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Rapid Communication

First record of the Ponto-Caspian amphipod *Chelicorophium robustum* (G.O. Sars, 1895) in Great Britain with notes on the method of collection

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Abstract

The invasive non-native Ponto-Caspian amphipod *Chelicorophium robustum* has been recorded for the first time in Great Britain. In October 2021 a single specimen was found at a site on the River Thames near Hampton, London during a programme of surveys undertaken on behalf of Thames Water Utilities Ltd. The programme employed a novel method of multi-habitat survey devised to target the collection and identification of aquatic non-native species from a range of water body types. Surveys were conducted in accordance with a strict biosecurity protocol. Non-native taxa found alongside *C. robustum* included other Ponto-Caspian crustaceans, bivalve molluscs and a polychaete worm plus additional invasive macroinvertebrates from Asia, North America and New Zealand.

Key words: crustacean, multi-habitat survey, invasive non-native species, freshwater, River Thames

Introduction

Growing numbers of non-native crustaceans have established in European inland waters over recent years. Foremost among these are amphipods from the Ponto-Caspian basin and North America (Holdich and Pöckl 2007). Of these, some 30 species of Ponto-Caspian amphipod have spread outside of their native region (Gallardo and Aldridge 2013), and 12 have been identified as potential threats (e.g. through predation or amensalism) to British freshwaters in previous horizon risk assessments (Gallardo and Aldridge 2015).

Prior to this report, two species of corophiid amphipod crustacean have been recorded in Great Britain. One of these, the Caspian mud shrimp, *Chelicorophium curvispinum* (G.O. Sars, 1895), was described by Gallardo and Aldridge (2015) as "already recorded in Great Britain but showing a limited distribution". This species has been present in this country since at least the 1930s (Crawford 1937) and currently, nearly 3,500 records are shown on the National Biodiversity Network Atlas (NBN 2021) and the

species is considered widespread across England. The other recorded species is *Chelicorophium chelicorne* (G.O. Sars, 1895), reported by the Environment Agency from two locations in England (Berkshire in 2005 and Shropshire in 2012) (NBN 2022).

Here, we report the first record of a single adult specimen of the non-native Ponto-Caspian amphipod *Chelicorophium robustum* in Great Britain from the River Thames near Hampton. Below, we outline the specific sampling methods and discuss the novel species.

Materials and methods

Multiple locations, including the River Thames at Hampton, were surveyed for invasive non-native species (INNS) in 2020 and 2021. Surveys were undertaken by Ricardo Energy & Environment and Instar Ecology on behalf of Thames Water Utilities Ltd to inform the environmental appraisal process for water resource supply options and requirements for mitigation measures during construction and operation of water resource schemes.

Multi-Habitat Survey

The following novel multi-habitat survey (MHS) method was devised by P. Sibley to facilitate a relatively quick, robust, targeted and repeatable procedure for the identification and collection of INNS over a range of water body types, including rivers, canals and still waters and where entry to the water may not be possible. Each MHS comprises the following parts:

Part i) Make a visual assessment over at least 200 m of the water's edge and bank for macrophyte INNS, signs of potential non-native fauna (e.g. colonies of mussels or burrows) and possible focal points for colonisation by INNS (e.g. artificial structures such as pontoons). At still waters the perimeter of the waterbody is, where practicable, walked in its entirety and the leeward shore and any strandline is examined.

Part ii) Sample macrophytes with a grapnel at a minimum of three points per site, where a series of five throws is made in a fan pattern. Any resident macrophyte INNS are recorded using a relative scale of abundance. Other INNS, such as clumps of mussels, retrieved by grapnel are also recorded. This element of the MHS is also useful for determining the presence of snags and can help determine whether the deployment of a dredge is advisable. The use of flexible tines is recommended.

Part iii) Sample targeted macroinvertebrate INNS for three-minutes per site from the bankside or shallow margins where appropriate. Sampling effort should target multiple habitat types including features of interest such as artificial structures, patches of soft and coarse "natural" substrate and stands of vegetation or floating algal mats. Long sections of watercourse or large still waters may be surveyed at multiple sites. This element yields a single composite macroinvertebrate sample per site and may include the use of one or all of the following, depending on the nature of the site:

- Metal-framed pond net with detachable long handle (at least 3 m), 25 cm frame width and mesh size < 1 mm aperture. This should be used along the bank and as deep as possible at full extension, to sweep the water column and any cryptic areas. It should also be used to lightly sample different substrate types, including patches of soft sediment, plants and algae. Areas of coarse or artificial substrate such as boulders, concrete or sheet piling should be actively targeted and scraped. For example, the Ponto-Caspian amphipod *Dikerogammarus haemobaphes* (Eichwald, 1841) has an affinity for a range of vegetative and hard substrates (Knight et al. 2017) and the related *D. villosus* (Sowinsky, 1894), has a preference for coarse substrate and artificial surfaces (Clinton et al. 2018).
- Hand-held lightweight naturalists' dredge, frame size 31 cm × 19 cm, mesh size < 1 mm aperture. This may be used where netting is not possible to sweep the water column and sample the substrate surface, being most effective on soft sediments. It will typically provide a horizontal reach of up to 10 m.
- Manual search, with the aid of a bathyscope where necessary, for INNS associated with or attached to submerged objects and plants or swimming at the water's surface.

Multi-habitat surveys may be supplemented by additional survey elements, such as the collection of environmental DNA (eDNA).

Biosecurity

A strict biosecurity procedure is to be followed after the MHS, whereby all equipment is visually checked for INNS and treated with Virkon® Aquatic disinfectant. Net, frame, grapnel and dredge, if used, are all immersed in a disinfectant solution within a large waterproof dry bag, according to the duration and rate specified in Bradbeer et al. (2020).

Collection of Chelicorophium robustum

The specimen of *C. robustum* reported here was found using MHS in a macroinvertebrate INNS sample collected by long-handled net from the River Thames near Hampton (Figure 1) at National Grid Reference TQ 13181 69115. The location is approximately 10 km upstream of the tidal limit. and the river here bifurcates around a small island, Platt's Eyot; the left-hand channel is approximately 50 m wide. The river is constrained by concrete and sheet metal piling, with boats moored along the length of the site, including off a wooden pontoon. The water in the sample area was 2–3 m deep in October 2021, and macrophytes present included the North American INNS, Nuttall's pondweed, *Elodea nuttallii* (H. St. John, 1920).

Results and discussion

In October 2021, a single adult specimen of an unknown corophiid amphipod was found by P. Sibley along with multiple specimens of the Ponto-Caspian

Figure 1. River Thames near Platt's Eyott, Hampton, London, view downstream showing sample site from left bank. Photo by P. Sibley.

corophiid amphipod *Chelicorophium curvispinum* in the River Thames near Hampton, London (Table 1). The specimen was approximately 10 mm in length compared to a smaller typical length for *C. curvispinum* of up to about 6 mm (Lincoln 1979). Initial examination fitted the description given in Dobson (2013), and the specimen was identified as *Chelicorophium robustum* (G.O. Sars, 1895). The specimen was subsequently sent to the Natural History Museum (NHM) in London, where it was confirmed as *C. robustum* (Figure 2). This is the first record for the species in Great Britain and most likely for the islands of the United Kingdom and Ireland as a whole. Terminology for the identifying features of each Antenna 2 was provided by L. Hughes (*pers. comm.*), these being two distal teeth on peduncle article 4 and a proximal and distal tooth on article 5 (Figure 3).

Table 1. Non-native macroinvertebrates found from the River Thames near Hampton, London in 2021.

		16/03/2021	04/10/2021	Origin
Branchiura sowerbyi (Beddard, 1892)*	Oligochaete worm		+	AS
Chelicorophium curvispinum	Amphipod crustacean	+	+	PC
Chelicorophium robustum	Amphipod crustacean		+	PC
Corbicula fluminea (O.F. Müller, 1774)	Bivalve mollusc	+	+	AS
Crangonyx pseudogracilis/ floridanus agg. (Bousfield, 1958)/(Bousfield, 1963)	Amphipod crustacean	+		NA
Dikerogammarus haemobaphes	Amphipod crustacean	+	+	PC
Dreissena bugensis (Andrusov, 1897)	Bivalve mollusc	+	+	PC
Dreissena polymorpha (Pallas 1771)	Bivalve mollusc	+	+	PC
Glossiphonia verrucata (Müller, 1844)**	Glossiphonid Leech		+	NE
Hypania invalida (Grube, 1860)	Polychaete worm	+	+	PC
Physella acuta/gyrina agg. (Draparnaud, 1805)/(Say, 1821)	Gastropod mollusc	+		NA
Potamopyrgus antipodarum (J.E. Gray, 1843)	Gastropod mollusc	+	+	NZ

Origin: AS (Asian), PC (Ponto-Caspian), NA (North American), NE (North European), NZ (New Zealand).
*Branchiura sowerbyi** is generally thought to be a native of tropical and subtropical Asia (Mills et al. 1993).
*Glossiphonia verrucata*** is of uncertain status, possibly native and likely under recorded in the UK (Lindsay et al. (2020).

