Dikerogammarus bispinosus (an amphipod, no common name)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, February 2022
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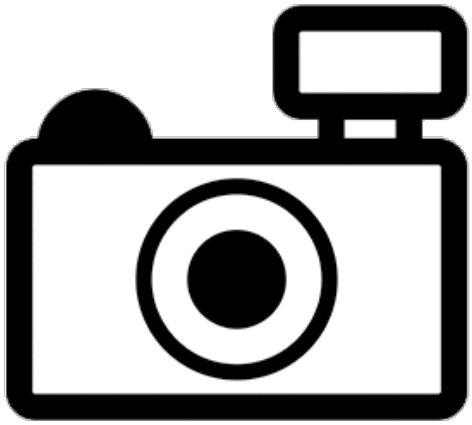
Web Version, 8/26/2022

Organism Type: Crustacean
Overall Risk Assessment Category: Uncertain



1 Native Range and Status in the United States

Native Range

From Copilaş-Ciocianu and Arabačiauskas (2018):

"*Dikerogammarus bispinosus* was described by Martynov (1925) from the lower Dnieper and appears to be native to the Black Sea basin (Cărăuşu et al. 1955; Jażdżewski and Konopacka 1988)."

From Morhun et al. (2022):

"*Dikerogammarus bispinosus* Martynov, 1925 described from the Dnieper River has been considered as native in the lower stretches of rivers that drain to the Black Sea (Martynov, 1925; Cărăuşu et al. 1955; Jażdżewski & Konopacka 1988)."

"Therefore, our results clearly indicate not only that *D. bispinosus* is native in the Caspian region, but that it has been overlooked for a long time."

Status in the United States

No records of *Dikerogammarus bispinosus* in trade or in the wild in the United States were found.

Means of Introductions in the United States

No records of *Dikerogammarus bispinosus* in the wild in the United States were found.

Remarks

Dikerogammarus bispinosus was previously considered a subspecies of *D. villosus* and therefore tracking the historical native distribution of the species may be difficult. The native or introduced status of *D. bispinosus* in the Caspian Sea has been the subject of debate. Recent molecular and morphological work (Morhun et al. 2022) makes a strong case for the species being native to the Caspian Sea. This screening follows that evidence in considering the species native to the Caspian Sea. Below is more information regarding the issue and arguments for the perspective that *D. bispinosus* is introduced to the Caspian Sea, included here for completeness.

From Copilaş-Ciocianu and Arabačiauskas (2018):

"On the other hand, it is also possible that *D. bispinosus* reached the Caspian basin earlier than the 1990s given that the Volga-Don canal was opened in 1952. Moreover, *D. bispinosus* was considered for a long time as a subspecies of *D. villosus* and only relatively recently was elevated to specific status based on mitochondrial and nuclear genetic markers (Müller and Schramm 2001; Müller et al. 2002). In addition, Pjatakova and Tarasov (1996) considered *D. villosus* (and consequently *D. bispinosus*) as a synonym of *D. haemobaphes*, so they may have overlooked *D. bispinosus* in the Caspian basin (Tarasov 1995). Similarly, it is likely that other authors did not distinguish *D. bispinosus* from *D. villosus* due to its subspecific status until 2002. Nevertheless, it appears that neither *D. villosus* is native to the Caspian basin (Mordukhai-Boltovskoi 1979), where it has been reported at least since 1964 (Mordukhai-Boltovskoi 1964), suggesting a similar dispersal route as for *D. bispinosus*."

"Thus, according to the available data, we tentatively conclude that even if *D. bispinosus* has been overlooked, it appears that it is not a native species in the Caspian basin and that it reached it between 1952 and late 1990s. Of course, at present, we also cannot completely rule out the possibility that it might be a native Caspian species."

From Morhun et al. (2022):

"Our analyses reveal that *D. bispinosus* comprises three evolutionary independent lineages that are molecularly and morphologically distinct. One lineage occurs throughout rivers in the Black Sea basin, while the other two inhabit the Caspian Sea and were found in sympatry, further reinforcing that they are distinct species. Our time calibrated phylogeny indicates that these lineages split during the Late Miocene-Pliocene, a period corresponding with the separation of

the Black and Caspian basins via the Caucasus mountain uplift. SEM [scanning electron microscopy] imaging revealed morphological differences with respect to setal patterns on the gnathopod propodi among all three lineages. Therefore, our results clearly indicate not only that *D. bispinosus* is native in the Caspian region, but that it has been overlooked for a long time."

