, 20% of records with altitude being from 150 to 599 metres.



Helpful hints
Adults can be especially abundant in autumn, and recorders are recommended to examine the middle leg in the field so as to avoid collecting too many specimens - see this sub-heading in the account for *Corixa dentipes* and Savage (1989) p 73.



Corixa punctata to show, inset, the lack of an indentation between the femur and tibia of the middle leg.



Map 40: *Hesperocorixa castanea* (Thomson)

No of records: 431
No of 10 km squares recorded: 294
No of 10 km squares pre-1970 only: 29

Distribution

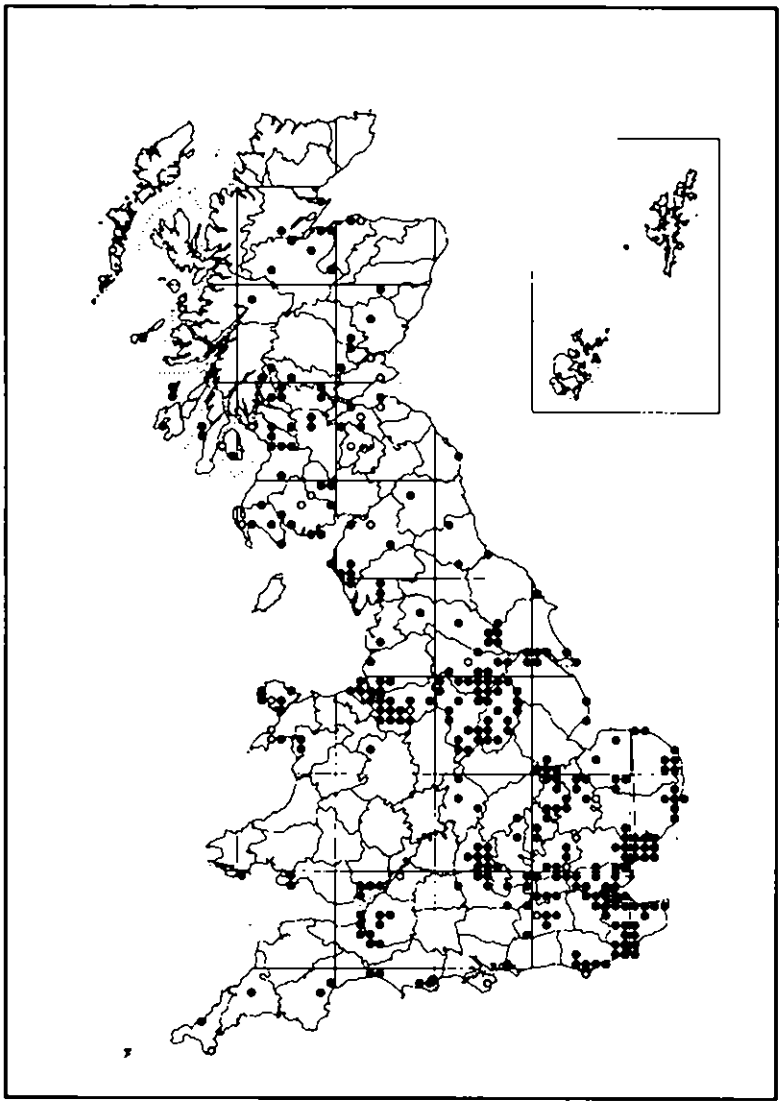
The statement by Kirby (1990) that this species is widely distributed, but more frequent in the north and west, is largely true. It is interesting, however, that a cluster of records around the Berkshire/North Hampshire/Surrey border reflects the presence there of a group of acidic heathland ponds, such as at Frensham Common [J.S.Denton, 1998], Heath Pond, Crowthorne [A.T.Hine, 2000] and Eelmore Marsh [P.J.Hodge, 1997]. Possibly some other clusters similarly reflect acidic waters.

Habitat

Typically in base-deficient standing water, particularly at shallow margins with emergent vegetation and *Sphagnum* moss (Kirby, 1990). In moorland, even where bugs are scarce, one can always hope to find a few *H. castanea*, even after much rain and collecting limited to flooded grassland.

Helpful hints

This is one of the very small corixids for which it is always better to collect plenty of specimens because, until they are examined under the microscope, one cannot be sure of the species. A catch might be mostly *Sigara scotti*, with a few *H. castanea*, or the converse, perhaps with one or two other species present as singletons.



Map 41: *Hesperocorixa linnaei* (Fieber)

No of records: 646
No of 10 km squares recorded: 336
No of 10 km squares pre-1970 only: 30

Distribution

Although said by S&L to be found throughout Britain, the records as mapped show a sparse and scattered distribution in Scotland, mostly absent north of the Great Glen, whereas there are several large clusters in the south half of Britain. The actual numbers are 83 10 km squares in north Britain and 253 in the south. Even in the south, however, one has to wonder why there are so many counties with few or no records. Possibly this is partly due to under-recording of water bugs generally and partly to poor recognition of this species.

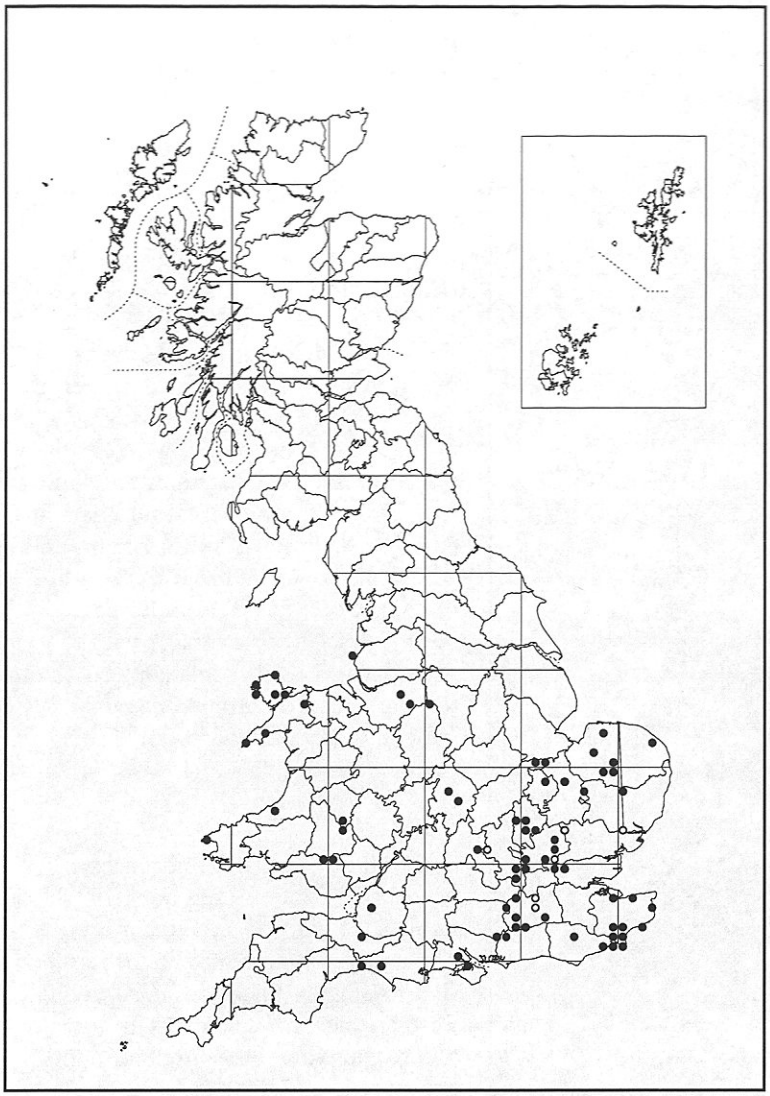
Habitat

Small lakes, ponds, former brick pits, canals and wide ditches are typical habitats of this species. Regarding percentage organic matter, *H. linnaei* prefers slightly less than *H. sahlbergi*. Both species, however, occur in waters where there are substantial amounts of organic matter in the substratum (see Savage, 1989, pp 134-5).

Helpful hints

Although there are differences in habitat preference between *H. linnaei* and *H. sahlbergi*, it is not unusual to find both species present in the same water body. It is crucial, therefore, to examine every specimen. The character of whether the dark markings do or do not extend to the posterior apex of the corium may be less reliable than counting the number of pale transverse lines on the pronotum: 6 in *H. linnaei* and 7-9 in *H. sahlbergi*. In this genus, there is no difference in the male palae.

Hesperocorixa sp. are distinguished by the narrow light lines on the corium and by the metasternal xiphus, which is distinctly longer than its breadth at the base. Shown left, the pronotum of *H. linnaei* with six pale lines and a fine light line around the margin (see Savage 1989, pp 78-79).



Map 42: *Hesperocorixa moesta* (Fieber)

No of records: 119
No of 10 km squares recorded: 78
No of 10 km squares pre-1970 only: 6

Distribution

The map shows a southern distribution from which all pre-1970 peripheral records have been placed in category 2*, thus excluding old records in Cumbria, South-east Yorkshire, Nottinghamshire and West Cornwall. The most northern confirmed record is at Ainsdale, South Lancashire [I.D.Wallace, 2000]. The two Dorset records are at Lambert Castle and Drakenorth [both P.Temple, 1992].

Habitat

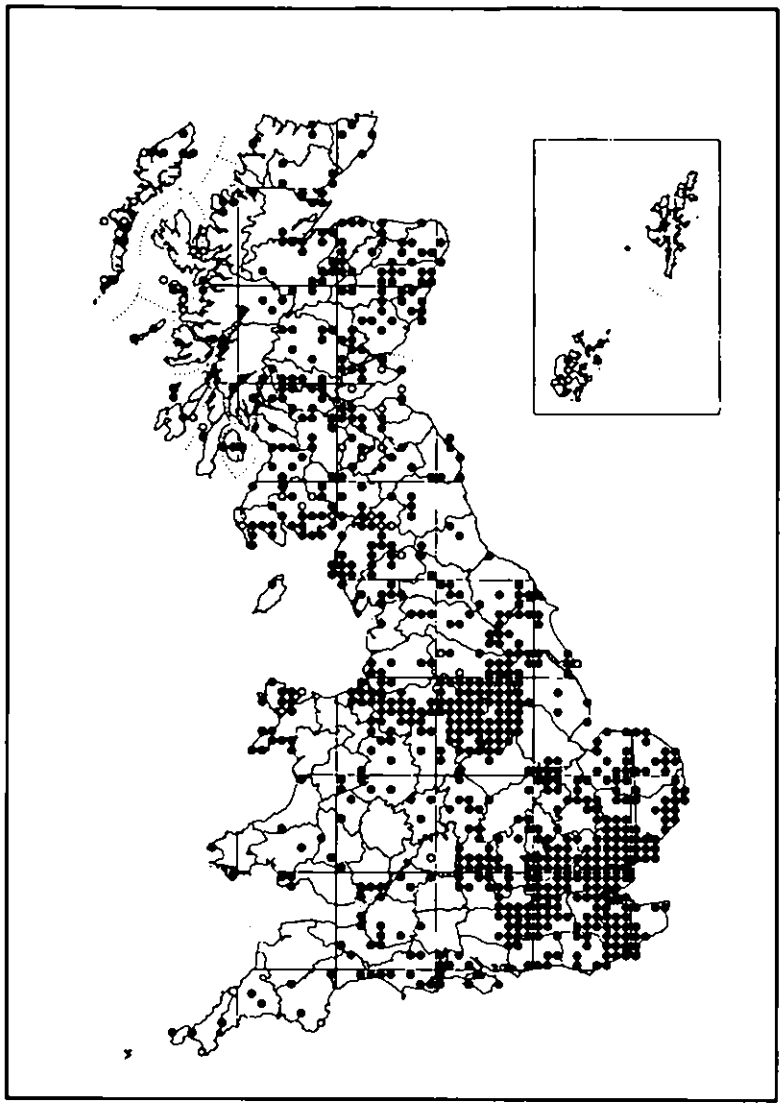
H. moesta generally occurs in small ponds with neutral to alkaline water, in contrast to the acidic waters frequented by *H. castanea*. This difference, however, is not always clear-cut [P.Kirby].

Helpful hints

H. moesta is one of the most difficult species to determine with total confidence. The difference in wing colouration between it and *H.castanea* is not always obvious; and the tuft on the seventh abdominal segment in dorsal view requires neat setting of fresh or well preserved material, a good microscope and well directed light. One recorder always notes "tuft on male seen". It would give much greater confidence if all records had this confirmation.

Male *Hesperocorixa moesta*. The arrow points to the tuft on the seventh abdominal tergite, readily visible in fresh mounted specimens with the hemielytra and wings spread out. The black oblong structure is the strigil. See also Savage (1989, pp 79 and 81-82).

* See Glossary.



Map 43: *Hesperocorixa sahlbergi* (Fieber)

No of records: 1,655
No of 10 km squares recorded: 789
No of 10 km squares pre-1970 only: 40

Distribution

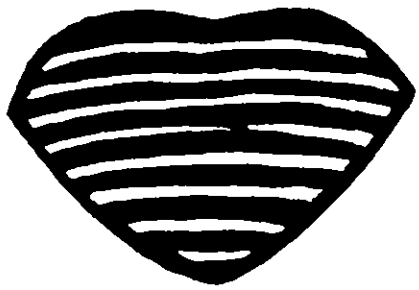
This is a common corixid, found throughout Britain. Post-1970 records stretch from Evie, on Orkney Mainland, to Bostraze Farm, 5 miles from Land's End [T.Huxley, 1996 and 2000]. Other recorders, e.g. W.A.Ely at Rotherham, I.D.Wallace at the Liverpool Museum, and R.Merritt, have shown that this species is present in almost every 10 km square in a broad swathe across the counties of Cheshire, Derbyshire and Nottinghamshire. There are other concentrations of records in much of south-eastern England.

Habitat

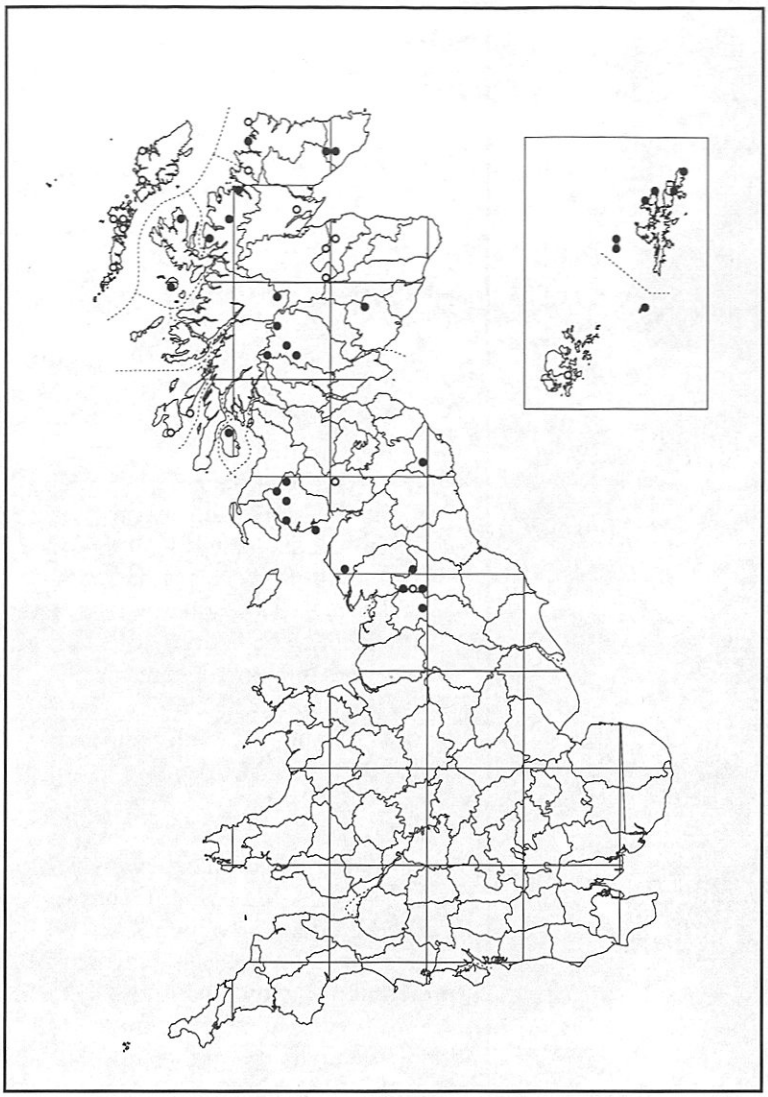
This is a species of thickly weedy habitats, often where the net has to be pushed hard into submerged vegetation. This obligate habitat preference is expressed in the fact that *H. sahlbergi* occurs where there is 70-90% organic matter in the substrata (Savage, 1989, p 134, fig 76).

Helpful hints

This middle sized, dark coloured corixid is best determined by counting the pronotal lines (7-9), having initially confirmed that the metasternal xiphus is distinctly longer than its breadth at the base. Another distinctive feature is whether the dark markings do not extend to the apex of the corium (cf. *H. linnaei* where they do), but this is occasionally not obvious (see Savage, 1989, pp 78-79). The males of these two rather similar looking species cannot be separated by their palae.



Pronotum of *Hesperocorixa sahlbergi* with 7-9 light lines.