Figure 2. *Chelicorophium robustum* (left) and *C. curvispinum* collected October 2021 from the River Thames near Hampton, London. Photo by P. Sibley.

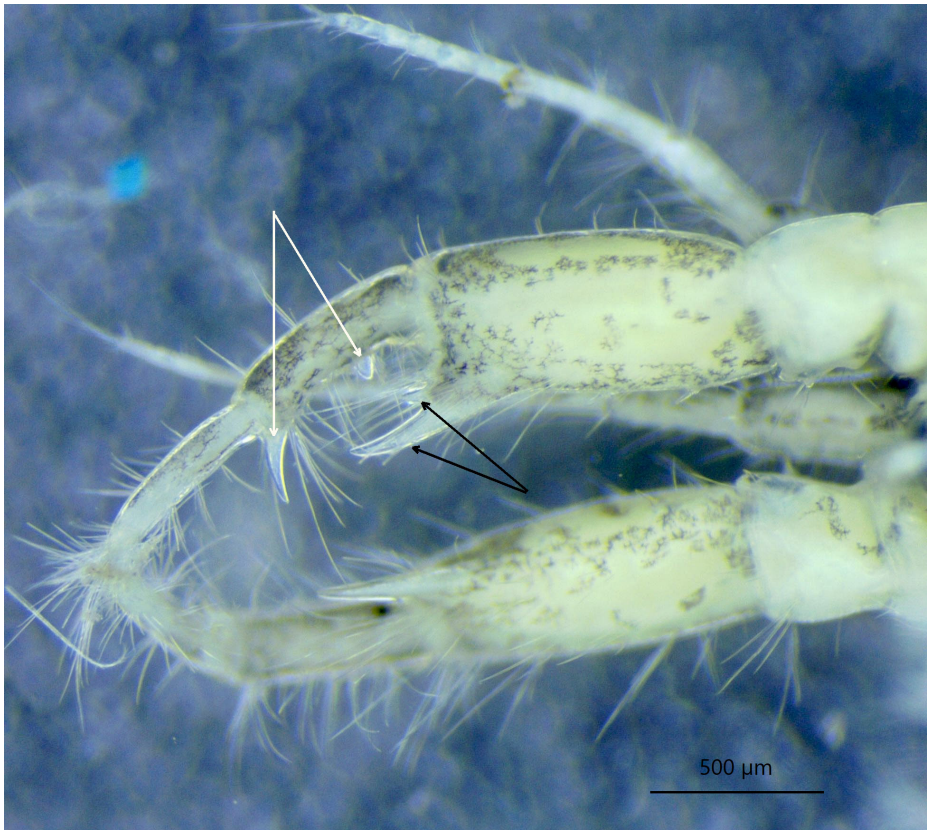

Figure 3. Antenna 2 of *C. robustum* showing two distal teeth (black arrows) on peduncle article 4 and a proximal and distal tooth (white arrows) on article 5. Photo by P. Sibley.