"This suggests that the MOTUs [Molecular Operational Taxonomic Units] may in fact be distinct species, yet more material from the Black, Azov, and Caspian seas, as well as additional molecular markers and morphometry are needed to fully clarify the taxonomic status of the *D. bispinosus* lineages identified in this study."

Literature searches for this assessment were conducted for the valid name *Dikerogammarus bispinosus* and the former treatment *D. villosus bispinosus*.

Additional information, not included in this screening, for *Dikerogammarus bispinosus* was found in languages other than English.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From Horton (2016):

"Animalia (Kingdom) > Arthropoda (Phylum) > Crustacea (Subphylum) > Multicrustacea (Superclass) > Malacostraca (Class) > Eumalacostraca (Subclass) > Peracarida (Superorder) > Amphipoda (Order) > Senticaudata (Suborder) > Gammarida (Infraorder) > Gammaridira (Parvorder) > Gammaroidea (Superfamily) > Gammaridae (Family) > *Dikerogammarus* (Genus) > *Dikerogammarus bispinosus* (Species)"

"Status accepted
Rank Species"

Size, Weight, and Age Range

From Dobson (2012):

"*Dikerogammarus bispinosus*. Up to 16 mm long"

Environment

According to CABI (2022), *Dikerogammarus bispinosus* is known from freshwater and brackish habitats.

Climate

No information on climate was found for *Dikerogammarus bispinosus*.

Distribution Outside the United States

Native

From Copilaş-Ciocianu and Arabačiauskas (2018):

"*Dikerogammarus bispinosus* was described by Martynov (1925) from the lower Dnieper and appears to be native to the Black Sea basin (Cărăuşu et al. 1955; Jażdżewski and Konopacka 1988)."

From Morhun et al. (2022):

"*Dikerogammarus bispinosus* Martynov, 1925 described from the Dnieper River has been considered as native in the lower stretches of rivers that drain to the Black Sea (Martynov, 1925; Cărăuşu et al. 1955; Jażdżewski & Konopacka 1988)."

"Therefore, our results clearly indicate not only that *D. bispinosus* is native in the Caspian region, but that it has been overlooked for a long time."

Introduced

From Copilaş-Ciocianu and Arabačiauskas (2018):

"In Western Europe it has spread throughout the southern invasion corridor reaching the Rhine estuary via the Rhine-Main-Danube canal (Bij de Vaate et al. 2002)."

"[…] Lake Balaton [Hungary] where it was introduced in 1950 (Borza et al. 2015, 2017)."

From Morhun et al. (2022):

"Its non-native range stretches westwards along the middle and upper sectors of these rivers [Dnieper River in Russia and Belarus and rivers draining into the Black Sea], reaching into the Rhine [Austria, France, Germany] in western Europe (Labat et al. 2011). It is also widespread in the upper Danube River, particularly in Germany (Eggers & Martens 2001), Austria (Müller & Schramm 2001, Borza et al. 2015), and in the middle Danube in Hungary and Slovakia (Borza et al. 2015)."

Means of Introduction Outside the United States

No information regarding the means of introduction for *Dikerogammarus bispinosus* was found.

Short Description

From Dobson (2012):

"*D. bispinosus* has conical projections normally at least as high as long; each projection with only 2 spines, and the anterior projection typically has a single long seta."

From Morhun et al. (2022):

"The diagnostic morphological features for *D. bispinosus* were defined as follows: pillar-shaped protuberances on first and second urosomites, antenna 2 peduncular segments with tufts of setae longer than the underlying segment and a postero-distal lobe on the basis of the 7th pereopod."