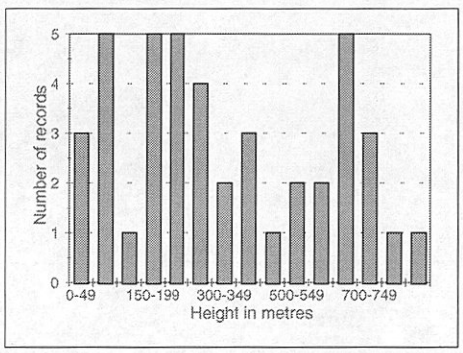


Map 44: *Arctocorisa carinata*
(Sahlberg)

No of records: 70
No of 10 km squares recorded: 50
No of 10 km squares pre-1970 only: 17

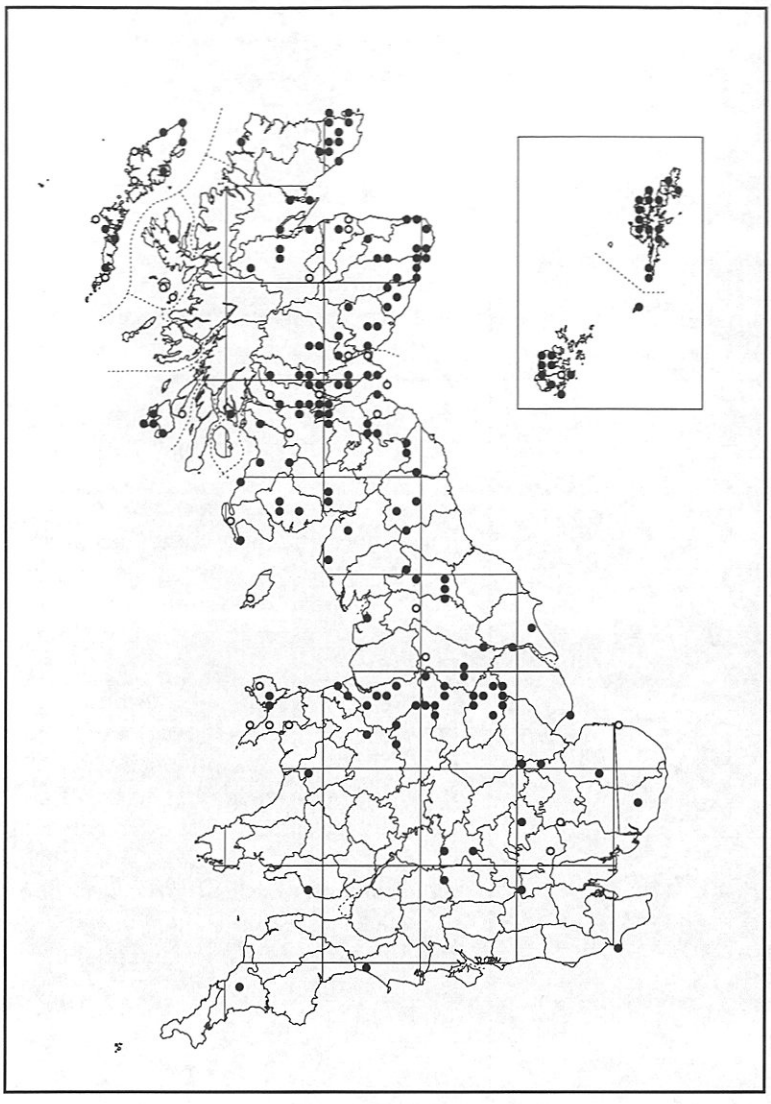
Distribution
Mainly a species of northern Britain, from the Shetland Islands to the Pennines. The most southern record is at or near Gordale Beck [R.H.L.Disney, 1980], extracted from a Malham Tarn Field Centre record card. Scottish records are fewer than implied by the statement in S&L that it is "found throughout Scotland".

Habitat
Published accounts generally describe *A. carinata* as a montane species, occurring above 300 metres. However it may also be found near sea level in northern latitudes; see histogram.



S&L state that its upland haunts are generally "with little vegetation" but wherever I have found it, there is always some vegetation: from marginal sedge beds to the thin leaves of floating bur-reed, *Sparganium angustifolium* (see Huxley 1998a and 1998b for a discussion of habitat). Conversely, I have never found it in stony-edged, oligotrophic hill lochs without vegetation. There is no altitude given for the Gordale Beck record. The record in Mid-west Yorkshire at South Grain Tarn, Cray Moss is at 587 metres, "a peaty tarn with marginal cottongrass, *Eriophorum"* [R.Merritt, 2000]. A nearby record in a sedgy pool beside Widdale Great Tarn is at 630 metres [T.Huxley, 1998].

Helpful hints
For confidence, determination requires a male and careful examination of one of the palae, the right paramere and strigil (Savage, 1989, pp 94-95 and 98-99). Capturing a female only is frustrating because the distinction "dark areas of hemielytra wider than light areas" *(A. carinata)* compared to "light areas of hemielytra wider than dark areas" (*A. germari)* is not reliable, especially as *A. germari* can also sometimes occur in high altitude pools.



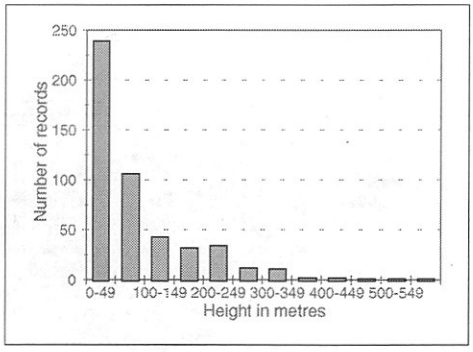
Map 45: *Arctocorisa germari*
(Fieber)

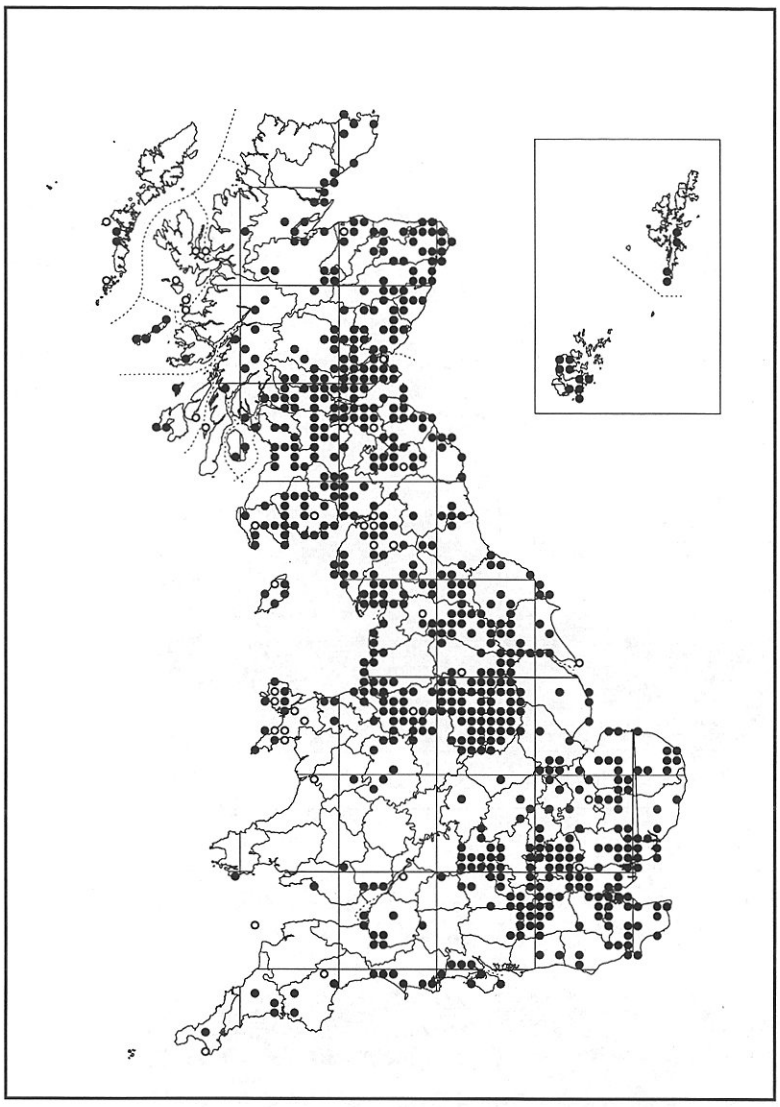
No of records: 272
No of 10 km squares recorded: 249
No of 10 km squares pre-1970 only: 30

Distribution
The species occurs across a wide national geographical range, but has a restricted and often patchy distribution at a local scale. The map shows a somewhat northern distribution: 141 records (57%) in north Britain compared to 108 (43%) in the south. The three most southern records are at Dozmary Pool, East Cornwall [S.J.Lambert, 1985], Dottery, Dorset [P.Temple, 1992] and Dungeness, East Kent [R.Carr, 1998].

Habitat
May occur in a wide range of water conditions and is tolerant of some salinity, but is almost invariably found in still water bodies with little or no live vegetation (Kirby, 1990). A bare mineral substrate is more usual in the places where Kirby finds *A. germari*, e.g. in recently dug quarry ponds. From my records, this species may also be found where the substrate is covered by much leaf detritus from surrounding trees. The altitude distribution is shown in the histogram.

Helpful hints
The suggestions given for *A. carinata* apply also to *A. germari*. It is safest to find a male and carefully check all the characters provided by Savage (1989, pp 94-95 and 98-99).





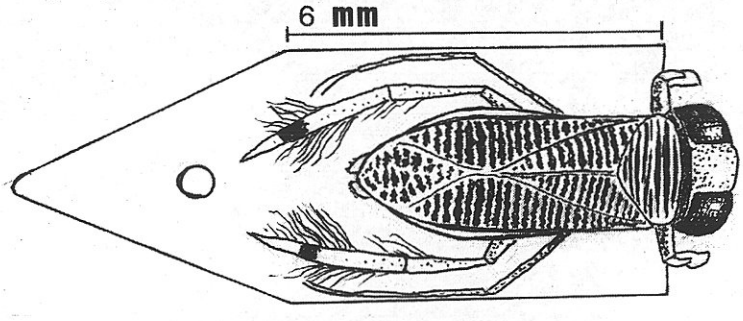
Map 46: *Callicorixa praeusta*
(Fieber)

No of records: 1,317
No of 10 km squares recorded: 723
No of 10 km squares pre-1970 only: 41

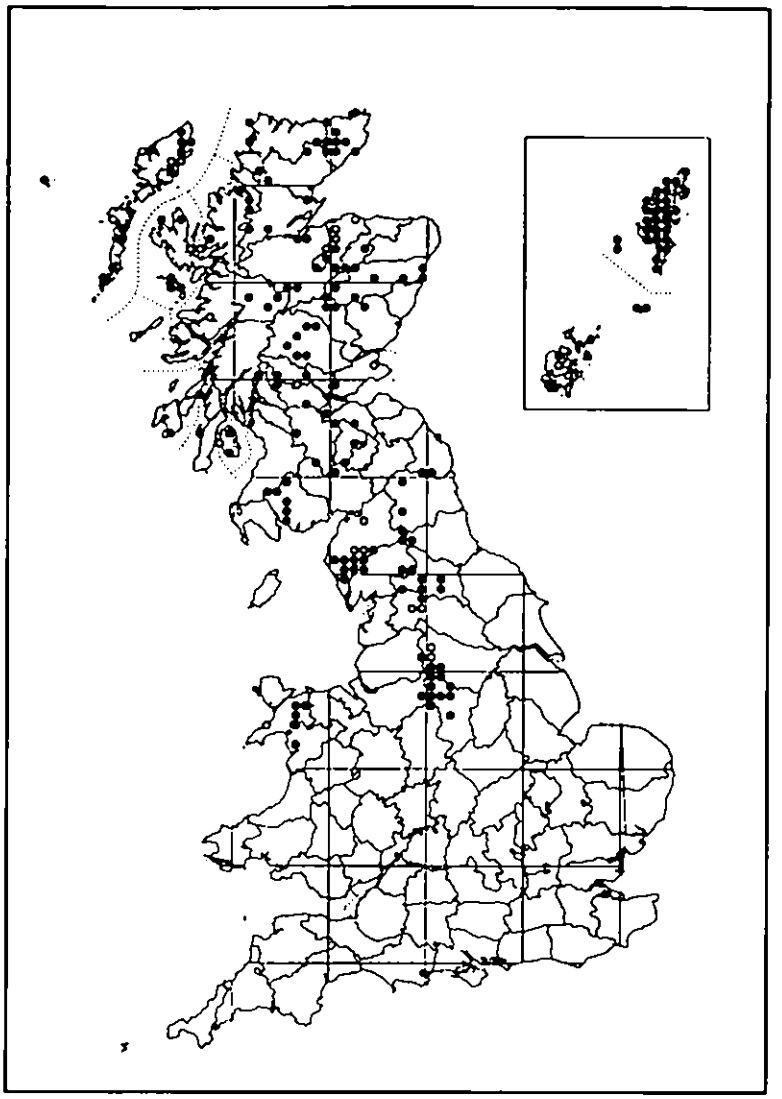
Distribution
Common throughout much of lowland Britain but apparently scarcer north of the Great Glen in Scotland, in south Wales and south-west England. In some of the lowland English counties further survey should provide more records. Although *C. wollastoni* is much more common in the Shetlands, *C. praeusta* also occurs on the main island in a few locations.

Habitat
Found in most types of still or slow flowing water. The amount of organic matter in water can influence the presence or absence of species of corixids. Research has shown that for a range of increasing organic matter in different water bodies - from very little to a thick "pea soup" - then *C. praeusta* prefers water in about the middle of that range (Savage, 1989, fig 76, p 134).

Helpful hints
This is the commonest of the four species of corixid that have black marks on the rear legs. Problems can arise where this species may be present with, or in the general area of, its congener *C. wollastoni*, because the shape of the dark markings can vary in both species. As well as the differences provided in Savage (1989, p 106-109), additional diagnostic characters are given in Savage and Swift (1997). However, in order to see the fine hairs illustrated in that paper, specimens have to be fresh or preserved in alcohol. In the far north of Britain, such as the Shetlands, adults may be smaller than the 7.0-8.0 mm given in Savage (1989, p 108).



Callicorixa praeusta: When card mounting specimens the long hairs on the rear legs should be brushed out to reveal the dark markings on the tarsi.



Map 47: *Callicorixa wollastoni* (Douglas & Scott)

No of records: 295
No of 10 km squares recorded: 189
No of 10 km squares pre-1970 only: 24

Distribution

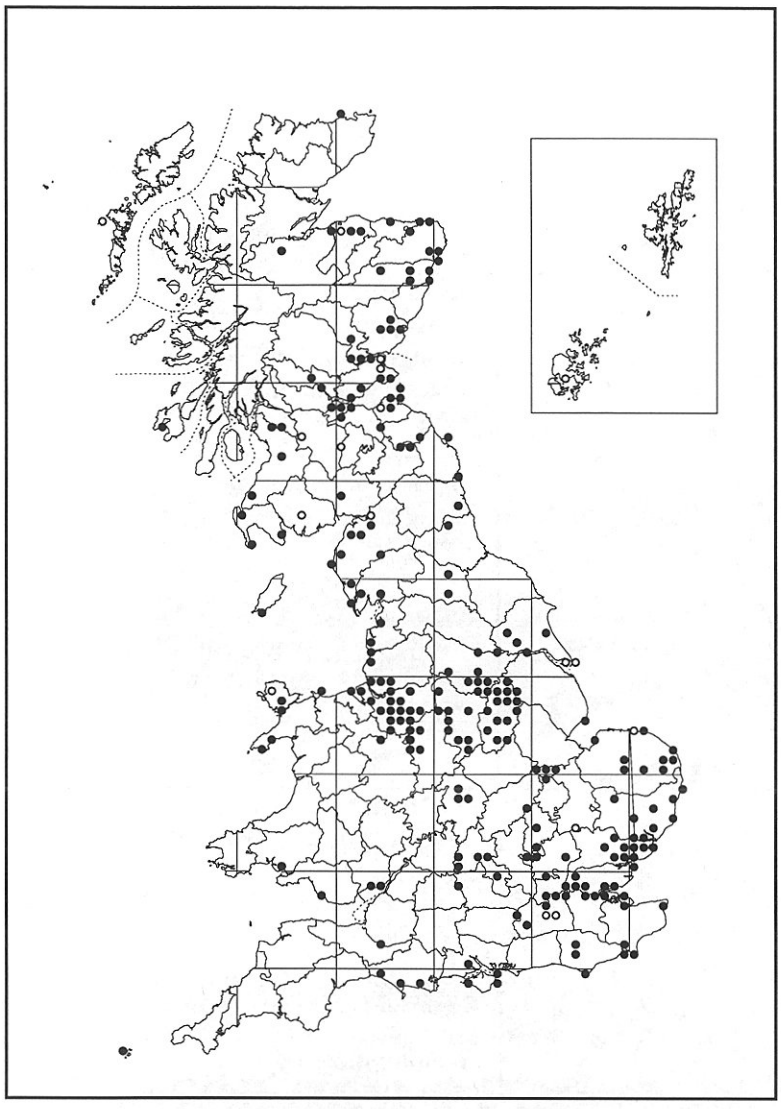
This species occurs mainly in north Britain: 159 10 km square records in the north compared to 30 in the south or 84% : 16%. A recent Welsh record is at Y Lethr [A.P.Foster, 1993] and the most southern record in England, at Saley Forest, Derbyshire [I.D.Wallace, 1970].

Habitat

Kirby (1990) states that the species is particularly associated with dystrophic or oligotrophic waters at high altitudes. The records broadly agree, always bearing in mind that at high latitudes, e.g. in the Shetlands, the species may also be found at low altitudes. Typical *C. wollastoni* habitats are therefore acidic moorland and upland tarns and lochans, often with other moorland species such as *Glaenocorisa propinqua* and *Arctocorisa carinata*.

Helpful hints

The chief problem with this species is to be certain that it is not *C. praeusta*. The dark marks on the posterior tarsi can vary in both species, so that, judged by this character alone, some *C. praeusta* look like *C. wollastoni*. Also, in old dry specimens, the difference in the shape of the palae is not always clear, and the leg hair characters are difficult to see in dry mounted material. Specimens must be killed and stored in alcohol and examined under carefully directed light. Savage and Swift (1997) have provided additional characters for separating females based on the hairs and spines of the middle leg. The variety name *caledonica* (Macan, 1965), based on smaller size and differences in hemielytral markings, is no longer considered valid.



