

First records of the oriental prawn *Palaemon macrodactylus* (Decapoda: Caridea), an alien species in European waters, with a revised key to British Palaemonidae

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This paper details the first recorded instance of the prawn *Palaemon macrodactylus* in Europe, at the Orwell estuary, Suffolk. The species is native to north-east Asia, including Japan and Korea, and has previously been introduced to other areas outside its natural range. Records of the abundance of caridean species, obtained from routine benthic trawl samples in the Stour and Orwell estuaries, provide a summary of *P. macrodactylus*' habitat preference in reduced-salinity waters. Consistent catches and records of ovigerous females provide evidence for the stability of the Orwell population. A revised key to British Palaemonidae is also provided.

INTRODUCTION

Many exotic marine species have been introduced into Europe since the advent of regular intercontinental transport; a directory of marine introductions to British waters has been compiled (Eno et al., 1997) which records the 51 non-native species known up to 1997. Records of additional introductions continue to be reported in the scientific literature. Many of these introductions include species from East Asia (e.g. Smith et al., 1999; Nishikawa et al., 2000; Baldock & Bishop, 2001), some of which have been reviewed as economically important (Clark et al., 1998; Rainbow et al., 2003). Successful introductions generally involve species from similar latitudes (Eno et al., 1997). The possibility of further introductions should always be considered by those involved in biological monitoring.

This paper details the first recorded occurrence of the oriental prawn *Palaemon macrodactylus* Rathbun 1902 in Europe. The species was found at the Orwell estuary in Suffolk, eastern England, during a series of ecological surveys carried out on the Stour and Orwell estuaries by Unicomarine Ltd on behalf of Harwich Haven Authority. The fish and shrimp monitoring surveys undertaken are described. A benthos survey (Dyer, 2000) and a biotope mapping exercise (Worsfold, 2002) have also been conducted in the area: these found several other non-native species.

Another north-east Asian species, the ascidian *Styela clava* Herdman, believed to have been introduced to Plymouth in 1952 (Carlisle, 1954; Houghton & Millar, 1960), was found during the biotope mapping exercise, as well as during the present fish monitoring surveys. This species had already been recorded by the Marine Nature Conservation Review (Irving, 1998). Other non-native invertebrate species found during the above surveys include the molluscs *Ruditapes philippinarum* (Adams &

Reeve), *Potamopyrgus antipodarum* (Gray), *Crepidula fornicata* (L.), *Crassostrea gigas* (Thunberg), *Mya arenaria* L., *Petricola pholadiformis* Lamarck, and *Ensis americanus* (Gould in Binney), and the barnacle *Elminius modestus* Darwin. The Chinese mitten crab (*Eriocheir sinensis* H. Milne-Edwards) has also been reported to occur in the Stour estuary (Rainbow et al., 2003), but has not been found there by the present authors. In addition, the sponge *Suberites massa* Nardo, found in the Orwell estuary during the biotope and trawl surveys, may be a cryptogenic species, as it has been recorded in British waters only near ports (Eno et al., 1997). A review of the physical and biological features of the Stour and Orwell estuaries is provided in Barne et al. (1988).

Palaemon macrodactylus is a large, edible palaemonid which is native to Japan, Korea and northern China (Rathbun, 1902; Newman, 1963). It was introduced into San Francisco Bay, California, prior to 1957 (Newman, 1963) and has since become well-established along most of the west coast of North America (Ricketts et al., 1968; Cohen, 1996; Williams, 1997; United States Geological Survey, 2002; California Resources Agency, 2002). Newman (1963) has discussed the possible means of introduction, and the expansion of the species' range has been documented by other authors (Ricketts et al., 1968; Cohen, 1996; Williams, 1997; United States Geological Survey, 2002; California Resources Agency, 2002). A number of papers and reports have been published which concern the species' ecology and physiology in American waters (Born, 1968; Sitts & Knight, 1979; Siegfried, 1980, 1982). Instances of the occurrence of the species in two Australian states have also been recorded (Pollard & Hutchings, 1990). However, the only confirmed instance is that recorded for an area near Newcastle, New South Wales (Buckworth, 1979; Holthuis, 1980). There is also an unsubstantiated record from South Australia (Williams et al., 1978, 1982; Carlton, 1985). In the United States,