Biology

From Kley and Maier (2006):

"Reproductive characteristics of *E. berilloni* and *D. bispinosus* resemble those of natives. Mean clutch sizes ranged between 10 and 40 and mean egg volumes approximately between 0.07 and 0.08 mm^3 and between 0.08 and 0.15 mm^3, which is roughly within the range of clutch sizes and egg volumes reported for native species (Pöckl (1993a), Pöckl (1993b); Teichmann 1982; Ward 1986)."

Human Uses

No information on human uses was found for *Dikerogammarus bispinosus*.

Diseases

No records of OIE- reportable diseases (OIE 2022) were found for *Dikerogammarus bispinosus*. No information on diseases was found for *Dikerogammarus bispinosus*.

Threat to Humans

No information on threats to humans was found for *Dikerogammarus bispinosus*.

3 Impacts of Introductions

Dikerogammarus bispinosus has been reported as introduced across Europe. No information regarding impacts from those introductions was found. Uncertainty remains regarding the invasive status in the Caspian Sea basin where this species is established.

4 History of Invasiveness

The history of invasiveness for *Dikerogammarus bispinosus* is classified as Data Deficient. Even though there are records of introductions to the upper portions of the Black Sea basin and to rivers draining into the Baltic and North seas that have led to established populations, information regarding any impacts was not found. No trade history associated with *D. bispinosus* was found. Additionally, there has been uncertainty in what has been considered the species native range.

5 Global Distribution

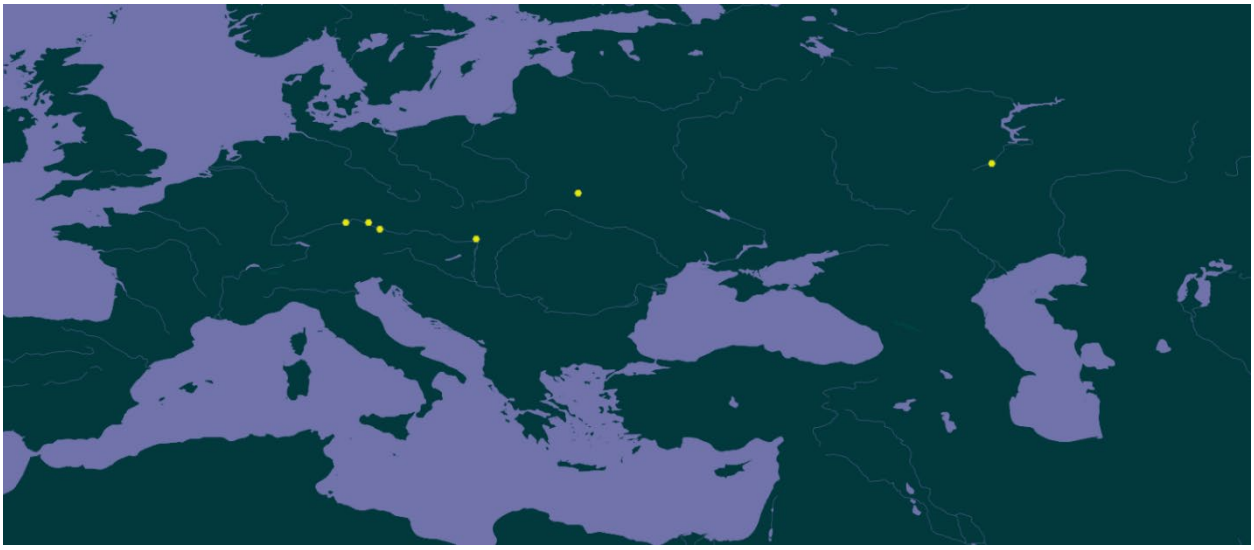


Figure 1. Known global distribution of *Dikerogammarus bispinosus*. Observations are reported from Hungary, Germany, Russia, Slovakia and the Ukraine. Map from GBIF Secretariat (2022).

Figure 2. Additional known global distribution of *Dikerogammarus bispinosus*. Observations are reported from The Netherlands, France, Germany, Austria, Hungary, Slovakia Croatia, Romania, Ukraine, Belarus, Russia, and Kazakhstan. Map created with Google Earth (2022) based on locations described by Copilaş-Ciocianu and Arabačiauskas (2018).