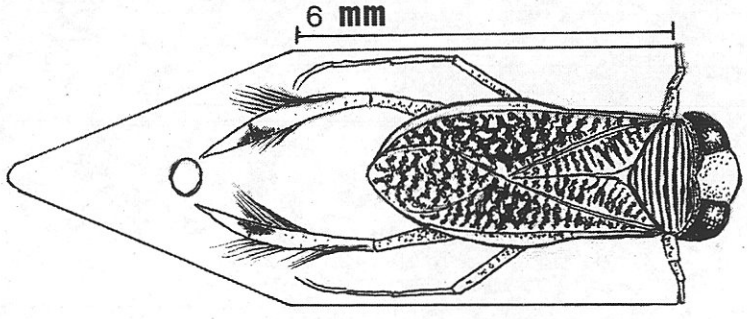
Map 48: *Sigara concinna*
(Fieber)

No of records: 335
No of 10 km squares recorded: 242
No of 10 km squares pre-1970 only: 17

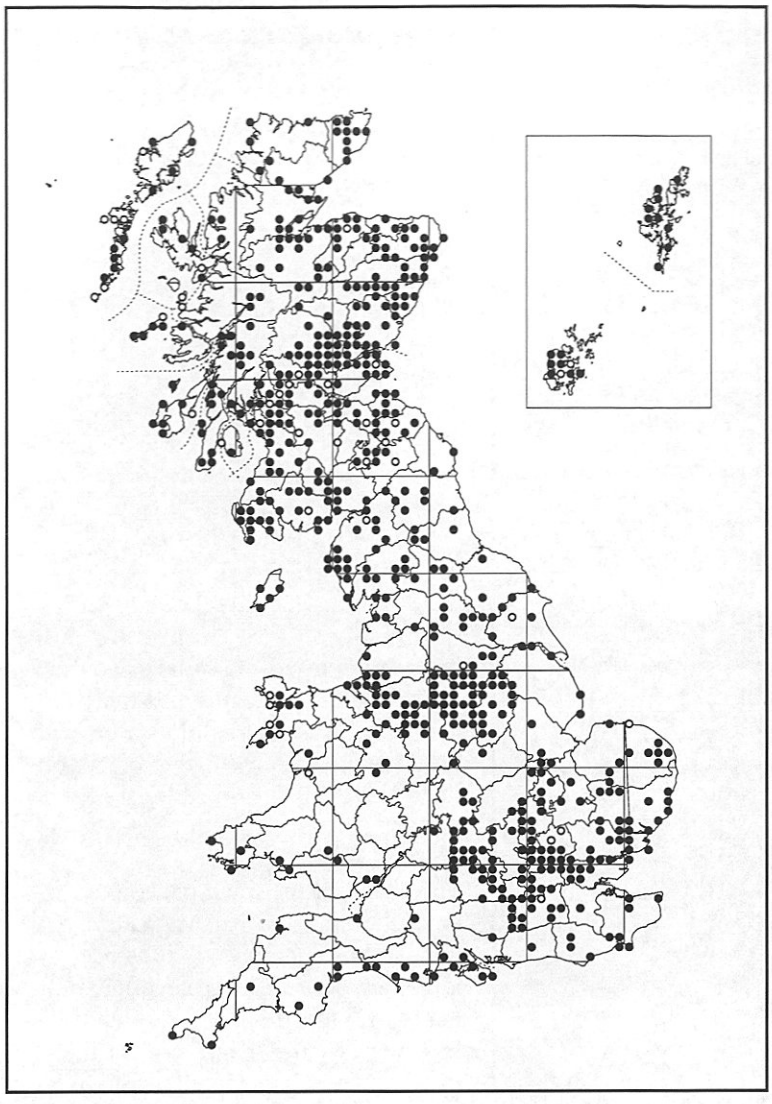
Distribution
This species has been described as widely distributed throughout Britain, most frequent in the south but rarely common (Kirby, 1990). There is an old record from Gyre Orphir, Orkney [E.Kellock, 1965]. In Caithness it was recorded at Loch Scrabster [M.G.Spirit, 1985] and, in the far south-west, at Tresco Abbey pool, Isles of Scilly [S.J.Lambert, 1987]. Clusters of 10 km square records, for example in the midland counties of Nottinghamshire, Derby and Cheshire, may in part be due to collector effort. It has been speculated that, because *S. concinna* is a mobile species with small transitory populations, its patchy distribution may also be because of competition with other corixids [P.Kirby].

Habitat
Found in small numbers in a range of still waters in the lowlands and is known to breed in saline water (Kirby, 1990). Savage (1989, p. 135) shows *S. concinna* as favouring open water of moderate size with high conductivity. However, in my experience, *S. concinna* also occurs in quite small waters, such as farm ponds, where the attraction may be more because of high conductivity than size of water body.

Helpful hints
Sigara concinna is one of the four species of corixid with a dark mark on its posterior tarsi and/or claw. In males, the long palae with a single line of pegs, are also diagnostic characters (see Savage, 1989, pp 106-109).



Sigara concinna: to show that the dark area in this species is both on the proximal part of the claws and an approximately matching area of the tarsi of the posterior legs. It is essential to brush out the long hairs when card mounting.



Map 49: *Sigara distincta*

(Fieber)

No of records: 1,069
No of 10 km squares recorded: 649
No of 10 km squares pre-1970 only: 42

Distribution

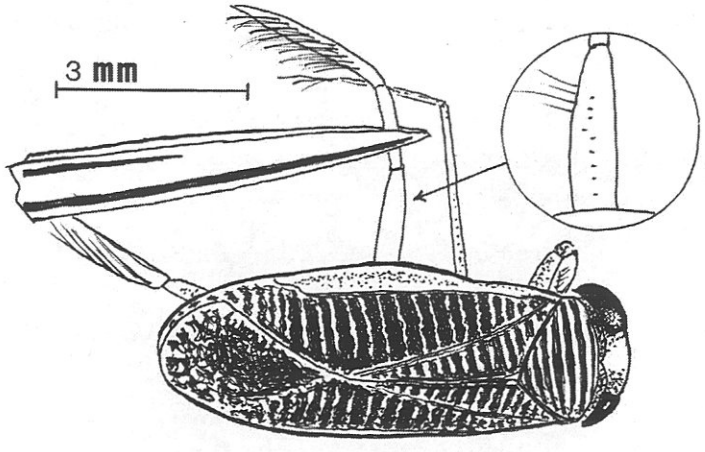
This corixid is common throughout much of Britain. Insufficient recording probably accounts for the lack of records in many of the counties with few records.

Habitat

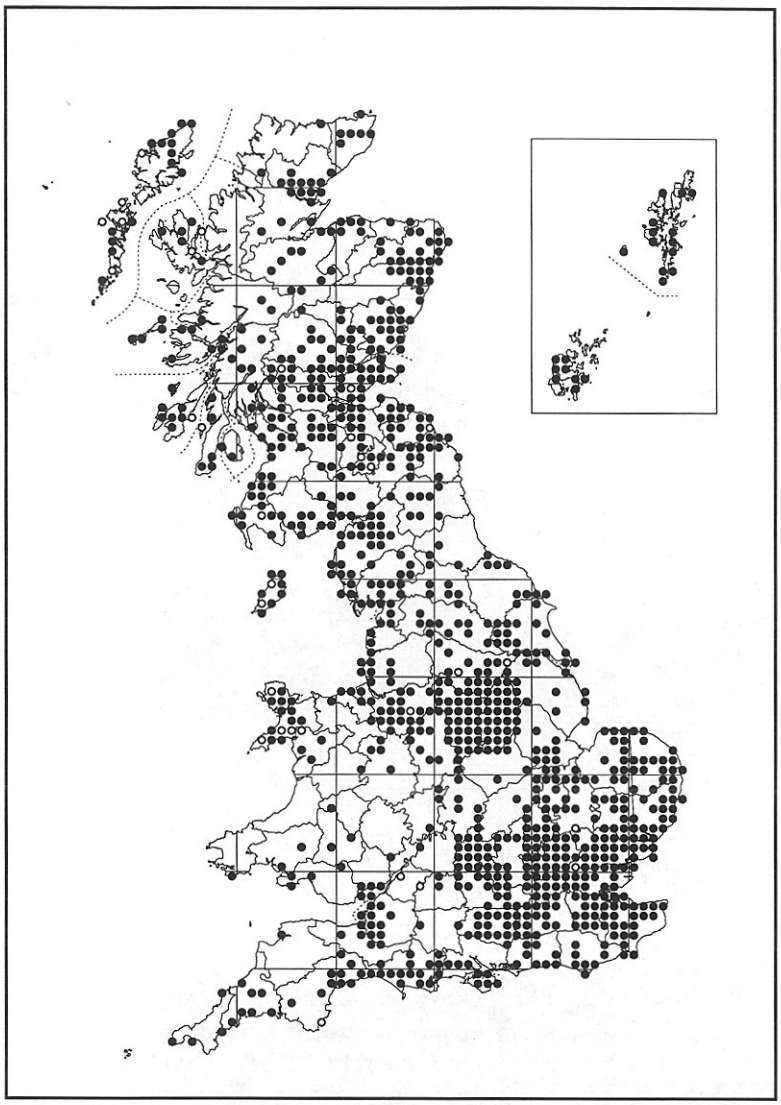
Savage (1989, p 134) shows *S. distincta* as mainly occupying a middle type of water between little and much organic matter. However, it is fairly catholic in its habitat preferences and one can expect to find it in most lowland habitats, so long as they are lacking in extremes, such as the thickly weedy habitats typical of *Hesperocorixa sahlbergi* or acidic waters typical of *Sigara scotti.*

Helpful hints

Males can be readily determined in the field with a hand lens by their large palae - subject to more careful examination with Savage (1989, p 87). Females can be distinguished from the somewhat similar looking *S. dorsalis* by counting the number of spines on the dorsal side of the femur of the posterior leg (Savage, 1989, p 88). Notwithstanding advice in Savage, this can be done with fine forceps without having to detach the leg, see illustration below.



Female *Sigara distincta* to show how to check on number of very small spines on dorsal side of femur of posterior leg. In this species there are 7-12 spines.



Map 50: *Sigara dorsalis* (Leach)

No of records: 2,225
No of 10 km squares recorded: 957
No of 10 km squares pre-1970 only: 31

Distribution

This is the commonest corixid, recorded in 109 of the 112 vice-counties in Britain. Because it is so widely distributed, the map is a useful measure of overall recorder effort. There should be many more 10 km square records, especially in lowland country.

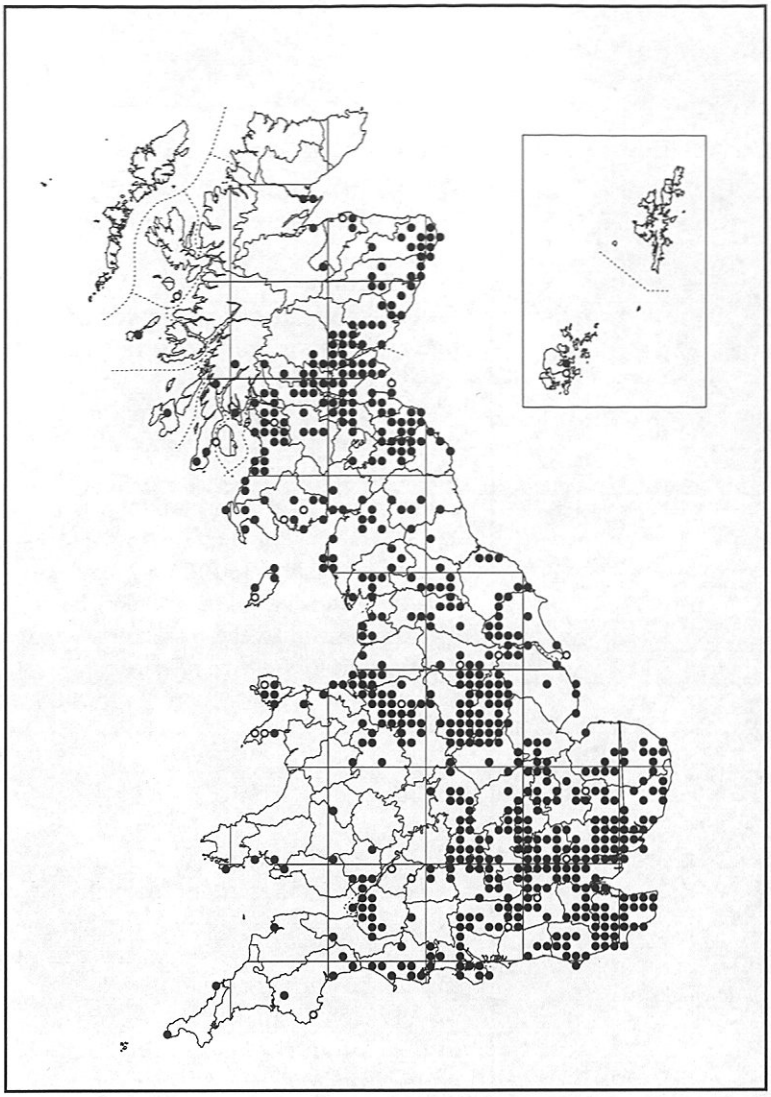
Habitat

Occurs in a wide range of still and slow-flowing waters, from lakes and open-water ponds, to canals, and the slower parts of streams and rivers. It prefers neutral to alkaline water, with little fouling from animal excreta and dead leaves (S&L and Kirby, 1990).

Helpful hints

The shape of the male palae and distribution of the palar pegs in two lines are distinctive. When sorting large, mixed-species collections, both males and females can generally be separated by the lighter area at the front of the clavus (see illustration below). When females only are present, count the number of short spines on the dorsal (inner) side of the posterior femur (Savage, 1989, p 88): 3-6 in *S. dorsalis* and 7-12 in *S. distincta*. This can be done with fine forceps without detaching the leg. Recorders in Kent and Sussex should, however, be aware that the very similar *S. striata* - or hybrids between *S. striata* and *S. dorsalis* - might also be present. See this sub-heading under *Sigara striata*.

Sigara dorsalis: to show lighter area at the front of the clavus, just posterior to the pronotum.



Map 51: *Sigara falleni* (Fieber)

No of records: 1,402
No of 10 km squares recorded: 640
No of 10 km squares pre-1970 only: 22

Distribution

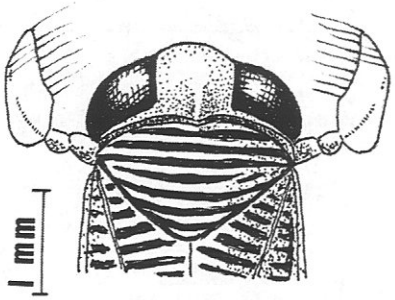
This species is almost entirely absent from Scotland north and west of the Great Glen, despite much recording. For example, there are only three post-1970 records from islands: Am Fhadair, Tiree; Loch Skerrols, Islay and Wideford Reservoir, Orkney [T.Huxley, 1996-1998]. There are also few records from much of central Wales and from the south-western English counties of Somerset, Devon and Cornwall. However, the lack of records in these parts of the country is probably due more to under-recording, rather than to actual absence. In a brief visit in 2000, in West Cornwall I found *S. falleni* at Bosistow Farm pond and in a fishing pond north east of St Merryn. Elsewhere in Britain, the species can be common and abundant, often mixed with populations of *S. distincta* or S. *dorsalis*.

Habitat

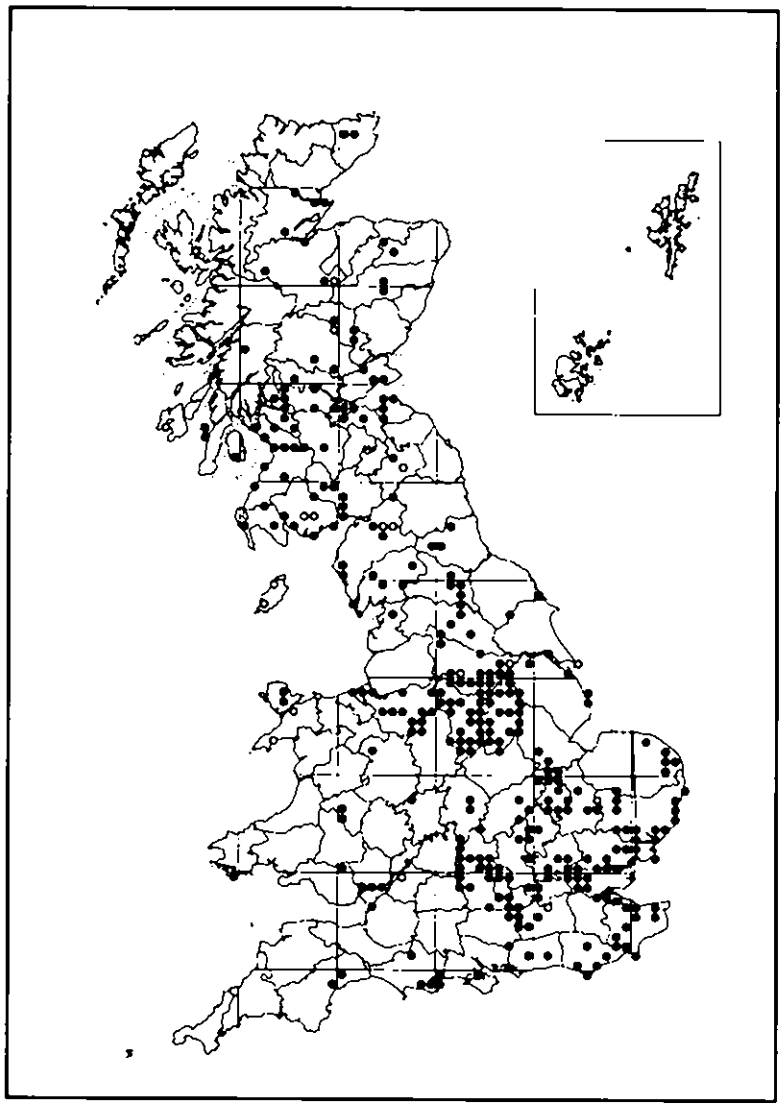
It is typically a clear water species of non-acidic, non-saline, lakes, ponds and ditches. In the species associations and succession described in Savage (1989, pp 130-135) *S. falleni* appears at the lowest end in terms of percentage organic matter.

Helpful hints

When sorting large, mixed-species collections, it is helpful to look for specimens with a slim build and sharply angled side corners of the pronotum (see sketch below and fig 54 in Savage, 1989, p 92). This character works for females as well as males. In males, look for the exceptionally large palae with a projecting, sharply rounded proximal corner (Savage, 1989, fig 50, p 87).



Male *Sigara falleni* to show large characteristically shaped palae and, in both sexes, sharply angled side corners of pronotum.



Map 52: *Sigara fossarum*

(Leach)

No of records: 495
No of 10 km squares recorded: 317
No of 10 km squares pre-1970 only: 20

Distribution

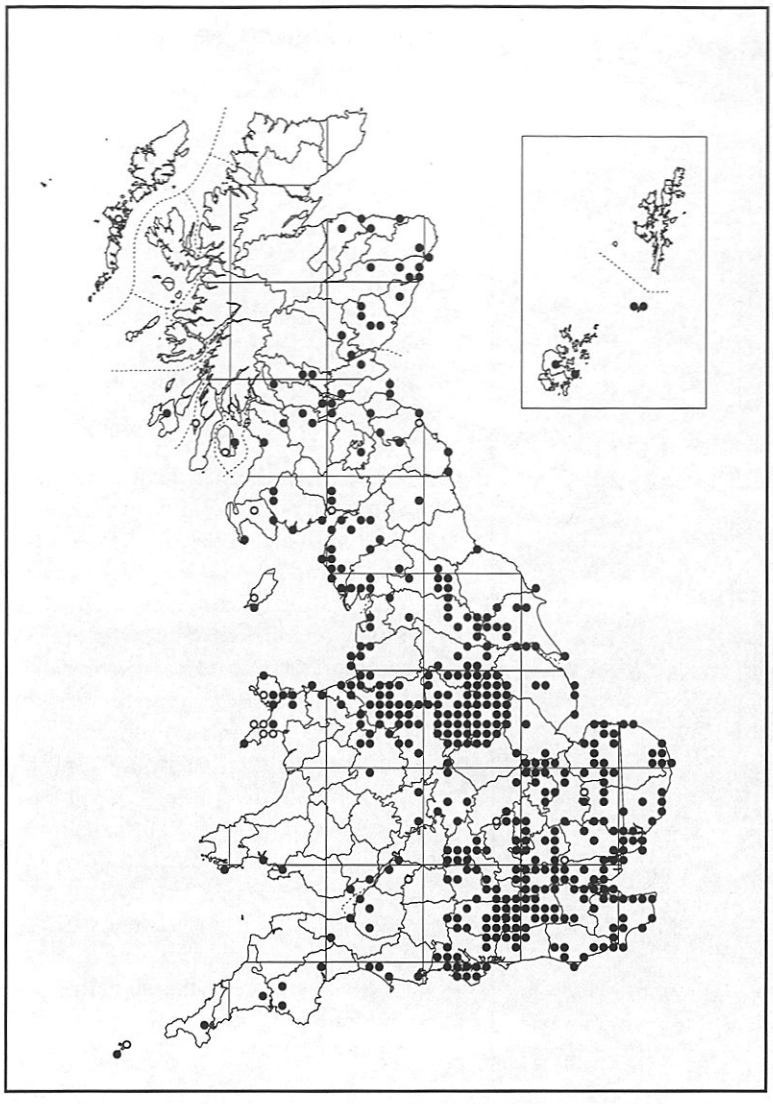
Whereas the clusters of records in the midlands and in south-east England are partly because of recorder effort, *S. fossarum* may be less common further north. Its most northerly known locations are in Caithness at Lamsdale Leans and Spittal Pond [M.G.Spirit, 1985]. The pre-1970 records for Harris, Raasay and Islay are old and may no longer represent living populations. The most south-western records are at Exminster Marsh and Aylesbeare Common in South Devon [R.Merritt, 1999].

