

**BRITISH FRESHWATER MALACOSTRACAN "SHRIMPS"**

DAVID W. SUTCLIFFE

(Dr D. W. Sutcliffe, c/o Freshwater Biological Association,  
The Ferry House, Far Sawrey, Ambleside, Cumbria LA22 0LP, England)

**Introduction**

This short divertissement touches lightly on the vagaries of vernacular names for culinary and other crustaceans, gives a thumbnail sketch of the distribution of the common and less well-known freshwater "shrimps" in the British Isles, and speculates on some likely changes in the future. The animals are illustrated by Gledhill et al. (1992) who also give further details of the taxonomy, distribution and ecology of the British freshwater Malacostraca.

**Shrimps and prawns**

When is a prawn not a prawn? The reply, "when it's a shrimp" is, it seems, more than mere jocular allusion to size. The Collins Paperback English Dictionary (1986 edition) defines shrimps as "any of a genus [*sic*] of chiefly marine decapod crustaceans having a slender flattened body with a long tail and a single pair of pincers", whereas prawns are "any of various small edible marine decapod crustaceans having a slender flattened body with a long tail and two pairs of pincers". This is an attempt to rationalise a very irrational and somewhat cavalier colloquial terminology. In fact the term "shrimp" has been applied to an extremely wide assortment of aquatic crustaceans that belong in the Malacostraca, a subclass of the class Crustacea and including the familiar crabs, crayfishes and lobsters. Indeed, from a perusal of an extensive literature spanning this century, it appears that any malacostracan not a crab, crayfish or lobster is probably a shrimp - unless it is a prawn (!) or a member of the order Isopoda which are familiarly known as "slaters" or "lice", including the freshwater hoglouse, *Asellus*. In passing we may also note that many other kinds of Crustacea are also called shrimps as, for example, the ostracodan seed shrimps or mussel shrimps (Chapman & Lewis 1976) in the subclass Ostracoda, which are relatively common in Britain (Griffiths & Evans 1991). Much less common are the anostracan fairy shrimps (*Chirocephalus*; *Tanyrastix*) and the notostracan shield shrimps or tadpole shrimps (*Triops*), rare in Britain (Bratton & Fryer 1990); all are in the subclass Branchiopoda.

### **Decapod edible shrimps (and prawns)**

Edible shrimps from shallow coastal waters are familiar to everyone. In zoological literature they are often referred to as the "true shrimps" but, as in popular parlance, there is no obvious reason why some are termed "shrimps" whilst others are "prawns". The scientific, taxonomic distinctions are often small and a single species may to some be a shrimp and to others a prawn! *Crangon crangon* (L), is undoubtedly "the common shrimp". On the other hand, although superficially resembling *Crangon*, both *Palaemonetes varians* (Leach) and *Palaemon longirostris* Milne Edwards are confusingly called prawns by some whereas to others they are shrimps. Both, like *Crangon*, are almost colourless and translucent when alive, and both may be encountered in fresh waters far from the sea, particularly in the fenland dykes and broads of East Anglia. Their life history and biology is briefly described by Smaldon (1979) who sensibly suggests that the best way of dealing with the etymological confusion surrounding shrimps and prawns is to use the appropriate family name as a prefix, e.g. palaemonid shrimps (or prawns) for Palaemonidae, and crangonid shrimps for Crangonidae. All are classified in the order Decapoda and superorder Eucarida (in which the carapace is fused with all the thoracic somites) and are sometimes referred to as the true eucaridan shrimps.

In fact the possession of a carapace is a characteristic feature of true shrimps, and of *Mysis relicta*, the opossum shrimp. All others mentioned in the remainder of this article do not possess a carapace, and strictly they should not be called "shrimps". Nevertheless, commonly-accepted usage is so well entrenched and so convenient that no doubt it will continue to be used, as herein.

### **Peracaridans**

Except for bathynellids, all of the animals mentioned below are classified in the superorder Peracarida, characterised by having a ventral broodpouch in which the eggs (embryos) are carried whilst they develop into miniatures of the adults. All but *Mysis* are members of the order Amphipoda and suborder Gammaridea.