6 Distribution Within the United States

No records of *Dikerogammarus bispinosus* in the wild in the United States were found.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Dikerogammarus bispinosus* in the contiguous United States was generally medium to high. The largest area of high match stretched from the central Great Plains through the Midwest and Great Lakes basin, and into portions of Appalachia and the Northeast. Scattered high matches were also found throughout the Intermountain West. Large areas of medium match were found in the Southeast, upper Midwest, and extreme Northeast. Low matches were restricted to peninsular Florida, coastal reaches along the Gulf of Mexico, and along the Pacific Coast. The overall Climate 6 score (Sanders et al. 2021; 16 climate variables; Euclidean distance) for the contiguous United States was 0.716, high (scores greater than or equal to 0.103 are classified as high). Most States had high individual Climate 6 scores except for California which had a medium score; and Florida, Louisiana, and Mississippi which had low individual scores.

Figure 3. RAMP (Sanders et al. 2021) source map showing weather stations in Europe selected as source locations (red; The Netherlands, France, Germany, Austria, Hungary, Slovakia Croatia, Romania, Ukraine, Belarus, Russia, and Kazakhstan) and non-source locations (gray) for *Dikerogammarus bispinosus* climate matching. Source locations from GBIF Secretariat (2022) and Copilaş-Ciocianu and Arabačiauskas (2018). Selected source locations are within 100 km of