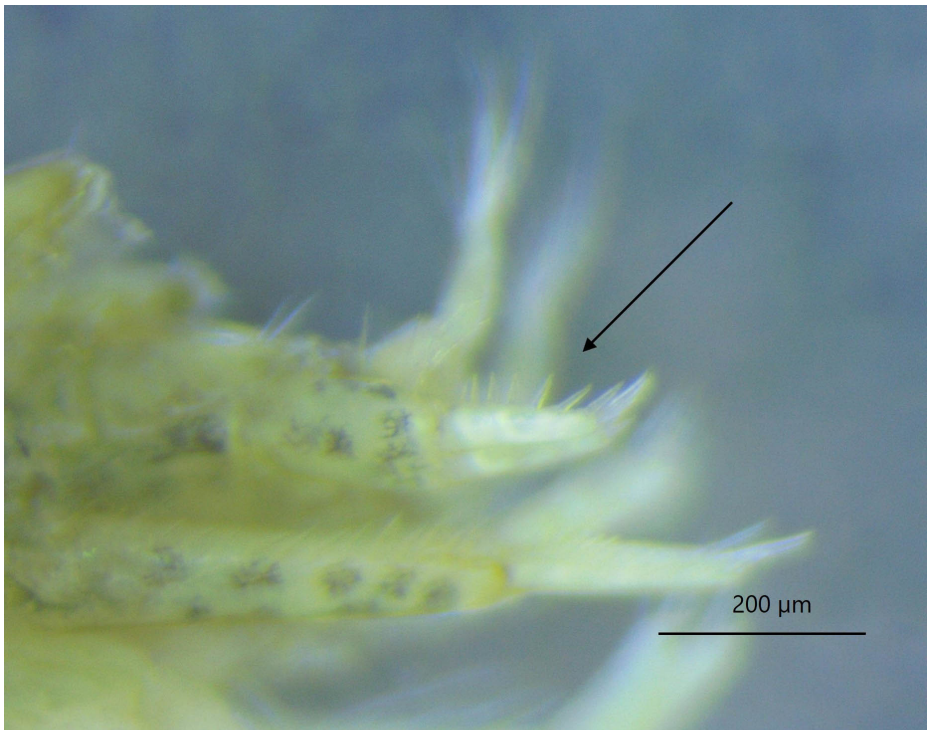

Figure 4. Uropod 2 of *C. robustum* showing 6 or 7 spines along the outer edge. Photo by P. Sibley.

The specimen also possessed six or seven spines on the outer edge of Uropod 2 (Figure 4) compared to *C. curvispinum* which possesses only three or four.

Further to the 12 taxa shown in Table 1, the following eight non-native macroinvertebrates were detected elsewhere in the Thames using MHS in 2020–21; *Eriocheir sinensis* (H. Milne Edwards, 1853) (Decapod crustacean, Asian), *Ferrissia wautieri* (Mirolli, 1960) (Gastropod mollusc, North American (NA)), *Gammarus tigrinus* (Sexton, 1939) (Amphipod crustacean, NA), *Hemimysis anomala* (G. O. Sars, 1907) (Mysid crustacean, Ponto-Caspian), *Musculium transversum* (Say, 1829) (bivalve mollusc, NA), *Menetus dilatatus* (Gould, 1841) (Gastropod mollusc, NA), *Pacifastacus leniusculus* (Dana, 1852) (Decapod crustacean, NA) and at least one species of semi-terrestrial Talitridae (Amphipod crustacea, probably originating from South-Eastern Europe).

Chelicorophium curvispinum has been found by MHS in the Thames as far downstream as Richmond Sluice (Thames Tideway) and is often present in tens per sample, occasionally hundreds. At the Hampton site, abundances in MHS INNS samples have ranged between 14 and 67 individuals. The river is a busy waterway for commercial and leisure craft, which offer one potential pathway for the introduction of *C. robustum* (Bernauer and Jansen 2006). Whereas *C. curvispinum* can become the most numerous macroinvertebrate of the littoral zone, on stones, wooden piles, plants, sponges, brickwork etc. (Nesseman et al. 1995), *C. robustum* can occur on hard bottom substrates (Jazdzewski and Konopacka 1985). It can dominate other species of amphipod, including *C. curvispinum* (Borza et al. 2011), and was designated a medium risk species with respect to likelihood of arrival, establishment and impact to native biodiversity in Britain (Roy et al. 2014).

Interestingly, Gallardo and Aldridge (2015) predicted the arrival of *C. robustum* in Great Britain between 2001–2016, based on its recorded arrival in the Netherlands in 2003. Whether slightly late to arrive or previously undetected, this first record should serve to focus further attention on the list of potential invaders that may be just over the horizon.

There is a growing understanding of INNS and the threat they present to global biodiversity but spatially-explicit information on how and where they are likely to establish at a regional scale is incomplete (Aldous et al. 2016). To manage INNS cost-effectively, the water industry needs reliable information about the species most likely to threaten their operations and the catchment areas most vulnerable to invasion. Such information also plays a critical role in the selection of water resource options to avoid the introduction of distribution pathways.

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The survey work was designed by Ricardo Energy & Environment (Ricardo) in collaboration with Pete Sibley of Instar Ecology, who devised the multi-habitat survey (MHS) method. Thames Water Utilities Ltd (TWUL) funded the programme of survey work, incorporating the collection, analysis and reporting of data. The draft manuscript was prepared by Pete Sibley with input from Ricardo and TWUL, all of whom collaborated in the decision to publish. The journal was selected by Pete Sibley with the agreement of the other parties.

Author's contribution

Pete Sibley devised the multi-habitat survey method, undertook sample collection, analysis and preliminary identification of the specimen and wrote the original draft manuscript. Martin Ferreira managed the survey planning and design, contributed to the methodology and provision of funding and in the review of the draft manuscript. Claudia Innes contributed to the survey requirements, data interpretation, funding provision and review of the draft manuscript.

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