Habitat

Found in still or slow-flowing water (Kirby, 1990). Savage (1989, p 135) places this species at about a mid point for percentage organic matter, somewhat the same as *S. distincta* and *Callicorixa praeusta*, but with a preference for smaller bodies of water. In the eastern counties of England, it is often abundant in slow rivers with muddy substrata [P.Kirby].

Helpful hints

The male palae are distinctive (Savage, 1989, p 102). Problems occur where there are females without males. The character to look for is the number of pale transverse lines on the pronotum. *Sigara fossarum* and *S. scotti* (the latter usually much smaller) have 4-6, whereas the other four smallish to very small species of *Sigara* all have more than six (Savage, 1989, top of p 100).



Map 53: *Sigara lateralis* (Leach)

No of records: 852
No of 10 km squares recorded: 465
No of 10 km squares pre-1970 only: 17

Distribution

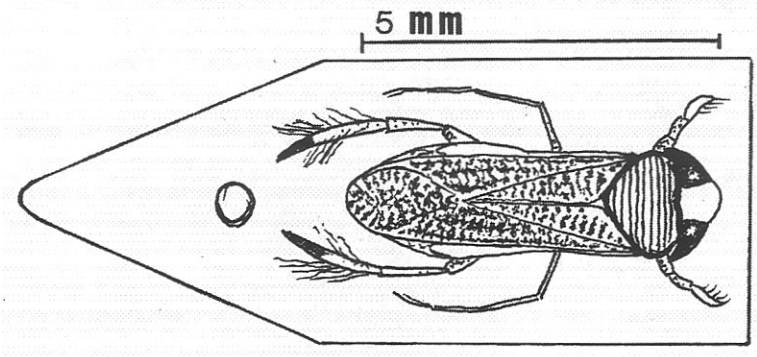
This species occurs throughout much of Britain, from Fair Isle to West Cornwall. However, there are no recent records north of the Great Glen and records are thinly scattered in some other parts of Britain. It is not known if the concentrations of records in the midlands, and elsewhere such as in North Hampshire, Surrey and the Isle of Wight, are mainly because of recorder effort [mostly by R.Merritt and J.S.Denton] or whether its presence in these areas is because of some other factor, such as the underlying geology.

Habitat

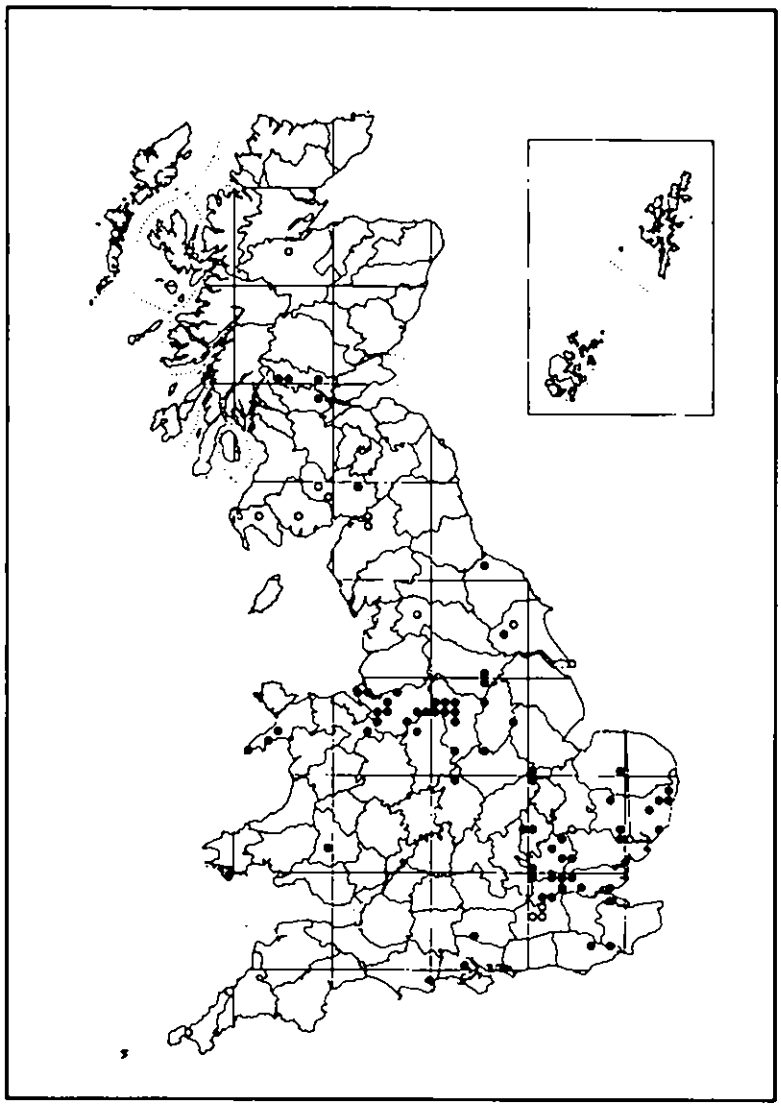
Typically, this is a species of polluted habitats, e.g. because of fouling by farm stock. For example, a sample from Field Pool in Fair Isle, a site contaminated with sheep and bird droppings and perhaps salt spray, produced 81 males and 53 females [N.Riddiford, 1997]. This species also occurs in brackish water with *S. stagnalis* and can be a rapid coloniser of new pools, even ones that are unpolluted [P.Kirby].

Helpful hints

This bug is the smallest of the four species with a dark mark on the tarsi and/or claws of the posterior legs (Savage, 1989, pp 106-109). In *S. lateralis* it is generally the claws only that are dark. The whole animal is particularly lovely to look at under the microscope because of its finely broken hemielytral stripes, which give it a mottled appearance.



Sigara lateralis: to show the dark marks on the claws of the posterior legs; sometimes also with a very small dark area on the adjoining distal part of the tarsi. Note how the long hairs on the hind legs need to be brushed out when card mounting.



Map 54: *Sigara limitata* (Fieber)

No of records: 112
No of 10 km squares recorded: 79
No of 10 km squares pre-1970 only: 15

Distribution

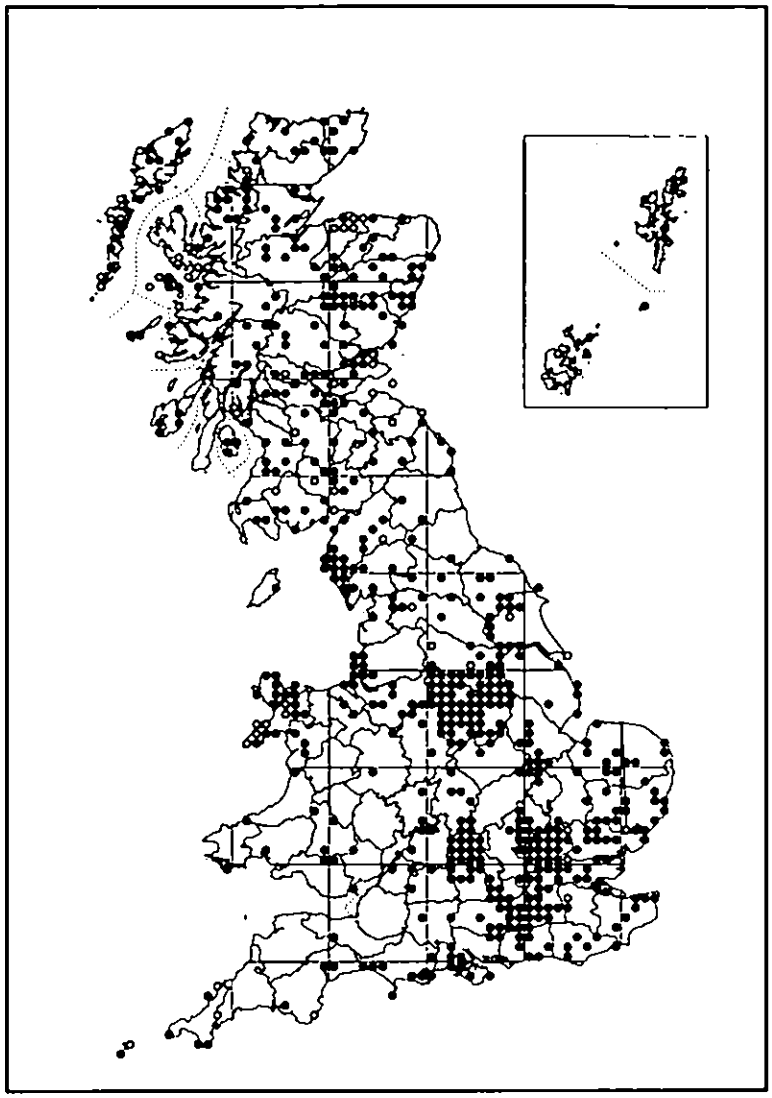
This species gives much difficulty because of unreliable records. It has been described as widely distributed in Britain, most frequent in the south and east (Kirby, 1990). It has also been described as not uncommon and widely distributed in southern England, and widespread in Scotland and northern England (S&L). In Scotland, however, I have not found it and the only Scottish records by a reliable authority are for the Solway counties of Wigtownshire, Kirkcudbrightshire and Dumfriesshire (Brown, 1946), all more than 50 years old. In England, the most northern reliable record is at Eston Moor, North-east Yorkshire [M.Hammond, 1999]. The pre-1970 record in Mid-west Yorkshire is from Tarn Fen at Malham, det T.T.Macan [Flint, 1963]. The two most southern records, both in East Sussex, are at Ellison's Pond, Duddleswell [R.Carr, 1998] and Peasemarsh Place [E.K.Goldie-Smith, 1984].

Habitat

The records giving habitat data range from a moorland pond with *Sphagnum* moss and 'rushes' to grazing marsh ditches and chalk streams. Frequently, ponds are described as shallow and on limestone. The amount of vegetation varies, from considerable to a dew-pond with bare substrate and grassy margins. One recorder has speculated that in some parts of the country *S. limitata* may be declining due to changes in stock-rearing practices.

Helpful hints

This is a smallish corixid with more than 6 pale transverse lines on the pronotum and two clearly defined longitudinal dark bands on the corium. In males, the pegs in the distal row of the palae need to be counted carefully. If in any doubt, extract and examine the right paramere, which has a distinctive distal hook and obvious "elbow" (see Savage, 1989, pp 100-103), or refer specimens to an expert.



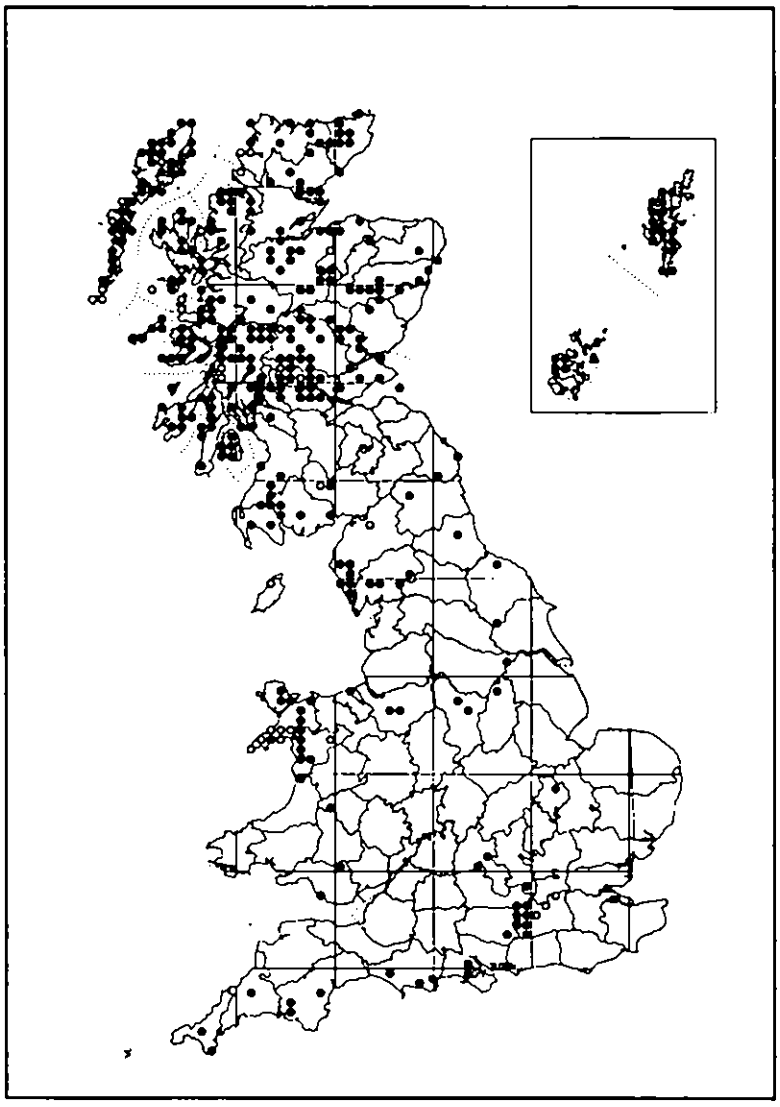
Map 55: *Sigara nigrolineata*
(Fieber)

No of records: 970
No of 10 km squares recorded: 602
No of 10 km squares pre-1970 only: 59

Distribution
It is widespread throughout much of Britain and apparent gaps in distribution are probably more because of under-recording than absence.

Habitat
This corixid is best known for having several differing habitat preferences. In upland and moorland country, it is often common in small, shallow peat pools, burying itself in *Sphagnum* moss or swimming just above a bottom of fine silt (where it has to be seen, scooped in the net and then searched for amongst the black peaty ooze). In lowland habitats, it may occur in ponds and lakes, usually in small numbers mixed with other species. Indeed, it may be found in almost any habitat, except very saline water [P.Kirby].

Helpful hints
The three or four longer palar pegs at the distal end of the single row and the ridge between the eyes distinguish males. Females without males are best determined by checking out the species that they are not, e.g. more than 6 pale lines on pronotum, (not *S. fossarum* or *S. scotti*); no three hemielytral stripes (not *S. semistriata* or *S. venusta*). But females alone are not easy. The equilateral triangular shape of the metasternal xiphus can help, so best not to card mount until this is checked out.



Map 56: *Sigara scotti* (Douglas & Scott)

No of records: 546
No of 10 km squares recorded: 346
No of 10 km squares pre-1970 only: 33

Distribution

This is mainly a northern species. There are 283 records in north Britain and 63 in the south (82% to 18%). As well as clusters of records in Cumbria and north Wales, there are widely scattered records elsewhere. One may speculate whether these are relict populations of a former more continuous distribution now occurring in remnants of suitable habitat, such as heathland; cf. records at Round Pond, Chobham, Surrey and Stoke Common, Buckinghamshire [A.T.Hine, 1994 and 2001]. As well as a very old record at Chynhalls, east of the Lizard, West Cornwall [A.T.Thornley, 1924], there is a recent record of 22 specimens in the same 100 km square, in the heathlands of Goonhilly Downs at Croft Pascoe Pool [P.Nicolet, 1999]. After consultation with A.Chalkley, seven records in East Suffolk and Essex have been placed in category 2*. A record at Crayford Marshes in West Kent (Knights & Powlesland, 1984) has also been put in category 2*.

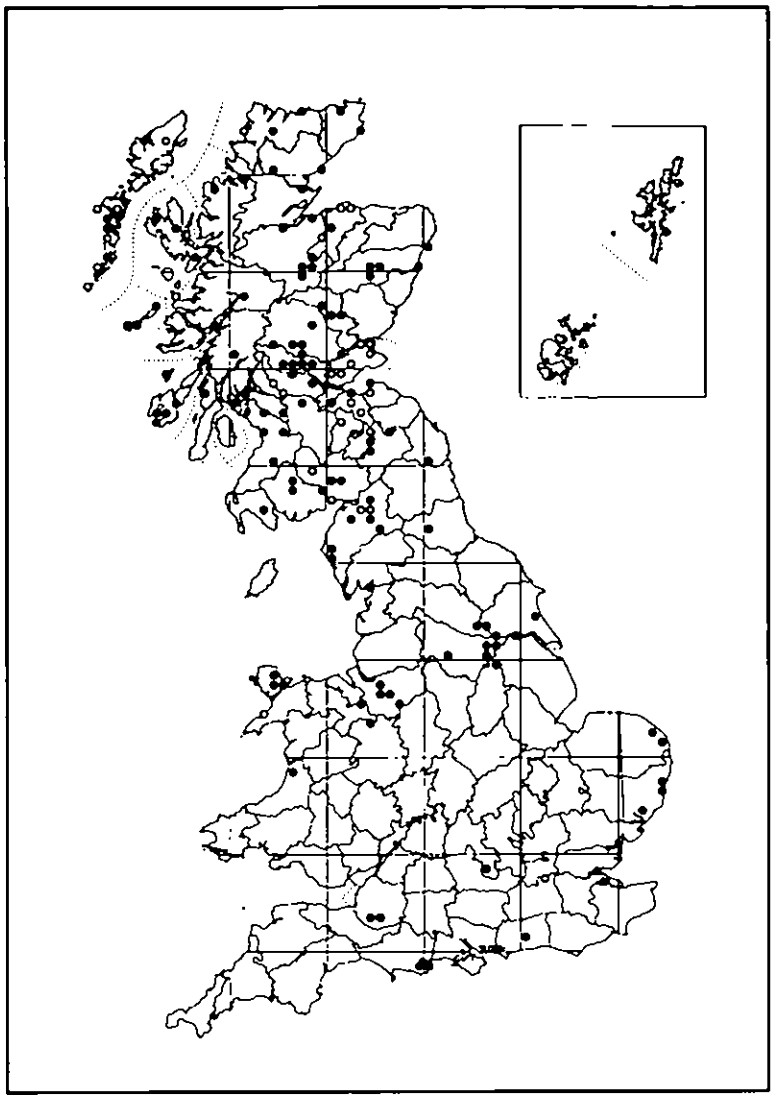
Habitat

Typically found in upland acidic waters, generally in less weedy places than *Hesperocorixa castanea*; also in ponds in lowland heaths and other places where the water is acidic. For example, the two 10 km dots in Cheshire, represent five records at Oak Mere and neighbouring ponds with a pH of 4 to 5 [M.A.Palmer, K.A.Feakes, K.G.Allenby and A.A.Savage, 1979-1985].