one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

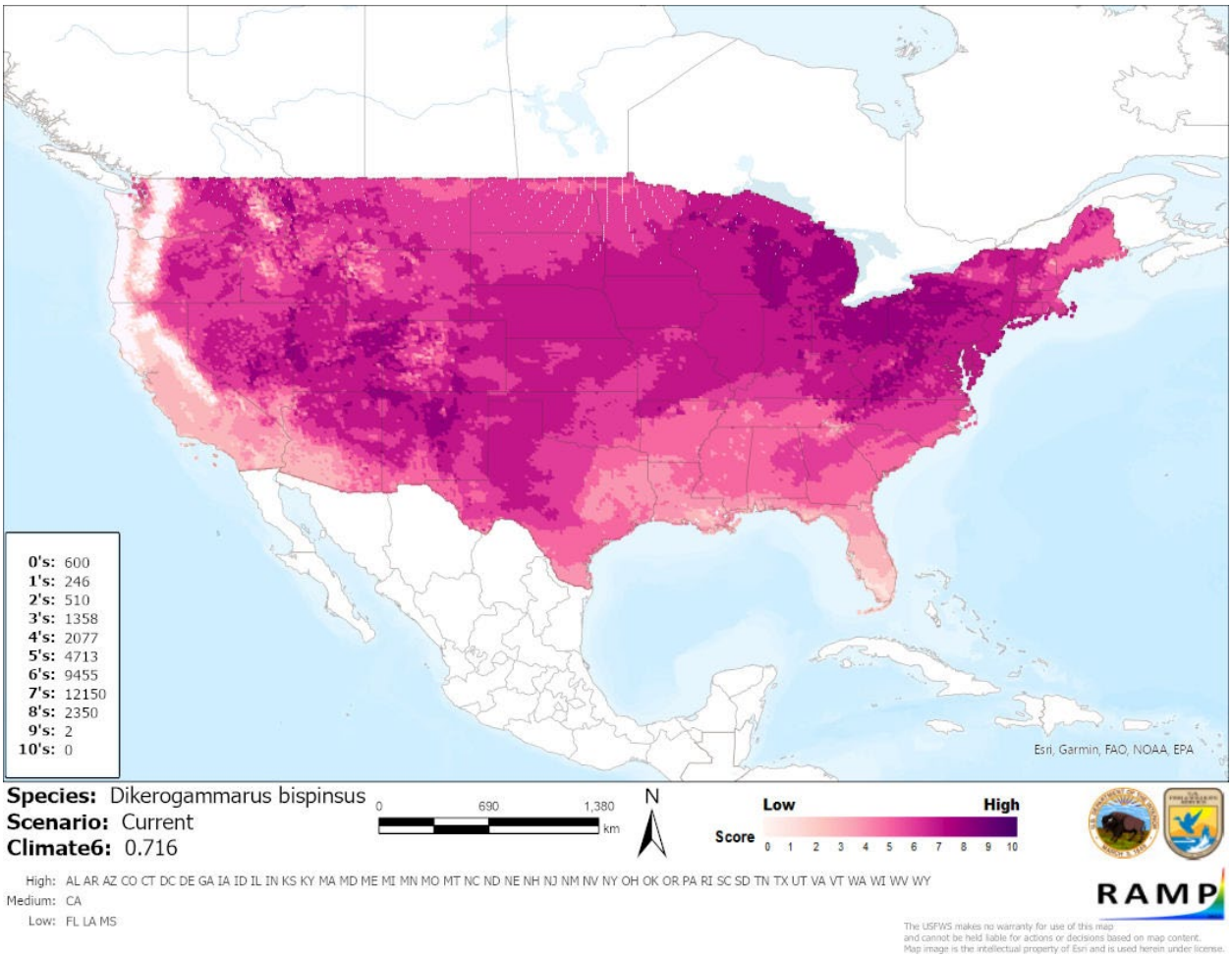


Figure 4. Map of RAMP (Sanders et al. 2021) climate matches for *Dikerogammarus bispinosus* in the contiguous United States based on source locations reported by GBIF Secretariat (2022) and Copilaş-Ciocianu and Arabačiauskas (2018). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

8 Certainty of Assessment

The certainty of this assessment is Low. Biological information for *Dikerogammarus bispinosus* was limited and some uncertainty exists regarding the native and introduced range of this species. There are records of introductions across Europe that have led to established populations, but the impacts of these introductions are unknown.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Dikerogammarus bispinosus is a freshwater amphipod native to the Ponto-Caspian region of Europe. *D. bispinosus* has been reported as introduced to the upper portions of the Black Sea basin, and to rivers draining into the Baltic and North seas. The impacts of these introductions are unknown, resulting in history of invasiveness being classified as Data Deficient. The climate match for the contiguous United States was categorically High. It was locally medium to high for most of the contiguous United States. The certainty of this assessment is Low due to a lack of biological information, uncertainty regarding the native and introduced range of this species and unknown impacts of introduction. The overall risk assessment category for *D. bispinosus* is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): Data Deficient**
- **Overall Climate Match Category (Sec. 7): High**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks, Important additional information:** No additional remarks.
- **Overall Risk Assessment Category: Uncertain**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 11.

[CABI] CAB International. 2022. *Dikerogammarus bispinosus*. CABI Invasive Species Compendium. Wallingford, United Kingdom: CAB International. Available: https://www.cabi.org/isc/datasheet/113907 (March 2022).

Copilaș-Ciocianu D, Arbačiauskas K. 2018. First record of *Dikerogammarus bispinosus* Martynov, 1925 in Kazakhstan: Invasive or overlooked native in the Caspian Sea basin? BioInvasions Records 7(3):285–291.

Dobson M. 2012. Identifying invasive freshwater shrimps and isopods. Cumbria, United Kingdom: Freshwater Biological Association.

GBIF Secretariat. 2022. GBIF backbone taxonomy: *Dikerogammarus bispinosus* Martynov, 1925. Copenhagen: Global Biodiversity Information Facility. Available: https://doi.org/10.15468/dl.rwf65b (March 2022).

Google. 2022. Google Earth desktop. Map data from SIO, NOAA, U.S. Navy, NGA, GEBCO, Landsat/Copernicus.

Horton T. 2016 *Dikerogammarus bispinosus*. World Register of Marine Species. Available: https://www.marinespecies.org/aphia.php?p=taxdetails&id=394915 (March 2022).

Kley A, Maier G. 2006. Reproductive characteristics of invasive gammarids in the Rhine-Main-Danube catchment, South Germany. Limnologica 36(2):79–90.

Morhun H, Copilaș-Ciocianu D, Rewicz T, Son MO, Khomenko A, Huseynov M, Utevsky S, Grabowski M. 2022. Molecular markers and SEM imaging reveal pseudocryptic diversity within the Ponto-Caspian low-profile amphipod invader *Dikerogammarus bispinosus.* The European Zoological Journal 89:87–101.