### **Mysids**

The order Mysidacea contains smallish shrimps that live chiefly in marine and coastal waters. However, a few, e.g. *Neomysis integer* Leach, can survive long periods in fresh water and one is a true freshwater species: *Mysis relicta* Loven, the opossum shrimp, presumably so-called because it has a pair of very large, prominent eyes. The specific name *relicta* refers to

its inclusion in an assemblage of taxa thought to be a post-glacial "relict fauna" occurring in northern Europe and North America, where *relicta* is widely distributed, preferring waters with pH above 6.0. Recorded only from Ennerdale Water in Britain, where it is elusively rare-(Fryer 1981), the opossum shrimp is common in some of the large lakes and rivers/of Ireland. In lakes, *M. relicta* lives in deeper, cooler waters during the day but migrates into surface waters at night to feed on phytoplankton, zooplankton and detrital material (Beeton & Bowers 1982; Grossnickle 1982).

### **Gammarid shrimps, scuds (and waterfleas)**

*Gammarus pulex* (L.) is familiarly known as the common freshwater shrimp. It is a member of the family Gammaridae which contains several thousand species, some 900 of them in fresh water - including about 240 species in Lake Baikal. *G. pulex* was first described in 1758 by Linnaeus, under the name *Cancer pulex*, and is formally redescribed by Pinkster (1970). It is widely distributed and common throughout Europe, and is used as the "type" species for a group of about 30 European species that are all morphologically very similar (Karaman & Pinkster 1977). *G. pulex* is not, however, common everywhere in the British Isles nor in Europe, being completely absent from Norway where *Gammarus lacustris* Sars is the common freshwater shrimp (Okland & Okland 1985).

Throughout its continental range, *G. pulex* is pre-eminently a freshwater organism although it occasionally occurs in coastal and inland saline waters in France and Germany (Karaman & Pinkster 1977). In Britain, *G. pulex* is also well known for being averse to acid waters (pH below 5.5).

*G. pulex* is not universally known as a "freshwater shrimp". With two other species (*G. fossarum* Koch and *G. roeseli* Gervais), *G. pulex* is common in the streams and rivers of Germany where the vernacular name is Flohkrebs (water-flea), not to be confused with Flufskrebs (river-crayfish) or Bachkrebs (stream-crayfish). Moreover, from ecological observations it has even been proposed that *G. pulex* should be called the Gemeiner (common) Flohkrebs, to distinguish it from *G. fossarum*, the Bachflohkrebs, and *G. roeseli*, the Flußflohkrebs, the latter two names denoting the main habitats of streams and large rivers respectively (Meijering 1971). In Britain (and North America) the term waterflea is reserved for microscopic crustaceans such as *Daphnia* and *Bosmina* in the order Cladocera, subclass Branchipoda, which are quite different from malacostracan shrimps, true or otherwise!

Incidentally, *Bosmina* occurs in the zooplankton of lakes. It is the FBA's logo in the top right-hand corner of the front cover of this Forum, and is also printed on the new tie for Members of the FBA. Appropriately, the FBA's River Laboratory in Dorset adopted *Gammarus (pulex)* as its logo,

reflecting the importance of this shrimp in the invertebrate communities of lowland rivers.

Some species of *Gammarus* and closely related marine-littoral genera (Lincoln 1979) commonly occur in estuaries and the intertidal zone of the seashore. They are generally known in Britain as "scuds", a term also used in North America, referring to the characteristic manner in which all the *Gammarus* species (including those in fresh water) frantically scud and scuttle into hiding when suddenly disturbed. Nevertheless, long-accepted usage ensures that in Britain, at least, *G. pulex* is a "shrimp" and this is a very convenient common name to use for all freshwater species of *Gammarus*. Indeed, it can be applied to any of the numerous small amphipods living in subterranean waters, such as *Niphargus* and *Niphargellus* (cave-shrimps and well-shrimps; see below). *Gammarus insensibilis* Stock, inhabiting brackish lagoons on the south and east coasts of England (Sheader & Sheader 1987), is called the sand lagoon shrimp. Rare in Britain, it is now protected under Schedule 5 of The Wildlife and Countryside Act 1981 (Variations of Schedules) Order 1988.