Helpful hints

The wavy line of the palar pegs is uniquely distinctive in males. If only females are found, helpful characters are the pronotum with 4-6 pale lines and often a lighter area in the clavus, near the pronotum.

* See Glossary.



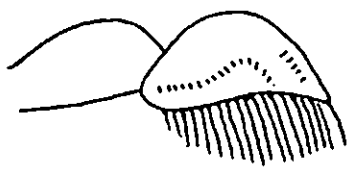
Map 57: *Sigara semistriata*
(Fieber)

No of records: 198
No of 10 km squares recorded: 144
No of 10 km squares pre-1970 only: 30

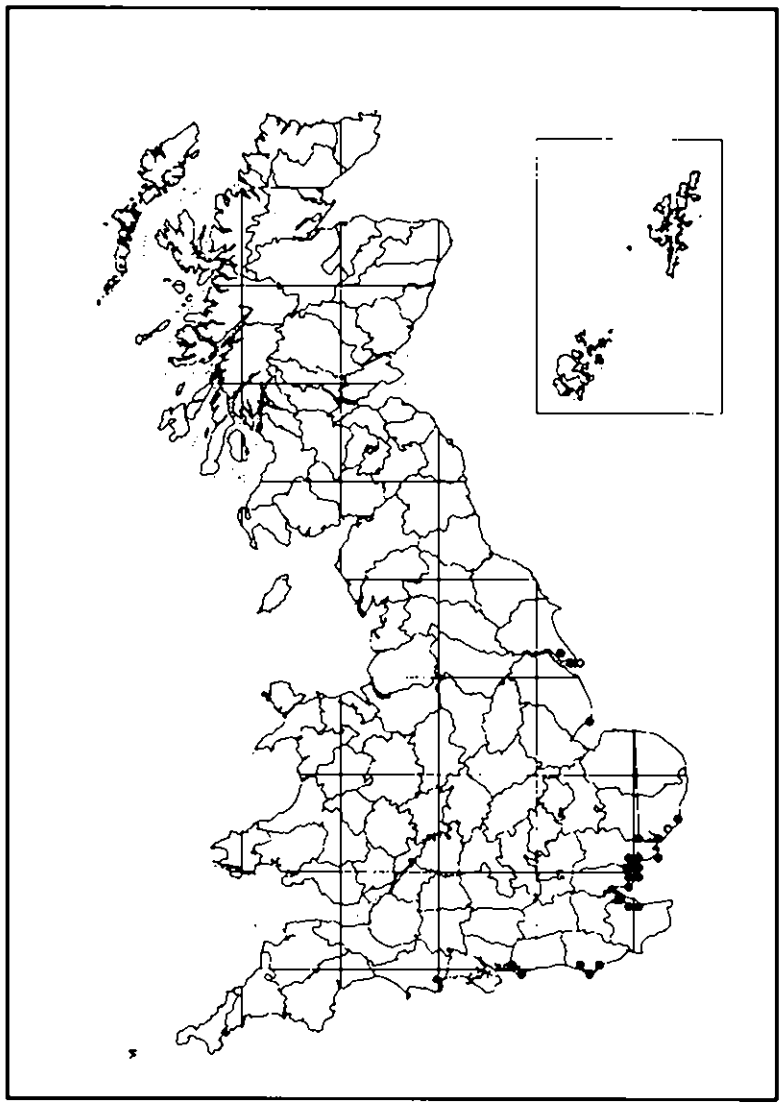
Distribution
This is another small corixid of mainly northern distribution. In north Britain there are 110 records and 33 in the south (76% to 23%). There are post-1970 records from Caithness [M.G.Spirit, 1985] and West Sutherland [T.Huxley, 2000]. Recent records in the Outer Hebrides are from South Uist [M.Palmer, 1983 and T.Huxley, 1994] and Benbecula [J.H.Bratton, 1987]. Records from East Norfolk and East Suffolk include, respectively, Catfield Great Fen [R.Merritt, 1998] and Minsmere [C.M.Drake, 1988]. The most southern record is in Dorset, from the Arne area, near Poole Harbour [J.H.Bratton, 1996]. This species often turns up as a single specimen amongst collections of other small species.

Habitat
Particularly associated with small base-deficient ponds, but it is not confined to such habitats (Kirby, 1990) and many records are from ditches.

Helpful hints
This is a small corixid with three-striped hemielytra and it is a relief when there is a male, for careful checking of the shape of the palae. Sometimes it is difficult to decide whether it is short and narrowly arched (*S. semistriata*) or longer, with a flatter arch (*S. venusta*) (see Savage (1989), pp 102-104). This difference is seen more easily when comparing both species in a reference collection. Confirmation can be obtained by extracting a right paramere, the shape of which is characteristic. It is not always easy to be sure that the indentation on the front of a male head is in the correct position, compared with males of other species with a front-of-head indentation.



Pala of *Sigara semistriata* with dorsal (strictly anterior) edge narrowly arched.



Map 58: *Sigara selecta* (Fieber)

No of records: 24
No of 10 km squares recorded: 22
No of 10 km squares pre-1970 only: 2

Distribution

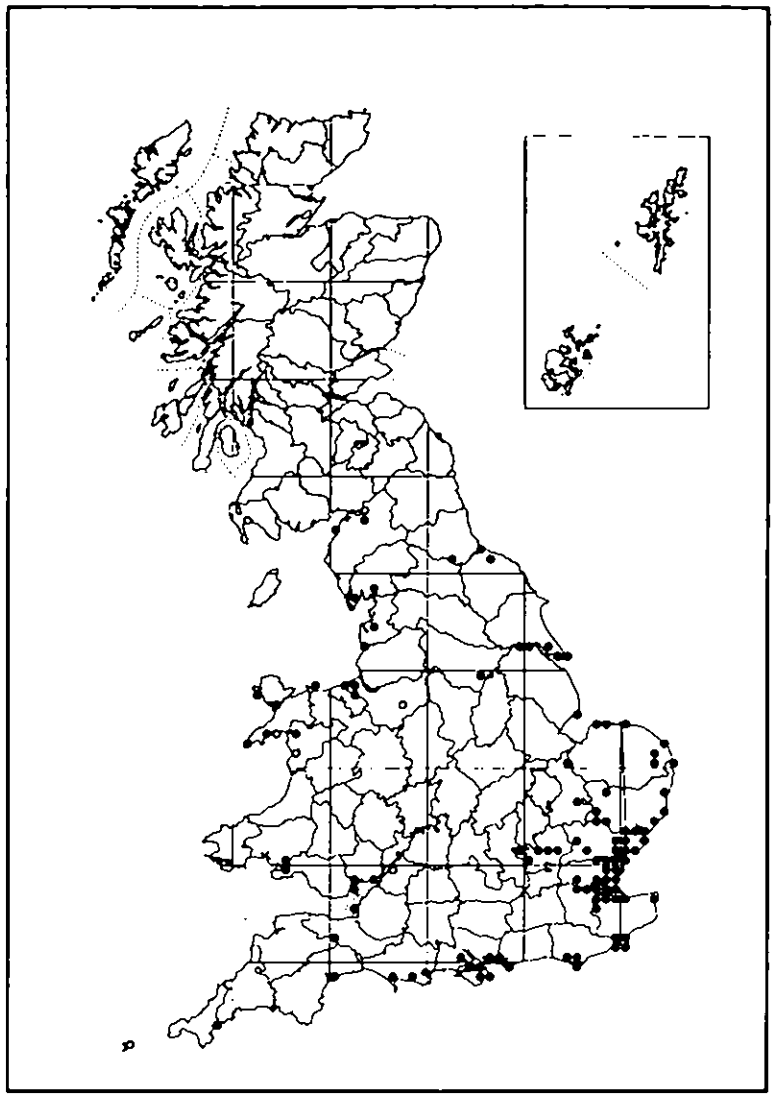
A scarce corixid confined to the English coastal counties and commonest in the south-east (Kirby, 1990). The statements in S&L, that it is known from almost all the English coastal counties, and that it is rare in Scotland, are not correct. The post-1970 South-east Yorkshire records comprise Cherry Cobb Sands [R.Merritt, 2000], Welwick Saltmarsh [M.Hammond, 2001] and three ponds at Gibraltar Point in North Lincolnshire [K.A.Feakes, 1985]. The West Sussex records are at Eames Farm, Southbourne [P.J.Hodge, 1991] and Pagham Harbour [J.H.Bratton, 1984].

Habitat

This is a strictly coastal species, confined to strongly saline or brackish habitats, such as ditches and ponds close to the sea.

Helpful hints

S. selecta is a corixid with a smooth and shiny corium, seen in dry specimens with fairly high magnification and side lighting. Putative specimens should be compared with a species in which the corium is finely wrinkled, such as *S. dorsalis*. For reliable determination, it is essential to collect males and to examine the palae, which are clearly different to those of *S. stagnalis*, the other saline water corixid. Other characters in Savage (1989, pp 83-84), such as the position of the transverse ridge on the front of the head in males and the length of the pronotal keel in both sexes, are not always easy to be sure about. As Savage comments, "some female specimens cannot be satisfactorily separated at all".



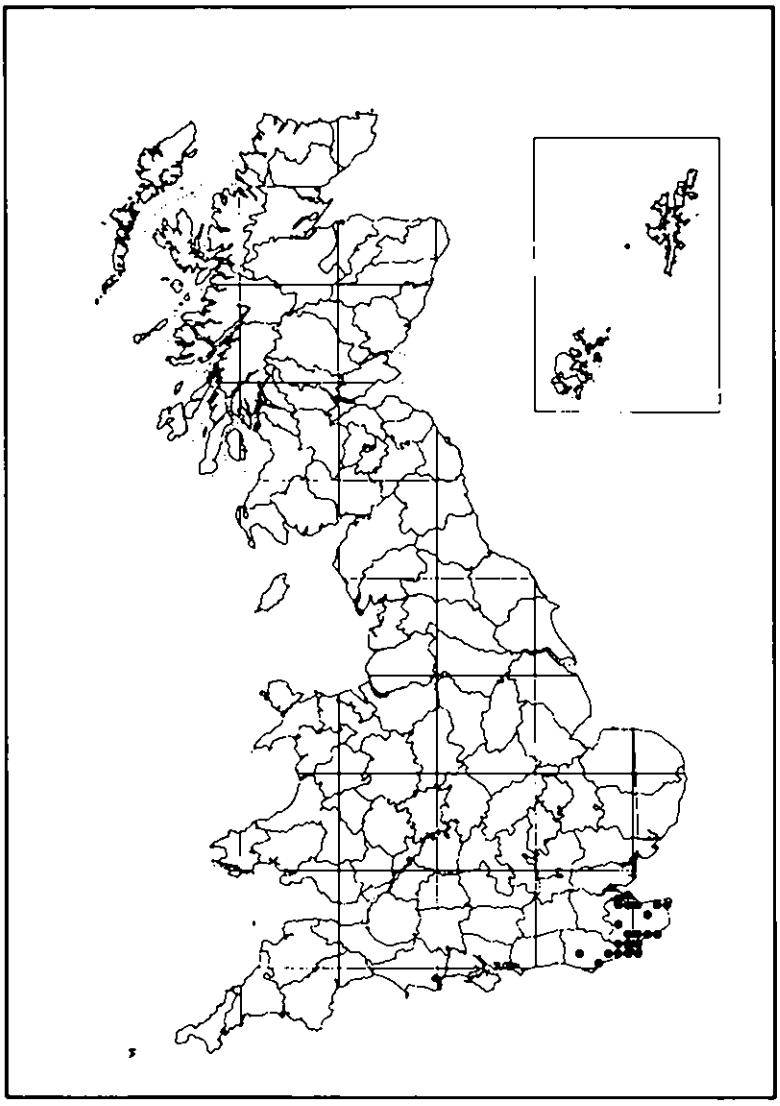
Map 59: *Sigara stagnalis*
(Leach)

No of records: 228
No of 10 km squares recorded: 111
No of 10 km squares pre-1970 only: 7

Distribution
Although there is a pre-1970 record of this species at Glenluce in Wigtownshire (Brown, 1946), it has not been found again in Scotland. All other records are in England and Wales, many near the coast but occasionally also at inland locations. In addition to a very old record for the Isles of Scilly [A.T.Thornley, 1940], the most south-western mainland record is from Swanpool in West Cornwall [R.S.K.Barnes, 1970].

Habitat
Brackish pools and ditches by the sea are typical habitats, often associated with the transparent prawn *Palaemonetes varians*. Inland locations include the saline lakes of Cheshire (Savage, 1971, 1996). In such habitats, water chemistry, deriving from ground sources, explains the presence of this species. At some other inland locations, water chemistry may be influenced by nutrient enrichment from waterbirds.

Helpful hints
The comments relating to *Sigara selecta* refer also to *S. stagnalis*. Because we do not know enough about the ecology of the latter species, the vetting of records is made unusually difficult. All inland records that cannot be definitely accepted have therefore been excluded. It is important to retain specimens of *S. stagnalis*, especially those from inland locations. In such places, records of juveniles accompanying adults would help to confirm the breeding status of inland records.



Map 60: *Sigara striata*

(Linnaeus)

No of records: 71
No of 10 km squares recorded: 21
No of 10 km squares pre-1970 only: 0
Threat status: Nationally scarce (Notable B) but formerly Red Data Book 3 (Rare) in Shirt (1987)

Distribution

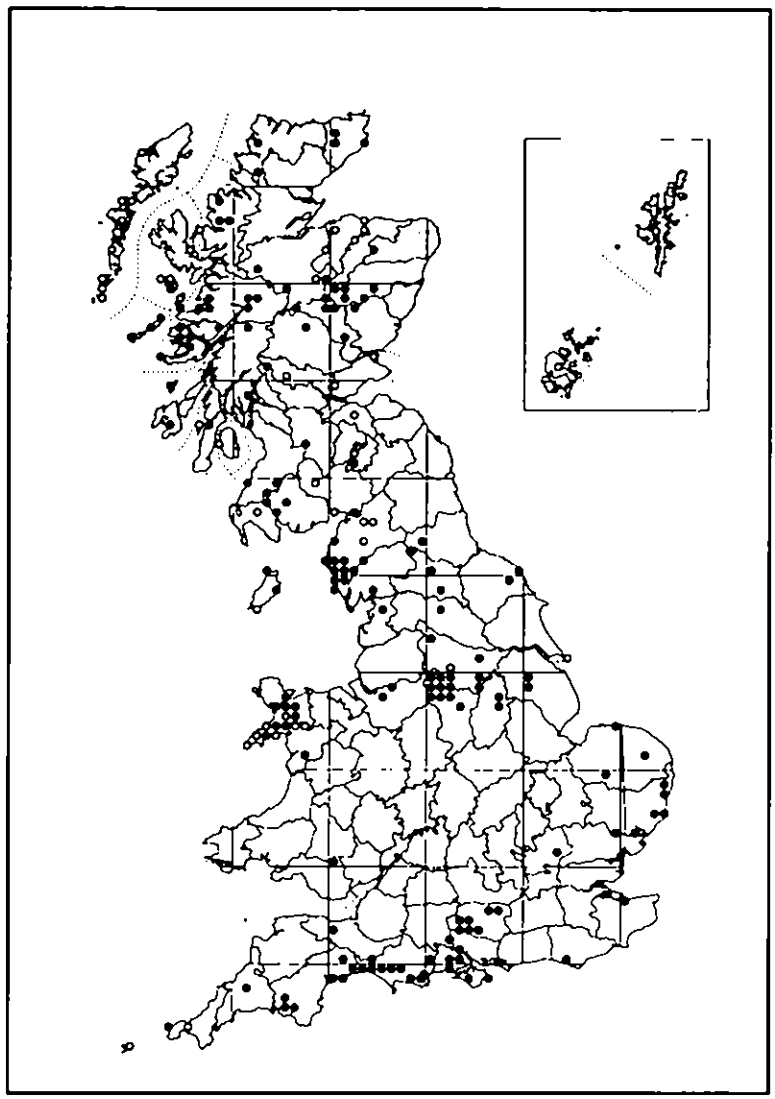
Kirby (1992) considers that the rarity of this species has been over-stated as it is frequent within its restricted range in East Kent and East Sussex. Putative records north of the Thames are considered to be errors.

Habitat

It is found in still or slow-flowing water and is tolerant of a wide range of conditions. It can occur in open, almost weed-free water over a variety of substrata and amongst fairly dense weed. It is tolerant of moderate salinity (Kirby, 1992).

Helpful hints

Savage and Parkin (1998) describe separation of *S. striata* from the much commoner *dorsalis*. This is not always easy as the authors presume that the intermediate forms found in Kent and Sussex are natural hybrids of *S. striata* x *S. dorsalis*. Laboratory experiments have shown that hybridization is possible (Jansson, 1979). Any collector in doubt about a specimen should therefore have the determination confirmed by an expert before submitting a record.



Map 61: *Sigara venusta*

(Douglas & Scott)

No of records: 306
No of 10 km squares recorded: 200
No of 10 km squares pre-1970 only: 46

Distribution

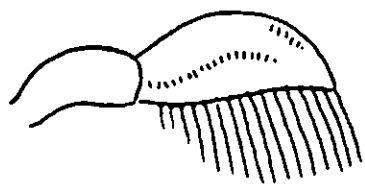
This species occurs in about the same number of 10 km squares in north and south Britain; 52% to 48%. In south Britain, however, most records are in counties bordering the south and east coast and there are about 24 vice-counties in southern England with no records. The cluster of 10 km square records in Anglesey and Caernarvon represent about 25 records by E.S.Brown, J.Ismay, A.E.Stubbs, J.Rees and J.M.Blackburn dating from 1941 to 1999. Most of the cluster in Derbyshire represents 27 records by R.Merritt [1987-2001] and, for the cluster in south Cumberland, 20 records by R.W.J.Read [1984-1991].

Habitat

Like *Sigara nigrolineata*, *S. venusta* can occur in a considerable range of habitats, from small peat pools and large lakes to rivers. It can occur, sometimes as the only species, in large, oligotrophic stony bottomed lakes, such as Loch Ba in Mull [T.Huxley, 1997]. It can also be found in the sandy substrate of small streams. S&L state that most habitats are slightly or strongly acid. However, *S. venusta* has been found in chalk rivers in Hampshire (J.S.Denton, 2001) and in the River Beane at Waterford, a chalk river rising in the Chilterns [B.S.Nau and S.E.Brooke, 2001]. Possibly, therefore, pH and calcium ion concentrations are not the only factors important in the ecology of this species.