[OIE] World Organisation for Animal Health. 2022. Animal diseases. Available: https://www.oie.int/en/what-we-do/animal-health-and-welfare/animal-diseases/ (March 2022).

Sanders S, Castiglione C, Hoff M. 2021. Risk Assessment Mapping Program: RAMP. Version 4.0. U.S. Fish and Wildlife Service.

11 Literature Cited in Quoted Material

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

Bij de Vaate A, Jazdzewski K, Ketelaars HAM, Gollasch S, van der Velde G. 2002. Geographical patterns in range extension of Ponto-Caspian macroinvertebrate species in Europe. Canadian Journal of Fisheries and Aquatic Sciences 59:1159–1174.

Borza P, Csányi B, Huber T, Leitner P, Paunović M, Remund N, Szekeres J, Graf W. 2015. Longitudinal distributional patterns of Peracarida (Crustacea, Malacostraca) in the River Danube. Fundamental and Applied 187:113–126.

Borza P, Huber T, Leitner P, Remund N, Graf W. 2017. Current velocity shapes co-existence patterns among invasive *Dikerogammarus* species. Freshwater Biology 62:317–328.

Cărăuşu S, Dobreanu E, Manolache C. 1955. Fauna Republicii Populare Romîne. Crustacea. Amphipoda Forme Salmastre şi de Apă Dulce. Bucharest: Editura Academiei RPR.

Eggers TO, Martens A. 2001. Bestimmungsschlüssel der Süßwasser-Amphipoda (Crustacea) Deutschlands/A key to the freshwater Amphipoda (Crustacea) of Germany. Lauterbornia 42:1–70.

Jażdżewski K, Konopacka A. 1988. Notes on the Gammaridean amphipoda of the Dniester River Basin and eastern Carpathians. Proceedings of the VIth International Colloquium on Amphipod Crustaceans. Crustaceana 13:72–89.

Labat F, Piscart C, Fontan B. 2011. First records, pathways and distributions of four new Ponto-Caspian amphipods in France. Limnologica 41(4):290–295.

Martynov AV. 1925. Gammaridae des unteren Laufes des Dnjepr. Trudy Azovsko-Chernomorsko nauchno-promyslovnoi ekspeditsii 1:135–153.

Mordukhai-Boltovskoi. 1964. Caspian fauna beyond the Caspian Sea. Internationale Revue der gesamten Hydrobiologie und Hydrographie 49:139–176.

Mordukhai-Boltovskoi PD. 1979. Composition and distribution of Caspian fauna in the light of modern data. Internationale Revue der gesamten Hydrobiologie und Hydrographie 64:1–38.

Müller J, Schramm S. 2001. A third *Dikerogammarus* invader is located in front of Vienna. Lauterbornia 41:49–52.

Müller JC, Schramm S, Seitz A. 2002. Genetic and morphological differentiation of *Dikerogammarus* invaders and their invasion history in Central Europe. Freshwater Biology 47(11):2039–2048.

Pjatakova GM, Tarasov AG. 1996. Caspian Sea amphipods: biodiversity, systematic position and ecological peculiarities of some species. International Journal of Salt Lake Research 5:63–79.

Pöckl M. 1993a. Beiträge zur Ökologie des Bachflohkrebses (*Gammarus fossarum*) und Flussflohkrebses (*Gammarus roeseli*). Natur und Museum 123:114–125.

Pöckl M. 1993b. Reproductive potential and lifetime potential fecundity of the freshwater amphipods *Gammarus fossarum* and *G. roeseli* in Austrian streams and rivers. Freshwater Biology 30:73–91.

Tarasov AG. 1995. Crustaceofauna (Malacostraca) of the Ural River. Zoologichesky Zhurnal 74(3):24–34. (In Russian.)

Teichmann W. 1982. Life history of Gammaridae under environmental conditions Archiv für Hydrobiologie 64(Supplement):240–306.

Ward PI. 1986. A comparative field study of the breeding behaviour of a stream and a pond population of *Gammarus pulex* (Amphipoda). Oikos 46:29–36.