### Distribution of native gammarids

In the southern counties of England almost every kind of running (lotic) or standing (lentic) freshwater habitat contains *G. pulex*. Because this is now regarded as a commonplace fact amongst freshwater biologists, collected specimens probably rarely receive more than a perfunctory examination. *G. pulex* is indeed the common gammarid shrimp here and, if the animals are strongly reddish-brown in colour and frequently occur paired — with a larger male carrying a smaller female in most months of the year (there may be fewer pairs in autumn) — then almost certainly they are specimens of *G. pulex*. Nevertheless, care should be taken to check that pale (greyish) specimens are not *Crangonyx pseudogracilis*, which is becoming commoner in southern England (see later), or pale specimens of *Gammarus lacustris*. So far no-one has recorded finding any of the closely related continental species from the *G. pulex* group, such as *G. fossarum* (Karaman & Pinkster 1977). However, *G. lacustris* was found recently (1984) in ponds at Rye Harbour Nature Reserve (Dr E. Goldie-Smith, pers. comm.), and also in the River Wandle, a tributary of the River Thames (Aston & Andrews 1978). The last record is particularly unusual as it is the first time, to my knowledge, that *C. lacustris* has been found in a lotic habitat in Britain. As its specific name implies, this species generally inhabits lentic habitats throughout most of its enormous geographical range across the northern regions of North America and Europe. However, it does occur in streams and rivers in some areas on both continents (Karaman & Pinkster 1977).

In Britain, *G. lacustris* is commoner further north and in some lakes it may be the only species present, though not infrequently it coexists with *G. pulex* (or *G. duebeni* in Ireland). *G. lacustris* may be extending its range further south in England, or perhaps in the past it has not been so diligently searched for and identified. An experienced eye can identify live specimens in the field, using a hand-lens, but examination under a microscope may be needed in order to be certain. Live animals are normally light-brown to greyish in colour, often with a slightly bluish tinge, but unfortunately some specimens of *G. pulex* are also pale in colour, especially when they have recently moulted (Adams et al. 1983). When killed in very dilute formaldehyde (now regarded as a hazardous substance, IPOCS 1989), *G. lacustris* retains its natural light colouration whereas *G. pulex* becomes strongly reddish, due to precipitation of carotenoids. This is a very effective way of searching for odd specimens of *G. lacustris* amongst large numbers of *G. pulex*. I have used it on many occasions in the field and record here my indebtedness to Professor H. B. N. Hynes who told me about it when I had just begun to take an active interest in the distribution of *Gammarus*.

In the extreme southwestern tip of England, in streams on the Lizard peninsula, the common gammarid shrimp is *Gammarus duebeni* Liljeborg. This species has a more elongated and larger pair of eyes but is otherwise very similar in general appearance to *G. pulex*. Distributed rather sporadically in brackish habitats round the coastlines of northern Europe, and on the east coast of North America, *G. duebeni* occurs in some inland saline areas of northern England (Holland 1976; Fryer 1978; Savage 1982). *G. duebeni* also occurs in a few localised freshwater streams on the west coast of mainland Britain, on the Isle of Man — where it is common, and in streams and lakes in Ireland. In most of Ireland *G. duebeni* is in fact the commonest freshwater gammarid shrimp; *G. pulex* has only recently entered the country, by deliberate introduction into Northern Ireland (Strange & Glass 1979), although it is spreading and apparently can displace *G. duebeni* (Dick et al. 1990). *G. duebeni* is also the common shrimp in the burns of Orkney and Shetland, but shares many of the lochs with *G. lacustris*. *G. pulex* is absent from the Shetland Isles but it was collected recently from a burn on Orkney (Heppleston 1984). It has also been found in the northern tip of mainland Scotland, a region where *G. pulex* was formerly thought to be absent.

Thus, although *G. pulex* is widespread and common in the south of Britain and occurs sporadically elsewhere, in the north and west of the British Isles the commonest freshwater shrimps are *G. lacustris* and *G. duebeni*. Moreover, even in its stronghold, *G. pulex* increasingly has to coexist or compete with two alien amphipod shrimps that are spreading in fresh waters.

### **An alien gammarid from North America**

*Gammarus tigrinus* Sexton is a native of North America, where it occurs primarily in coastal brackish habitats. This gammarid shrimp was probably introduced into Britain via bilge water and/or ballast water in ships entering western ports such as Bristol, Liverpool and Belfast, possibly in the late 19th or early 20th century. It tolerates slightly saline water. *G. tigrinus* is spreading eastwards through the waterways of the English midlands and may be expected to continue expanding its range. In 1982, *G. tigrinus* was found in the stomachs of perch (*Perca fluviatilis*) caught in Lough Conn, County Mayo, Ireland (O'Grady & Holmes 1983). It has been present in Lough Neagh, Northern Ireland, for most of this century and is now also common in nearby Lough Erne (Strange & Glass 1979). Live specimens of *G. tigrinus* tend to be yellowish-green in colour with darker transverse bands across the body, as indicated by the specific name *tigrinus*. During the spring and summer breeding season, mature males possess long curled setae on the second pair of antennae and the pereopods (walking legs), so this shrimp is readily distinguished from *G. lacustris* and *G. duebeni*. (Some large males of *G. pulex* also have long curled setae on the gnathopods and anterior pereopods.) *G. tigrinus* may be confused with *G. zaddachi* which is similar in colouration and sometimes has curled setae on large males, although these usually have conspicuous orange-red spots along the abdomen, when alive. *G. zaddachi* is a common estuarine species that enters fresh waters in lowlying coastal areas.