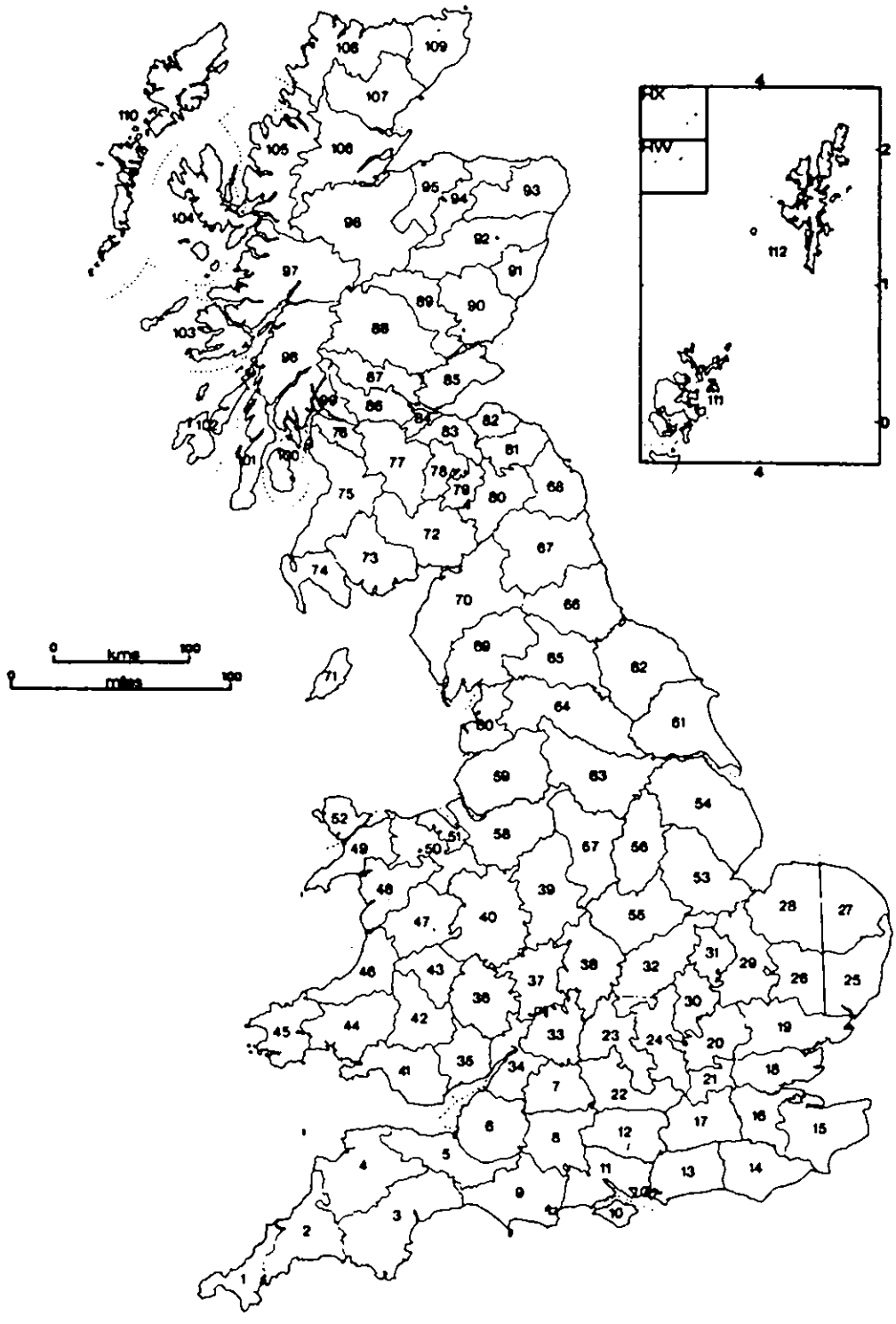
Helpful hints

It is useful to keep some specimens with palae carefully mounted for future comparison with *S. semistriata*, the other small corixid with three longitudinal stripes on the hemielytra. The palae in *S. venusta* are longer and with a flatter arch than *S. semistriata* (see sketch). Females without males have to be separated from *S. semistriata* by the shape of the metasternal xiphus: about equilateral in *S. venusta* but distinctly narrower and longer in *S. semistriata*. (See also Savage, 1989, pp 102-104.)



APPENDIX 1

Map of vice-counties and list of vice-county numbers



England, Wales & Isle of Man

1. West Cornwall (with Scilly)
2. East Cornwall
3. South Devon
4. North Devon
5. South Somerset
6. North Somerset
7. North Wiltshire
8. South Wiltshire
9. Dorset
10. Isle of Wight
11. South Hampshire
12. North Hampshire
13. West Sussex
14. East Sussex
15. East Kent
16. West Kent
17. Surrey
18. South Essex
19. North Essex
20. Hertfordshire
21. Middlesex
22. Berkshire
23. Oxfordshire
24. Buckinghamshire
25. East Suffolk
26. West Suffolk
27. East Norfolk
28. West Norfolk
29. Cambridgeshire
30. Bedfordshire
31. Huntingdonshire
32. Northamptonshire
33. East Gloucestershire
34. West Gloucestershire
35. Monmouthshire
36. Herefordshire
37. Worcestershire
38. Warwickshire
39. Staffordshire
40. Shropshire (Salop)
41. Glamorgan
42. Breconshire
43. Radnorshire
44. Carmarthenshire
45. Pembrokeshire
46. Cardinghamshire
47. Montgomeryshire
48. Merionethshire
49. Caernarvonshire
50. Denbyshire
51. Flintshire
52. Anglesey
53. South Lincolnshire
54. North Lincolnshire
55. Leicestershire (with Rutland)
56. Nottinghamshire
57. Derbyshire
58. Cheshire
59. South Lancashire
60. West Lancashire
61. South-east Yorkshire
62. North-east Yorkshire
63. South-west Yorkshire
64. Mid-west Yorkshire
65. North-west Yorkshire
66. Durham
67. South Northumberland
68. North Northumberland (Cheviot)
69. Westmorland with North Lancashire
70. Cumberland
71. Isle of Man

Scotland

72. Dumfriesshire
73. Kirkcudbrightshire
74. Wigtownshire
75. Ayrshire
76. Renfrewshire
77. Lanarkshire
78. Peeblesshire
79. Selkirkshire
80. Roxburghshire
81. Berwickshire
82. East Lothian (Haddington)
83. Mid-Lothian (Edinburgh)
84. West-Lothian (Linlithgow)
85. Fife (with Kinross)
86. Stirlingshire
87. West Perthshire (with Clackmannan)
88. Mid Perthshire
89. East Perthshire
90. Angus (Forfar)
91. Kincardineshire
92. South Aberdeenshire
93. North Aberdeenshire
94. Banffshire
95. Moray (Elgin)
96. East Inverness-shire (with Nairn)
97. West Inverness-shire
98. Argyll Main
99. Dunbartonshire
100. Clyde Isles
101. Kintyre
102. South Ebudes
103. Mid Ebudes
104. North Ebudes
105. West Ross
106. East Ross
107. East Sutherland
108. West Sutherland
109. Caithness
110. Outer Hebrides
111. Orkney Islands
112. Shetland Islands

APPENDIX 2

Tables of species per vice-county

	Table 1: English, Welsh & Isle of Man VCs		
Species list	**VC Nos 1-24**	**VC Nos 25-48**	**VC Nos 49-71**
Mesovelia to *Ranatra*	page 87	page 90	page 93 + total VCs
Ilyocoris to *Hesperocorixa moesta*	page 88	page 91	page 94 + total VCs
Hesperocorixa sahlbergi to *Sigara venusta*	page 89 + total spp.	page 92 + total spp.	page 95 _ total VCs & total spp.

	Table 2: Scottish VCs	
Species list	**VC Nos 72-95**	**VC Nos 96-112**
Hebrus to *Cymatia bonsdorfii*	page 96	page 99
Glaenocorisa to *Sigara semistriata*	page 97	page 100
Sigara stagnalis & *Sigar avenusta*	page 98 + total spp.	page 101 + total spp.

The tables above show where to find species presence or absence per vice-county, total numbers of species per vice-county and total number of vice-counties per species. Total numbers of vice-counties in Britain are given in the last column on pp 93-95. It was suggested that the tables and totals for England and for Wales should be shown separately, as they each have their own conservation agencies, but - although possible - this would have added considerably to the work because of the way the numbers of Welsh vice counties are ordered amongst English vice counties.

Records from 1970 onwards are shown by •; records pre-1970 by o. Absence of either symbol indicates lack of a record.

Consideration was given to including data in Massee (1955) wherein he lists Heteroptera geographically. But this is precisely the problem; for England and Wales the geographical divisions are by counties,not Watsonian vice-counties, and I could not work out a way to show his data without having to make an arbitrary decision that where a Massee county had been split into two or more Watsonian vice-counties, which column the symbol for the Massee entry should be placed. In any case Massee lumped data for Scotland and Ireland as if they were each one county. The upshot was that I gave up on trying to provide a way to compare this fifty year old data. Interested readers can try this for themselves but it is not easy because Massee's numbered list of counties proceeds from north to south: England first and then Wales, whereas of course Watson travelled - as it were - from Land's End to Unst!

Records and total species for England and Welsh vice-counties 1-70 and Isle of Man, vice county 71.

Species Name	Vice-county number																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mesovelia furcata			•		•	•			•			•	•	•	•	•	•	•	•	•	o	•	•	•
Hebrus pusillus	o	•							•		•			•	•	•				•				
Hebrus ruficeps									•		•	•			•		•	•	•		o			
Hydrometra gracilenta											o			•										
Hydrometra stagnorum	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Microvelia pygmaea	•									•		•	•	•	•	•	•	•	•	o		•		
Microvelia reticulata			•		•	•	•	•	•		•	•	•	•	•	•	•	•	•	•		•	•	•
Microvelia umbricola																								
Velia caprai	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Velia saulii					•				•		•													
Gerris najas	•	•	•	•	•				•		•	•			•		•	•		•				
Gerris paludum												•	•	•		•	•			•		•	•	•
Gerris argentatus		o	•		•	•			•		•	•	•	•	•	•	•			•	o	•	•	
Gerris costae																								
Gerris gibbifer	•	•	•	•		•			•	•	•	•	•	•	•	•	•	•	•	•	•	•		•
Gerris lacustris	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Gerris lateralis																			•			•	•	
Gerris odontogaster					•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Gerris thoracicus	•		•	•	•		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Nepa cinerea	•	•	•		•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Ranatra linearis	•		•		•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•

Species Name	Vice-county number																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Ilyocoris cimicoides	•		•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•		•	•	•
Aphelocheirus aestivalis		•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
Plea minutissima	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Notonecta glauca	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Notonecta maculata	•		•			•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Notonecta viridis	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Notonecta obliqua	•	•	•		•	•			•	•	•	•	•	•	•		•	•		•				•
Micronecta minutissima												•					•			•				
Micronecta poweri				•			•		•	•	•	•	•			•	•	•	•	•		•	•	
Micronecta scholtzi			•			•				•		•		•	•	•	•	•	•	•	•	•	•	•
Cymatia bonsdorffi									•	•	•			•	•		•		•	•	o	•	•	•
Cymatia coleoptrata			o		•			•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
Glaenocorisa propinqua																	•							
Corixa affinis	•					•				•	•			•	•	•		•	•					
Corixa dentipes							•			•		•	•		•		•	•	•	•		•	•	•
Corixa iberica																								
Corixa panzeri	•				•				•	•		•		•	•	•	•	•	•	•	•	•	•	•
Corixa punctata	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Hesperocorixa castanea	•	•	•			•			•		•	•	•	•		•	•			•		•		•
Hesperocorixa linnaei	•	•	•	•	•	•			•	o	•	•		•	•	•	•	•	•	•	•	•	•	•
Hesperocorixa moesta						•			•	•	•	•	•	•	•		•	•	o	•		•	•	•

Species Name	Vice-county number																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hesperocorixa sahlbergi	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Arctocorisa carinata																								
Arctocorisa germari		•							•						•					•		•	•	•
Callicorixa praeusta	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•
Callicorixa wollastoni																								
Sigara concinna	•				•				•	•	•	•		•	•	•	•	•	•	•		•	•	
Sigara distincta	•	•	•	•		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sigara dorsalis	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sigara falleni	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sigara fossarum			•			•			•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
Sigara lateralis	•	•	•		•	•			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sigara limitata	o										•	•		•			•	•		•				
Sigara nigrolineata	•		•		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sigara scotti	•	•	•						•		•	•					•					•	•	•
Sigara semistriata						•			•				•				•						•	
Sigara selecta													•	•	•	•		•	•					
Sigara stagnalis	•		•		•	•			•	•	•		•	•	•	•		•	•	•				
Sigara striata														•	•									
Sigara venusta	•	•	•		•				•	•	•	•		•	•					•				
Total species •	33	24	34	19	31	32	21	16	44	35	41	44	36	45	45	39	46	41	40	46	30	41	39	37
o	(2)	(1)	(1)							(1)	(1)								(1)		(4)			

Species Name	Vice-county number																							
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Mesovelia furcata	•	•	•	•	•	•	•	•			•													
Hebrus pusillus			•	•																				
Hebrus ruficeps	•		•	•		•	•	•									•				•	•		
Hydrometra gracilenta			•																					
Hydrometra stagnorum	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Microvelia pygmaea	•				•	•											•							
Microvelia reticulata	•	•	•	•	•	•	•	•		•	•			•	•	•	•			•	•		•	•
Microvelia umbricola			•	•	•																			
Velia caprai	•	•	o	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Velia saulii						•		•							•				•	•				•
Gerris najas								•			•				•				•	•	•	•	o	•
Gerris paludum						•	•																	
Gerris argentatus	o		•	•	•	•	•	•						•	•	•				•				
Gerris costai																								
Gerris gibbifer	•					•		•		•	•			•	•	•	•	•	•	•			•	•
Gerris lacustris	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Gerris lateralis				•		•					•		•				•					•		•
Gerris odontogaster	•	•	•	•	•	•	•	•		•	•			•	•	•	•				•			•
Gerris thoracicus	•		•	•	•	•	•	•	•	•	•			•	•	•		•		•	•	•	•	•
Nepa cinerea	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	o
Ranatra linearis	•	•	•	•	•	•	•	•		•	•			•		•	•			•	•			

Species Name	Vice-county number																							
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Ilyocoris cimicoides	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•		•	•		•	
Aphelocheirus aestivalis			•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	•		•	•	
Plea minutissima	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Notonecta glauca	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•
Notonecta maculata	•	•	•	o	•	•	•	•	•	•				•	•	•	•	•	•	•		•	•	
Notonecta viridis	•	•	•	•	•	•	•	•	o	•	•			•		•	•			•	•			
Notonecta obliqua	o						•	•	•	•	•				•	•	•	•	•	•	•	•	•	
Micronecta minutissima	•		•			•																		
Micronecta poweri	•	•	•	•		•	•	•	•		•			•	•	•			•	o	•			•
Micronecta scholtzi	•	•	•		•	•	•	•		o	•			•				•			•			
Cymatia bonsdorffi		•	•	•		•	•	•			•			•	•	•			•	•			•	o
Cymatia coleoptrata	•	•	•	•	•	•	•	•		•	•			•	•		•			•	•			
Glaenocorisa propinqua															•									•
Corixa affinis	•				•						•										•			
Corixa dentipes	•	•	•	•	•	•	•	•						•		•		•	•	•				•
Corixa iberica																								
Corixa panzeri	•	•	•	•	•	•	•	•		•	•			•			•						•	
Corixa punctata	•	•	•	•	•	•	•	•		•	•		•	•	•	•	•	•		•	•	•	•	•
Hesperocorixa castanea								•		•	•				•	•	•	•				•	o	•
Hesperocorixa linnaei	•	•	•	•	•	•	•	•		o	•			•	•	•	•			•	•			•
Hesperocorixa moesta	•	•	•	•	•	•	•	•						•	•		•	•	•		•	•		

Species Name	Vice-county number																							
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Hesperocorixa sahlbergi	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•
Arctocorisa carinata																								
Arctocorisa germari	•		o	•	o	•		•							•	•	•						•	o
Callicorixa praeusta	•	•	•	•	•	•	•	•		•	•			•	•	•	•				•		•	
Callicorixa wollastoni															•									•
Sigara concinna	•	•	•	•	•	•	•	•			•			•	•	•	•			•				
Sigara distincta	•	•	•	•	•	•	•	•			•		•	•	•	•	•	•		•	•		o	•
Sigara dorsalis	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•
Sigara falleni	•	•	•	•	•	•	•	•		o	•		•	•	•	•	•		•	•	•			
Sigara fossarum	•	•	•		•	•	•	•		o	•		•	•	•	•	•		•		•			
Sigara lateralis	•	•	•	•	•	•	•	•		•	•		•	•	•	•				•	•			
Sigara limitata	•	•		•	o	•		•						•	•			•			•			
Sigara nigrolineata	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•			•
Sigara scotti							•										•		•					•
Sigara semistriata	•		•													•						•		
Sigara selecta	•	•																						
Sigara stagnalis	•	•	•	•	•					o	•									•				•
Sigara striata																								
Sigara venusta	•	•	•	•													•							•
Total species •	44	35	43	40	38	43	38	42	16	29	37	7	17	35	36	34	35	22	22	32	31	18	22	28
o	(2)		(2)		(2)				(1)	(5)										(1)			(3)	(3)

Species Name	Vice-county number																							E&W	B
	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71		
Mesovelia furcata								•					•		•									29	29(1)
Hebrus pusillus	•			•																				12(1)	12(1)
Hebrus ruficeps	•			•						•			•	•		•	•				•	•	•	27(1)	34(1)
Hydrometra gracilenta																								3(1)	3(1)
Hydrometra stagnorum	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	69	79(1)
Microvelia pygmaea																								37	37
Microvelia reticulata	•	•		•	•	•		•	•	•	•		•	•	•	•	•	•	•		•	•		21	42(1)
Microvelia umbricola																								16(1)	16(1)
Velia caprai	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	70(1)	111(1)
Velia saulii	•		o		•				•	•		•				o	•				•	•		19(2)	46(5)
Gerris najas	•								•	o											o		o	26(4)	28(4)
Gerris paludum																								11	11
Gerris argentatus			•		•				•	•					•									32(3)	32(3)
Gerris costae									•	•	•			•	•	•	•	•	•	•	•	•		12	44
Gerris gibbifer	•	•		•						•				•	•	•					•	•	o	44(1)	46(2)
Gerris lacustris	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	o	71(1)	108(1)
Gerris lateralis	•			•				•	•	•			•	•	•	•	•	•			•	•		23	46
Gerris odontogaster	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		50	85
Gerris thoracicus	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	61	91(4)
Nepa cinerea	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•		•	•		66(1)	98(2)
Ranatra linearis					•			•	•															39	39