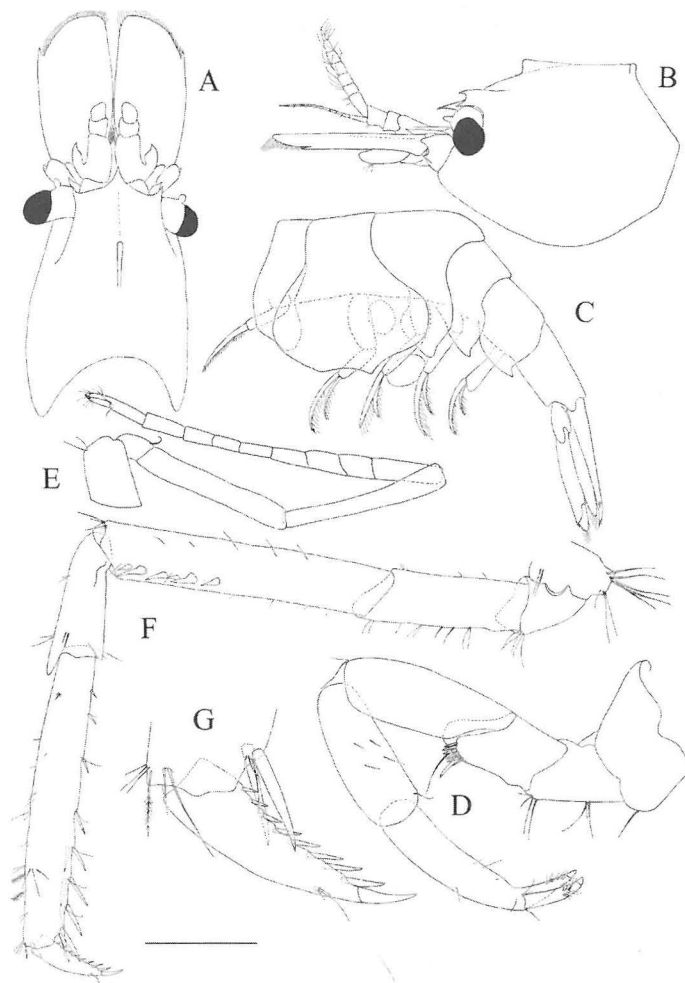


Figure 1. *Bythocaris cosmetops* Holthuis, 1951, Bay of Biscay: (A) anterior part of body in dorsal view; (B) anterior part of body in lateral view; (C) posterior part of body in lateral view; (D) left first pereiopod; (E) left second pereiopod; (F) left third pereiopod; (G) dactylus of left third pereiopod. Scale bar: A,B, 1.77 mm; C, 2.48 mm; D, 0.42 mm; E,F, 0.60 mm; G, 0.21 mm.

dredging. These fishing grounds were intensively sampled at five selected Sites A–E (34 suprabenthic hauls from 94 to 143 m water depth) during INTRIGAS and TROPHAL cruises. *Bythocaris cosmetops* was absent in all 24 daytime hauls and only detected in a night-time haul from Site D (10–40 cm near-bottom water layer). Therefore, this small species must be considered as very rare in the area and perhaps only exceptionally captured when swimming freely in the near-bottom water layer during night-time. Very little is known about the biology of other *Bythocaris* species. Some species like *B. simplicirostris* G.O. Sars, 1870 are known to be suprabenthic, whilst others like *B. leucopis* G.O. Sars, 1879 and *B. payeri* (Heller, 1875) are benthopelagic (Brattegard & Rømer, 1998). The present *B. cosmetops* specimen was collected in the so-called 'thermic bell', a cold bottom water mass (<11.5°C) centred along the mid-continental shelf (including the 'Grande Vasière' area) that maintains lower temperature conditions all year round. This is consistent with the boreal/Arctic and deep-sea distribution of most *Bythocaris* species, which have obvious affinities for cold waters, but conflicts with the tropical and circalittoral origin of the holotype of *B. cosmetops*.

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