### **An alien crangonyctid from North America**

*Crangonyx pseudogracilis* Bousfield has been spreading rapidly since its introduction (by unknown means) into Britain and discovery, in Regent's Park, London, in the 1930s. Like *G. tigrinus*, it is a native of North America, where it is widespread in freshwater habitats, although it also tolerates slightly saline water. *C. pseudogracilis* has become common and widespread throughout most of lowland Britain and now also occurs in northern Scotland, including catchments of the rivers Ugie (near Peterhead) and Lossie (near Elgin), and it is common in Loch Ness. The shrimp has also been reported from a pond in Dublin, Ireland. Live specimens resemble small pale specimens of *G. pulex*, with which it not infrequently occurs. However, *Crangonyx* is more translucent, often with a bluish tinge, it walks upright instead of scuttling on its side, and the tiny males only pair with the much larger females for a brief period in order to mate. By examining the posterior pereopods (large walking legs) on preserved specimens, *Crangonyx* is immediately identified by the

presence of a strongly serrated posterior edge on the enlarged basipodite or basis of the limb.

Crangonyctids are an ancient group of freshwater animals that, like the cambarid crayfishes, have radiated into numerous species in North America, occupying both epigeal (surface) and hypogean (subterranean and interstitial) fresh waters. In Eurasia they are mostly hypogean, the surface waters being occupied by numerous gammarid species. One of the hypogean species (*C. subterraneus*) is a native of Britain (see later).

The original introductions of a North American crangonyctid and a gammarid may well have occurred contemporaneously with the introductions of three North American molluscs (*Sphaerium transversum*, *Menetus* = *Planorbis dilatatus*, and *Physa* cf. *heterostropha*) during the 19th century (McMillan 1990).

### **A tubicolous corophiid**

The tube-building shrimp *Corophium* is mainly restricted to brackish and salt waters, where it lives in immense numbers in intertidal mudflats and provides an important source of food for wildfowl. Several species occur in fresh or slightly brackish water in Europe and of these, two species occur in Britain (Lincoln 1979). *Corophium multisetosum* Stock builds burrows in sand or clay near the mouths of rivers in Norfolk, Suffolk, Sussex, Devon and Cornwall. *Corophium curvispinum* Sars occurs in the canals and waterways of the English midlands, building its tubes on a variety of substrata including waterplants, e.g. *Vallisneria* and *Potamogeton* (Bratton 1982). There is an isolated record for the River Swale in Yorkshire (Pygott & Douglas 1989).

### **A semi-terrestrial talitrid**

Shoreline amphipods in the family Talitridae are generally and aptly known as "sandhoppers". One, *Orchestia cavimana* Heller, occurs in fresh waters in the north, the midlands and eastern England (Gledhill et al. 1992). Possibly it is more widely distributed but seldom looked for at the margins of streams and rivers.

### **Future changes in distribution of amphipod shrimps**

During the next decade, *C. curvispinum*, *C. pseudogracilis* and the four common *Gammarus* species mentioned above are all likely to expand their ranges in the British Isles. Movement across watersheds into new catchments presumably occurs rather sporadically, for example by transport in the plumage of waterfowl and the fur of mammals (Swanson 1984). Whether *Gammarus* can actively walk across land from one

catchment to another is not known, although *C. duebeni* can certainly survive for long periods out of water and moves about on land (Forsman 1951; Hynes 1954; Bulnheim 1979). Transport by human agencies is likely to increase, including ever-growing numbers of very mobile anglers, and biologists wielding pondnets. Uninspected seams in a damp pondnet can transport small, live specimens of *Gammarus* over long distances in the course of a day (pers. observ.).