Species Name	Vice-county number																							E&W	B
	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71		
Ilyocoris cimicoides		•	•		•	•	•	•	•	•	•		•	•	•	•								54	54
Aphelocheirus aestivalis	•	•	•		•	•		•	•	•			•	•		•						•		52	59
Plea minutissima	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•				•	•		65	67(1)
Notonecta glauca	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	70	109(1)
Notonecta maculata	•	•			•		•	•	•	•	•		•	•	•	•	•							52	52
Notonecta viridis	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•							•	55(1)	55(1)
Notonecta obliqua	•	•	•	•			•	•	•	•	•		o	•	•	•	•				•	•		47(2)	66(2)
Micronecta minutissima								o														o		8(2)	8(2)
Micronecta poweri	•	•		•	•				•	•					o	•	•				•	•		41(2)	62(4)
Micronecta scholtzi					•	•		•	•	•			•		•									34(1)	34(1)
Cymatia bonsdorffi	•		•		•	•		•	•	•	•		•	•	•	•	•				•	•		41(2)	74(2)
Cymatia coleoptrata					•	•	•	•	•	•					•									40(1)	40(1)
Glaenocorisa propinqua	•								•	•	•				•	•	•		•			•		12	32(2)
Corixa affinis				•	•	•							•											17	76
Corixa dentipes	•			•	•	•	•	•	•	•	•		•		•	•	•				•	•		41	63(1)
Corixa iberica																									11
Corixa panzeri	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	49	62(3)
Corixa punctata	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	68	101(1)
Hesperocorixa castanea	•	•		•	•	•			•	•				•	•	•	•	•			•	•	•	36(1)	75(2)
Hesperocorixa linnaei	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		58(2)	86(5)
Hesperocorixa moesta	•			•						•	•													34(1(	34(1)

Species Name	Vice-county number																								E&W	B
	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71			
Hesperocorixa sahlbergi	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		70	109
Arctocorisa carinata																•	•			•		•			4	19(5)
Arctocorisa germari	o	•	•	•		•		•	•	•		•	•		•	•	•		•			•	o		34(5)	67(5)
Callicorixa praeusta	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		62	95
Callicorixa wollastoni	•								•	•	•				•	•	•	•	•	•	•	•			14	46
Sigara concinna	•	•	•	•		•		•	•	•	•	•	•		•	•	•	•	•	•	•	•	•		49	73(3)
Sigara distincta	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		64(1)	104(1)
Sigara dorsalis	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		69	109
Sigara falleni	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		64(1)	98(1)
Sigara fossarum	o		•	•	•	•		•	•	•		•	•	•	•	•	•	•			•	•	o		51(3)	79(6)
Sigara lateralis	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•		59	87(2)
Sigara limitata	•	•					•	•	•	•			•	•	•	o						o			28(4)	31(7)
Sigara nigrolineata	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		65	103(2)
Sigara scotti	•		•	•				•	•	•				•	•			•	•	•	•	•	o		28(1)	61(1)
Sigara semistriata	o	•		•		•		•		•		•	•		•	•		•		•		•			21(1)	57(3)
Sigara selecta						•							•												10	10
Sigara stagnalis	•		•	•		•				•	•	•	•	•	•			•			•	•			36(1)	37(2)
Sigara striata																									2	2
Sigara venusta	•			•		•		•	•	•		•	o	•	•	•	•	•			•	•	•		33(1)	64(11)
Total species •	44	26	30	37	34	35	23	39	44	48	31	26	39	35	44	42	35	26	21	21	36	42	24			
o	(3)		(1)					(1)		(1)			(2)		(1)	(2)					(1)	(2)	(6)			

Species Name	Vice-county number																							
	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
Hebrus ruficeps		•	•				•	•	•									•						
Hydrometra stagnorum	•	•	•	•												•	•							o
Microvelia reticulata	•	•	•	•	•	•		•	•		•	•	•	•	o		•	•	•		•			•
Velia caprai	•	•	•	•	•	•	•	•	o	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Velia saulii	•	•	•			•		o	•			•	•	•	•	•	•	•	•				o	•
Gerris najas		•	•																					
Gerris costai	•	•	o	•		•					•	•	•	•	•		•	•	•		•	•	•	•
Gerris gibbifer	o	•																						
Gerris lacustris	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Gerris lateralis	•	•	•	•		•			•		•	•		•		•	•	•	•	•	•	•		•
Gerris odontogaster	•	•	•	•		•		•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
Gerris thoracicus	o	•	•	•	•	•		•	o	o		•	•	•			•		•	•	•	•	•	
Nepa cinerea	•	•	•	•	•	•		•	•	•	•			•	•	•	•			•	•	•		o
Aphelocheirus aestivalis		•	•	•	•					•						•		•						
Plea minutissima		•	o																					
Notonecta glauca	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Notonecta obliqua		•	•		•												•				•			•
Micronecta poweri	o	•	•					•	•					•		•	•	•			•		•	o
Cymatia bonsdorffi	•	•	•	•	•	•			•		•	•	•	•		•	•	•	•	•	•	•		•

Species Name	Vice-county number																								
	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
Glaenocorisa propinqua		•	o													•	•		•					o
Corixa dentipes	•	•	o	•	•	•			•					•	•	•	•	•	•	•	•			•
Corixa panzeri	•	o				•					•	•									•	•		o
Corixa punctata	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Hesperocorixa castanea	•	•	•	•	•	•						•	•	o	•	•	•	•	•	•	•	•	•	•
Hesperocorixa linnaei	•	•	•	•	•	•	o				•	•		o	•	•	•	•	•		•			•
Hesperocorixa sahlbergi	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
Arctocorisa carinata		•															•		•					o
Arctocorisa germari	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	•	•		•
Calicorixa praeusta	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Calicorixa wollastoni	•	•		•		•	•					•	•	•	•	•	•	•	•	•	•		•	•
Sigara concinna	•		•	•	•	o			•	•	•	•	•	•		•		•	•	•	•	•	•	•
Sigara distincta	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sigara dorsalis	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sigara falleni	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•
Sigara fossarum	•	•	•	•	•	•			•		•	•	•	•	•	•	•	•			•			
Sigara lateralis	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•
Sigara limitata	o	o	o																					
Sigara nigrolineata	•	•	•	•	•	•			•	•	o	•	•	•	•	•	•	•	•	•	•	•	•	•
Sigara scotti	•	•	•	•	•									•	•	•	•	•	•	•	•	•	•	•
Sigara semistriata	•	•	•	•	•	•	o	•	•		•	•	•	•	•	•	•	•		•	•	•		•

Species Name	Vice-county number																							
	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
Sigara stagnalis			o							·														
Sigara venusta	o	•	o	•		•		•				o		o		o	•	•	•		•	•	o	o
Total species •	34	40	38	30	25	29	11	18	25	15	23	27	23	30	24	30	32	30	28	23	31	25	20	33
o	(3)	(2)	(7)			(1)	(2)	(1)	(2)	(1)		(1)		(3)	(1)	(1)							(2)	(7)

Species Name	Vice-county number																	
	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	
Hebrus ruficeps											•							7
Hydrometra stagnorum					•	•		•										10(1)
Microvelia reticulata			•		•						•							21(1)
Velia caprai	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	41(1)
Velia saulii	•	•	•			•	•			•	•	•	•	•	o		o	27(3)
Gerris najas																		2
Gerris costae	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•		32
Gerris gibbifer																		2(1)
Gerris lacustris	•	•	•	•	•	•	•	•	•	•	•	•	•					37
Gerris lateralis	•			•					•						•	•	•	23
Gerris odontogaster	•	•	•	•	•			•	•	•	•	•	•	•	•	•		35
Gerris thoracicus	•			o	•	•	•	•	•	•	•	•	•		•			30(4)
Nepa cinerea	•	•	•	•	•	•	•	•	•		•	•		•	•	•		32(1)
Aphelocheirus aestivalis																		7
Plea minutissima																		2(1)
Notonecta glauca	•	•	•	•	•	•	•	•	o	•	•	•		•	•	•		39(1)
Notonecta obliqua	•	•	•		•	•	•	•	•	•	•	•	•		•			19
Micronecta poweri			•	•				•	•	•		•		•	•	•		21(2)
Cymatia bonsdorffi	•	•	•	•	•	•	•	•	•	•	•		•	•	•			33

Species Name	Vice-county number																S
	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	
Glaenocorisa propinqua	•		•		•		•	•	•	•	•	•	•	•	•	•	•	20(2)
Corixa dentipes	•	•	•	•		•									o			22(10
Corixa iberica			•		•		•	•	•	•		•	•		•	•	•	11
Corixa panzeri					o			•	•						•		•	13(3)
Corixa punctata	•	•		•	•	o				•	•	•	•	•				33(1)
Hesperocorixa castanea	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	36(1)
Hesperocorixa linnaei	•	•	•	•	•	•	•	•	o		•				•			28(3)
Hesperocorixa sahlbergi	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		39
Arctocorisa carinata	•				•		o		•	•	o		•	•	o	o	•	15(5)
Arctocorisa germari	•			•	•		•		•		•		•	•	•	•	•	33
Calicorixa praeusta	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	39
Calicorixa wollastoni	•	•	•		•	•	•		•	•	•	•	•	•	•	•	•	32
Sigara concinna	•						•							•	o	o		24(3)
Sigara distincta	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	40
Sigara dorsalis	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	40
Sigara falleni	•		•	•	•	•	•	•	•		•	•				•		34
Sigara fossarum	•		•	•	•	•	•	o		o	•	•		•	o			28(3)
Sigara lateralis					•	o	•								o	•	•	28(2)
Sigara limitata																		3(3)
Sigara nigrolineata																		38(2)
Sigara scotti	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	33
Sigara semistriata	•	•	•	o	•	•	•	•	•	•	•	•	•	•	•			36(2)

Species Name	Vice-county number																	?
	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	
Sigara stagnalis																		1(1)
Sigara venusta	•	•	•	•	o	•	•	•	•	•			•	•	•	o	o	31(10)
Total species •	30	22	27	24	31	25	28	25	30	23	28	24	22	24	31	23	17	
o				(2)	(2)	(2)	(2)		(4)		(1)				(6)	(4)	(2)	

APPENDIX 3

Gazetteer of locations and grid references

Location name	Vice-county	Grid Reference
Adonis Pond, Malling Hill, Lewes	E Sussex	TQ4311
Afon Llia	Brecon	SN9215
Ainsdale	S Lancs	SD2911
Am Fhaidhail, Tiree	Mid Ebudes	NM0145
Arne area, nr Poole Harbour	Dorset	SY9487
Arran	Clyde Isles	NR9535
Aylesbeare Common	S Devon	SY5090
Babworth, canal	Notts	SK48
Barrow Haven	N Lincoln	TA0623
Barton Broad	E Norfolk	TG3621
Barton Clay Pits	N Lincs	TA0322
Barton upon Humber	N Lincs	TA0322
Blackmoss Pool	Cumberland	NY4847
Blackwater of Dee	Kirkcudbright	NX5475
Bolton-on-Swale	NW York	SE2598
Borve Stream, Barra	Outer Hebrides	NF6601
Bosherston Lakes	Pembroke	SR99
Bosistow Farm	W Cornwall	SW3624
Bostraze Farm	W Cornwall	SW3931
Braithwaite	SW York	SE6312
Budby South Forest	Notts	SK8264
Bure Marshes	E Norfolk	TG3316
Bute (an island)	Clyde Isles	NS0663
Bwlch Tryfan	Caernarvon	SH6658
Canterbury	East Kent	TR1659
Cantley Park, Doncaster	SW Yorks	SE6202
Carlingwark Loch, Castle Douglas	Kirkcudbright	NX7661
Castle Loch, Lochmaben	Dumfries	NY0881
Catfield Fen	E Norfolk	TG3621
Cemlyn Bay	Anglesey	SH3293
Chamberhouse Farm	Berks	SU5165
Cherry Cobb Sands	SE Yorks	TA2121
Chynhalls	W Cornwall	SW7817
Clyst St Mary	S Devon	SX9791
Colchester	S Essex	TL92
Contin	E Ross	NH4156
Crayford Marshes	W Kent	TQ5477
Croft Pascoe Pool, Goonhilly Downs	W Cornwall	SW7319
Derwent Estate	Derbyshire	SK1914
Dottery	Dorset	SY4595
Dozmary Pool	E Cornwall	SX1974
Drakenorth	Dorset	SY5298
Dungeness	E Kent	TR0619
Eames farm, Southbourne	W Sussex	SU7603
East Lynn	N Devon	SS7448
Eelmore Marsh	N Hants	SU8352
Eelmore Flash	N Hants	SU8452
Ellison's Pond, Duddleswell	E Sussex	TQ6428
Eston Moor	NE Yorks	NZ5617
Evie	Orkney	HY3626
Exminster Marsh	S Devon	SX9587
Fair Isle	Shetland	HZ2071

Field Pool, Fair Isle	Shetland	HZ2071
Filey North Cliff	NE Yorks	TA0383
Flatford Mill	E Suffolk	TM0733
Foulden Common	W Norfolk	TF7600
Frensham Common	Surrey	SU8639
Frensham Little Pond	Surrey	SU8641
Gara Stream, Slapton	S Devon	SX8148
Gateford Common, Worksop	Notts	SK5681
Gibraltar Point	N Lincoln	TF5558
Gigha (a small island)	Kintyre	NR6450
Glenluce	Wigtownshire	NX1955
Gordale Beck	MW Yorks	SD9066
Grantham Canal, Bassingfield	Notts	SK6137
Great Chart	E Kent	TQ9842
Great Ouse	Beds	TL31
Gullane Point	E Lothian	NT4780
Gyre Orphir	Orkney	HY3404
Hatfield Chase, Humberside Levels	SW Yorks	SE7809
Heath Pond, Crowthorne	Berks	SU8164
Helston	W Cornwall	SW62
Hoy (an island)	Orkney	ND2899
Humberside Levels, Hatfield Chase	SW Yorks	SE7809
Kilnsea, Spurn Peninsula	SE Yorks	TA4115
Kirkconnel Flow	Kirkcudbright	NX9669
Kirkconnel Merse	Kirkcudbright	NX9868
Lambert Castle	Dorset	SY3698
Lamsdale Leans	Caithness	ND0554
Leighton Moss RSPB reserve	W Lancs	SD4774
Leven Canal	SE Yorks	TA1044
Lismore	Main Argyll	NM8542
Little Bradley Ponds	S.Devon	SX8277
Lochar Moss	Dumfries	NY06
Loch Ba, Mull	Mid Ebudes	NM5539
Loch of Harray	Orkney	HY3018
Loch of Kirbister	Orkney	HY3608
Loch Skerrols, Islay	S Ebudes	NR3463
Loch Scrabster	Caithness	ND0870
Longleat Park	S Wilts	ST84
Lower Test	S Hants	SU32
Lunan Burn	E Perth	NO1741
Minsmere	E Suffolk	TM4765
Moat Pond, Thursley Common	Surrey	SU8941
Mull (a large island)	Mid Ebudes	NM4351
New Forest	S Hants	SU20
Norton Golf Course	NE Yorks	SE7770
Oaksey	N Wilts	ST9993
Over Dale, Abney Moor	Derby	SK1810
Oxford Canal, Somerton	Oxford	SP42
Oxwich Burrows	Glamorgan	SS5086
Pandy Pools, Newborough Forest	Anglesey	SH4165
Peasemarsh Place	E Sussex	TQ8821
Pevensey Levels	E Sussex	TQ6606
Primrose Valley, Filey	SE Yorks	TA1377
Ranskill	Notts	SK6688
Reedham Marsh	E Norfolk	TG3619
Richmond Park	Surrey	TQ1972
River Beane, Waterford	Herts	TL3114
River Don, Braithwaite	SW Yorks	SE6312
River Lea	Herts	TL3707
River Stour nr Flatford Mill	E Suffolk	TM0733

Round Pond,Chobham Common	Surrey	SU9664
Saley Forest	Derby	SK2257
Saltmills, Saltash	E Cornwall	SX45
Seamer gravel pits	NE Yorks	TA0383
Shirley Pool	SW Yorks	SE5612
Silver Flowe	Kirkcudbright	NX4781
South Grain Tarn, Cray Moss	NW Yorks	SD9281
Spittal Pond	Caithness	ND1555
St Agnes, Isles of Scilly	W Cornwall	SV80
St Mary's, Isles of Scilly	W Cornwall	SV91
St Merryn	W Cornwall	SW8874
Stoke Common	Bucks	SU9885
Stromness	Orkney	HY21
Swanpool	W Cornwall	SW8031
Tarn Fen, Malham	MW Yorks	SD8867
Thorne Moors	SW Yorks	SE7214
Torrs Warren	Wigtownshire	NX1253
Tresco Abbey pool, Isles of Scilly	W Cornwall	SV81
Waterston Stream	Dorset	SY7495
Welwick saltmarsh	SE Yorks	TA3319
West End Farm, Muston	SE Yorks	TA0979
Wicken Fen	Cambridge	TL5570
Widdale Great Tarn	NW Yorks	SY7987
Wideford Reservoir	Orkney	HY4212
Windermere	Westmorland	NY3701
Wirral	Chester	SJ2285
Wroxham Broad	E Norfolk	TG3116
Y Liethr	Merioneth	SH6625

APPENDIX 4

Suggestions for improving recording

The problem about the several habitat systems summarised earlier is that they do not readily encompass the sorts of descriptive terms submitted with water bug records. It may be useful to list factors to be considered for recording in future, based on some eight years of compiling records and advice received from Alan Savage when I re-commenced recording water bugs in 1993. The list includes all the boxes on the BRC aquatic Heteroptera record card (RA54) and recognizes that some recorders may prefer to use their own database or spread-sheet format with columns instead of filling in BRC cards.

Locality: if the water body has a name then give this first, supported by the name of the nearest place (e.g. town, village, moor, mountain) shown on 1:50 000 OS map.

Grid reference: at least a four figure and preferably a six figure grid reference, preceded by letters for the appropriate 100 km square.

Vice-county: name and/or number.

Name of recorder and/or determiner: both should be given, especially if different.

Date of record: preferably the full date (day/month/year), but month and year if the full date is not known.

Source: BRC cards have boxes for field, museum and in literature. If a record has not been obtained in the field, then it would be helpful to include the name of the museum holding the specimen or the full literature reference.

Altitude: this may be given to nearest metre but nearest 50 metre height would be better than nothing. Bratton (pers.com.) suggests that because contours are often difficult to read at low altitudes, recorders should at least enter "<50 metres" where this applies.

Habitat: the essential factors are (i) water movement, (ii) size of water body, (iii) water chemistry, (iv) substrate, (v) amount and structure of vegetation and (vi) surrounding land use. Suggested ways to do this are as follows.

1. ***Water movement***: although general descriptive terms such as lake or river are fairly sure indications of whether a water body is still (lentic or standing) or flowing (lotic), this is not certain for e.g. ditches and in such cases water movement should be stated.

2. ***Size of water body***: estimate size in hectares, e.g. <0.25, 0.5, 1, 2 etc. I use gridded transparent overlays (in two scales, respectively for 1:50 000 and 1:25 000 OS maps) with which adequately accurate water areas can be estimated.

3. ***Water chemistry***: few recorders will have either facilities or expertise to analyse water chemistry so indications, such as eutrophic or oligotrophic, acid or alkaline (see Glossary for definitions), would help; or saline where appropriate. For several years I used a hand-held pH meter but ceased to do so because of its unreliability. Advice received was that water temperature can alter pH readings and that among some fresh-water biologists pH stands for per-Haps!

4. ***Substrate***: one or two simple words such as rock, gravel, sand, silt, peat or mud would suffice, supplemented where appropriate by whether substrate overlain by little or much organic matter.

5. ***Vegetation***: botanically correct plant lists are of interest but probably of less important for water bug ecology than amounts and nature of plant structure, such as abundant (or sparse) emergent and/or submerged plants, presence and abundance of algae, characteristics of marginal (overhanging) vegetation, floating vegetation and amount of dead plant material.

6. ***Surrounding land use***: brief indication, e.g. open, stock-grazed field, moorland, salt marsh or presence of trees, e.g. "in woodland" or "partly overhung by trees".

Other matters

i Obvious presence of fish, e.g. in a fishing pond, would be helpful; likewise presence of waterfowl.

ii. The origin of water bodies is frequently given and may be a help by indicating past land use history, e.g. disused mill pond, old clay pit, former sand and gravel quarry or recently dug pond. However some terms, e.g. "pingo pools", can be puzzling to anyone unfamiliar with this glacial relict.

iii. For species for which accurate determination can be difficult, noted under the Helpful Hints sub-heading in the species accounts, it would help greatly if some brief confirmatory information was added, e.g. genitalia examined.

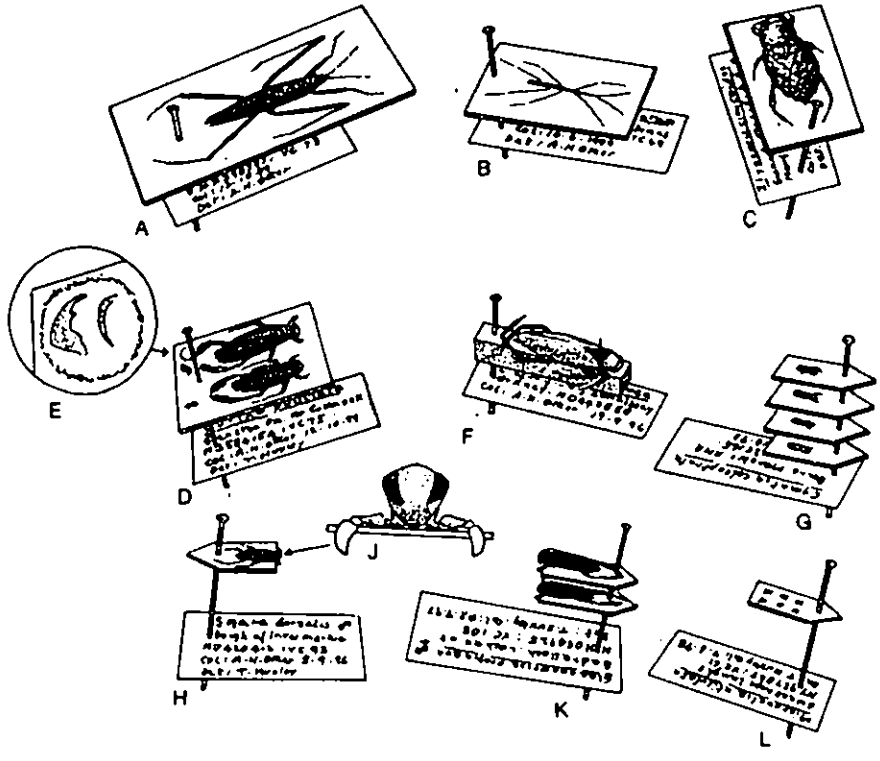
Future recording

For details of the recording scheme please contact the Biological Records Centre (see p 108). The scheme is no longer organised by the author of the *Atlas*; the name and address of the current scheme organiser is given on the BRC website: *http://www.brc.ac.uk*

APPENDIX 5

Mounting specimens in a dry collection

It is stressed that the following are only suggestions; experienced collectors will have their own methods. Because water bugs occur in such varied shapes and sizes, a variety of techniques are required.



A, **B** and **C** show large specimens on individually cut card mounts.
D shows a male and female pair of *Corixa punctata* mounted side by side.
E the parameres gummed behind the male. For absolute safety, parameres should be mounted on a microscope slide but this needs extra materials.
F shows a *Notonecta glauca* staged with small headless pin on a cut length of Nu-Poly, the synthetic substitute for polyporous strips.
G shows four specimens of *Cymatia coleoptrata* from the same location mounted on card mounting points and stacked on a 38 mm x 0.55 mm long pin.
H show a single male of *Sigara dorsalis* mounted on a card mounting point and, in J, how the specimen is mounted so as to present the palae for examination.
K and **L** show two specimens of a large corixid *Glaenocorisa propinqua* and six specimens of the small *Microvelia reticulata*, both mounted on card mounting points.

Notes

1. The card mounting points are pinned through the pointed end, contrary to normal practice for points. Points are available in boxes of 1000 so save much cutting. Their standard size is a useful visual comparative guide to the size of specimens.
2. It is essential to use Coleoptera mounting gum (Gum Tragacanth) which allows specimen to be removed with a drop of water.
3. A good reference collection should "speak to you", i.e. be an aid to identification in the way it is set out.
4. The eventual destination of a collection should be stated in your Will and the intended recipient informed.

APPENDIX 6

Obtaining identification guides, record cards and vice-county maps

Southwood, T.R.E. & Leston, D. 1959. Land and Water Bugs of the British Isles. London: Warne. Reissued 2002 on CD-ROM and on sale from: Pisces Conservation, IRC House, The Square, Pennington, Lymington, Hampshire SO41 8GN (telephone: 01590 676622, fax: 01590 675599, email: pisces@irchouse.demon.co.uk, website: http://www.irchouse.demon.co.uk/bugs.html).

Savage, A.A. 1989. Adults of the British Aquatic Hemiptera-Heteroptera: a key with ecological notes. Freshwater Biological Association Scientific Publication, No. 50. Ambleside: Freshwater Biological Association.
Savage, A.A. 1999. Keys to the larvae of British Corixidae. Freshwater Biological Association Scientific Publication, No. 57. Ambleside: Freshwater Biological Association.
Both are available on sale from Dept DWS, The Freshwater Biological Association, The Ferry House, Far Sawrey, Ambleside, Cumbria LA22 0LP (telephone: 015394 42468, fax: 015394 46914, email: Karen Rouen kjro@fba.org.uk, website: http://www.fba.org.uk).

Biological Records Centre record cards
The RA54 (Aquatic Heteroptera) record card and general record cards are available free of charge to those who wish to contribute records to the recording scheme.
There is an order form for BRC record cards on the BRC website: http://www.brc.ac.uk or they can be ordered by post from BRC, CEH Monks Wood, Abbots Ripton, Huntingdon PE28 2LS
(telephone: Val Burton 0148 777 2402, fax: (attn BRC) 0148 777 3467, email: Val Burton vjbu@ceh.ac.uk).

Watsonian vice-county maps of Britain
BRC has a small supply of the two Ray Society maps at 1:625,000 scale. The maps are flat and each map is approximately 80cm x 110 cm. These are available free of charge for collection from BRC or if you wish to order them by post please contact Val Burton (see above) for the cost of postage.

GLOSSARY

Acid, acidic Water with a low **pH** (below 7), usually base-poor.

Alary Any flat wing-like projection; in this *Atlas* meaning wings or **hemielytra.**

Alkaline, alkalinity With a high **pH** (above 7), usually base-rich.

Allopatric Describes two species or populations not living in the same geographical area, unable to interbreed by reason of distance or geographical barrier.

Arran A large island between Ayrshire and Kintyre; part of VC 100, Clyde Isles.

Backwater A dead-end diversion of a river or large stream where there is slow flow and much vegetation, such that the habitat is more like a pond than a river.

Base-deficient Water lacking substances which react with acids to form salts (Walker, 1995).

BRC Biological Records Centre, Centre for Ecology and Hydrology, Monks Wood.

Benbecula An island in the Outer Hebrides, between North and South Uist.

Brackish Any water which exhibits salinity intermediate between sea water and fresh water (Barnes, 1994). In practice, freshwater near the coast in which there is some mixing with sea water; the mixing resulting from high tides or spray.

Britain England, Wales, Scotland and nearby off-shore islands, including Isle of Man; not including the Republic of Ireland or Northern Ireland, or the Channel Islands.

Card mount The action of sticking a specimen to a small piece of card. (See Appendix 5).

Categories Records may be placed in one of three categories: 1 = OK; 2 = needs confirmation; 3 = known incorrect. Although records placed in categories 2 and 3 are included in statistics for numbers of records, they do not show on maps and are therefore not included in statistics for numbers of 10 km squares recorded.

Clavus The front, inner, triangular part of the hemielytra. In some Corixidae, the presence of lighter areas in the dark stripes can be helpful aids to determination.

Cluster On a map, symbols (dots) showing records in 10 km squares grouped together. One may speculate whether clusters show that a species is particularly common in the area of the cluster or whether elsewhere, where there are no or few 10 km records, this is because it is under-recorded.

Collembola An Order of small wingless insects, rarely more than 5 mm long and usually much less. Provided with a forked springing organ at the rear, hence the common name Springtails.

Conductivity A measure of the amount of dissolved salts in water. Low conductivity indicates sparse amounts; high conductivity large amounts.

Corium The middle, outside, triangular part of the hemielytra, usually the largest part. The arrangement of the horizontal stripes and whether they coalesce to form longitudinal stripes, can be important diagnostic features in Corixidae.

Corixid Species of the family Corixidae, commonly called water boatmen (represented in this *Atlas* by the genera *Micronecta, Cymatia, Glaenocorisa, Corixa, Hesperocorixa, Arctocorisa, Callicorixa* and *Sigara).*

Coxa The proximal part of a leg.

Cree A river draining to Wigtown Bay, between the counties of Wigtonshire and Kirkcudbrightshire.

Disk The posterior part of the **pronotum** in Gerridae.

Distal The part of a wing, leg or antenna furthest from the point of attachment to the body.

Diurnal During a day.

Dystrophic Has several definitions. In this *Atlas* dystrophic describes waters rich in organic matter, such as undecomposed plant fragments, but in which nutrient salts are sparse. (Walker, 1995).

Entered The process of typing into the computer all available data for a record. The amount of data varies. The minimum required is Vice-county, grid reference, location name, date recorded and name of species. Rarely, the name of the person, or other source of record, is not known, in which case the recorder is entered as Anonymous.

Eutrophic Nutrient-rich water, with high levels of phosphorous, nitrogen and calcium.

Femur A proximal long part of a leg, between the **coxa** and **tibia.**

Forth Valley The low lying country between Edinburgh and Glasgow, mostly drained eastwards by the River Forth.

Genus A group of closely related species; the first half of a species specific name – e.g. *Sigara dorsalis* is in the genus *Sigara* (pl. **Genera**, adj. **Generic**). The genera into which many species of aquatic bugs - especially Corixidae - have been placed at various times in the past has varied greatly, depending on whether taxonomists classifying water bugs are "lumpers", i.e. like to keep number of genera few, or "splitters", i.e. like to split species into many genera.

Gerrid Species of the family Gerridae, commonly called pond skaters, (represented in this *Atlas* by the genera *Limnoporous, Aquarius* and *Gerris).*

Glacial relict Said of a population of a species thought to have become isolated following retreat of glacial conditions.

Grampians The mountain massif south east of the Great Glen in Scotland.

Great Glen A major topographical and geological structure running NE/SW between Inverness and Fort William, containing the three large lochs of Nevis, Lochy and Linnhe.

Hand lens A small folding magnifying glass.

Harris The southern part of the most northern large island of the Outer Hebrides; the north part being Lewis.

Heathland Countryside typically on sands and gravels, sometimes overlain by peat, where the pH is acidic, and the vegetation characterised by the presence of heathers such as *Calluna vulgaris*. Ponds in heathland are generally also acidic.

Hebridean Adjective for a species occurring in the Inner or Outer Hebrides.

Hemielytra The front wings (**Hemielytron,** sing.). Hemielytra have three parts, from front to rear called: **clavus**, **corium** and **membrane** (see Savage, 1989, p 65).

Hibernation, hibernating Used loosely to describe any condition of reduced activity during winter.

Highland counties In Scotland, counties north of the Highland Boundary Fault. Much of the Highlands, especially near the coast, is not high in altitude.

Inner Hebrides Islands nearer to the west coast of mainland Scotland than the Outer Hebrides; collectively comprising vice-counties 102, 103 and 104; the South, Mid and North Ebudes.

Instar The morphological appearance between larval moults. The periods between each instar are called stadia.

Islay An island off the south west coast of mainland Scotland, forming part of VC 102, South Ebudes.

Juvenile A specimen that is not an adult; used instead of the scientifically more correct word "larva" and in some publications "nymph".

Light traps An arrangement for attracting and capturing insects by some kind of light.

Loch, lochan Scottish words roughly equivalent to lake and pond in England. May vary considerably in size.

Membrane The posterior part of each hemielytron; partly overlaps with the membrane of the opposite hemielytron.

Metanotum The dorsal, posterior plate of the thorax, in some genera hidden by the wings.

Metasternal xiphus This is a small, generally triangular structure, found on the undersides of Corixidae, between the basal segments (the coxae) of the hind legs. The shape of the metasternal xiphus should be examined before card mounting because its shape may be diagnostically important. If several specimens of the same species and location are retained in a reference collection, one specimen can be mounted upside down.

Metasternum The rear, underside, plate of the thorax.

Moorland Country from sea-level to mid-altitude mountains, typically overlying base-deficient rocks or glacial sands and gravels; often with a covering of peat; with a vegetation of grasses, sedges, rushes and heathers; often grazed by sheep and deer. Water bodies in moorland may vary from small streams and fast or slow rivers, to very small pools in peat where drainage is impeded, to large lakes. The amount of vegetation in moorland waters may vary greatly.

Neutral With a **pH** of 7; neither **alkaline** nor **acidic**.

Oligotrophic Nutrient-poor water, with low levels of nitrate, phosphate, calcium, and other ions, and usually **acidic**.

Outer Hebrides The chain of islands running far west of mainland Scotland, from Lewis in the north to Berneray in the south, sometimes called the Outer Isles; comprises VC 110.

Pala, palae, palar The distal segment of the front legs of Corixidae. **Pala** sing., **palae** pl. and **palar** adjective, e.g. palar pegs. In all but *Cymatia* sp, the **palae** are flattened and in males of most species their shape and the distribution of palar pegs, in one or two rows, is diagnostically important.

Parameres Parts of the genital apparatus. Beginners should practice examining parameres by removing the genital capsule of a largish common corixid such as *Sigara dorsalis*. This can be done fairly easily with a long pin. The capsule will be seen to have two curved pieces on either side. These are the parameres. They should be separated from the capsule and either mounted on a microscope slide (but this requires further expense and specialist mounting fluids) or card mounted beside the specimen. The stuck down paramere(s) should be circled with a fine line of waterproof ink. Mostly only the right paramere is required. It should be positioned so that the free end points to the left as in the text figures in Savage (1989 and 1990).

pH A logarithmic index for the hydrogen ion concentration in an aqueous solution. A **pH** below 7 indicates **acidity**; above 7 **alkalinity**, at 25°C (Walker, 1995).

Phenology The study of periodic biological phenomena, especially in relation to seasonal environmental cycles (Calow, 1998). In this *Atlas*, however, phenology is selective in that it refers to the months when adult bugs are recorded, thereby often with fewer records in winter than would be shown by their actual phenology.

Pitfall traps An arrangement for catching fauna that hunt on the ground. The simplest type is a jam jar buried so that the open top is level with the ground and animals fall into the jar. In shallow water the jar top has to be level with the water surface.

Polymorphism The occurrence of distinct forms within a population.

Proboscis The tube-like, piercing and sucking mouthparts of Hemiptera, called **rostrum** or *beak* in Savage (1989).

Pronotum Plate on the dorsal surface of the prothorax, immediately behind the head. The colouring of the **disk** of the pronotum in Gerridae and the overall shape and arrangement of stripes in Corixidae can be important diagnostic characters.

Proximal The part of a wing, leg or antenna, nearest the point of attachment to the body (cf **distal).**

Raasay An island off the west coast of mainland Scotland, to the east of the Isle of Skye, in VC 104, North Ebudes.

Reference collection A collection of specimens arranged systematically so as to demonstrate differences between species.

Relict A surviving population or habitat in a small part of a formerly wider geographic range.

Rostrum See **proboscis**.

Saline lake A freshwater lake in which the water has dissolved salt derived from its watersheds (Barnes, 1994) or as a result of extraction of brine for use in the chemical industry (Savage, 1996).

Solway Counties In Scotland, the counties of Dumfriesshire, Kirkcudbrightshire and Wigtonshire, part or all of whose coast forms the northern coast of the Solway Firth.

South Uist One of the islands in the Outer Hebrides of Scotland.

Spiniform Like a thorn.

Substrate The bottom material of a water body; e.g. stony, muddy, etc.

Surfactant Abbreviation for *surface active agent*. A compound that reduces surface tension (Walker, 1995).

Tarsus **Tarsi** (pl.). The distal segment of a leg, which may be subdivided (Tarsus I and Tarsus II). The tarsi often carry one or two claws. In Corixidae, tarsus II of the posterior legs are flattened to aid swimming.This distal tarsal segment is called a claw in Savage (1989), e.g. in Fig 63, p 106. The actual claw is very small and can only be seen with high magnification after brushing out the long swimming hairs.

Teith A tributary river of the River Forth, in Scotland.

Teneral Newly emerged adult whose cuticle has not fully hardened and darkened. Teneral specimens may thus appear pale and soft.

Tibia A long part of a leg, between the **femur** and **tarsus**.

Tubercle A small rounded projection.

Tweed A major river draining into the North Sea at Berwick-upon-Tweed, much of which forms the boundary between Scotland and England.

Vernacular names English names for water bugs; sometimes called common names, although some are less common than the scientific names.

VC Vice-county.

Voucher collection Specimens kept in a collection with full data labels, including grid reference, as evidence of where each specimen was collected. Crucial for uncommon species, for records new to a vice-county, or for re-checking determination if there are any later doubts.

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