*Corophium curvispinum* is spreading rapidly through large waterways in western Europe (Jazdzewski 1980; Scholl 1990) and may be expected to continue its expansion here in Britain. *Gammarus tigrinus* is also spreading fast in western Europe following its deliberate introduction into several large rivers in Germany, using shrimps taken from Wyken Slough in England (Fries & Tesch 1965; Ruoff 1968; Bulnheim 1985). This was done to provide a food organism for fish; populations of the native species of *Gammarus* had declined or disappeared due to pollution, including a rise in chlorinity. By 1964 the alien shrimp was also common in the IJsselmeer and northern parts of Holland (Pinkster et al. 1977), possibly originating from deliberately introduced specimens which were collected from Lough Neagh, Northern Ireland, in 1960 (Nijssen & Stock 1966). During its subsequent explosive spread in the Netherlands during the 1960s and 1970s, *G. tigrinus* apparently displaced *G. pulex* from many of its freshwater habitats and displaced *G. duebeni* and *G. zaddachi* from some of their brackish habitats. Later on these two brackishwater species reappeared when *G. tigrinus* inexplicably disappeared (Pinkster & Platvoet 1983; Platvoet et al. 1989). Savage (1982) describes a similar decline in numbers of *G. duebeni* (and corixid waterbugs) when *G. tigrinus* was introduced into the saline Watch Lane Flash in Cheshire. A subsequent decline in the *G. tigrinus* population was followed by a rise in the population of *G. duebeni*. A decline in numbers of *G. duebeni* and *G. lacustris* may have occurred when *G. tigrinus* colonised Lough Conn in Ireland (O'Grady & Holmes 1983).

These rapid increases in populations of *G. tigrinus* and its explosive spread in new areas are due to a very high reproductive capacity. At 15-20°C, sexual maturity is attained within 4-5 weeks from birth and four generations from a single female may be reproducing simultaneously by the end of the summer breeding season (Hynes 1955; Chambers 1977; Pinkster et al. 1977; Hackstein et al. 1986). *Crangonyx pseudogracilis* also has a high reproductive capacity, producing relatively large numbers of eggs (high fecundity) and numerous overlapping generations throughout the year, at least in relatively warm waters (Hynes 1955; Sutcliffe & Carrick 1981; Pinkster & Platvoet 1983). These two shrimps are particularly well suited for the physical-chemical conditions that currently prevail in many lowland rivers, especially in the east and south



of England, where periods of low flow, high water temperatures and increased salinities are all favourable to the introduced shrimps. It is not known if *C. pseudogracilis* can competitively displace *G. pulex* or the other native shrimps, but *G. tigrinus* certainly can do this in large waterbodies and slow-flowing or "stagnant" water. Although it is omnivorous, like all species of *Gammarus*, *G. tigrinus* is a particularly rapacious and voracious predator, feeding on other species of *Gammarus* (it is also cannibalistic) and other small invertebrates. It even attacks wounded or weakened fish (Fries & Tesch 1965; Ruoff 1968). Furthermore, like *Crangonyx*, *G. tigrinus* tolerates pollution, perhaps more so than the other *Gammarus* species in Britain ?

### **Some little-known subterranean amphipods**

Cave-shrimps or well-shrimps of the family Niphargidae are ancient gammaridean amphipods adapted for living in subterranean and interstitial waters. *Niphargellus glenniei* (Spooner) is known from Devon, *Niphargus aquilex* Schiodte, *N. fontanus* (Bate) and *N. kochianus* *kochianus* Bate are more widely spread in England and Wales, and *N. kochianus irlandicus* Schellenberg occurs in Ireland. All are less than 1 cm in length, eyeless and colourless, and are probably overlooked by the casual investigator; they may be commoner than is currently supposed and should be looked for in gravels and coarse sands in streams and rivers. The foregoing remarks are also applicable to *Crangonyx subterraneus* Bate (family Crangonyctidae) which, unlike the larger *C. pseudogracilis*, appears to be a native of Britain and Europe.

### **Syncaridan bathynellids**

Even less well-known are the ancient and primitive bathynellids. These are minute (about 1 mm in length), eyeless and colourless subterranean "shrimps" in the superorder Syncarida, which do not have a carapace and possess a series of simple two-branched limbs on the thorax, except for the last pair that are unbranched. Two species have been recorded, although the presence of only one has been substantiated. *Antrobathynella stammeri* (Jacobi) has been recorded from caves and riverine gravels in some northern counties of England, and in County Kerry, Ireland. *Bathynella natans* Vejdovsky appears to be more widespread, in riverine gravels, artesian waters and wells, but there is doubt about previous identifications of *B. natans*; they may in fact have been specimens of *A. stammeri* (Gledhill & Gledhill 1984; Gledhill et al. 1992). No doubt our knowledge of the distribution and identity of

bathynellids would be extended by careful searches in the interstitial of river gravels and sands.

### Acknowledgements

Terry Gledhill made some helpful comments on the manuscript and Ian Pettman kindly obtained some literature for me.

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