Hydrobiologia **359:** 13–22, 1997.
M. A. Simovich, C. Sassaman & D. Belk (eds), Studies on Large Branchiopod Biology and Conservation.

Distribution and phenology of large branchiopods in Austria

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Key words: Anostraca, Notostraca, Conchostraca, Austria, distribution, phenology

Abstract

In Austria, the distribution of Anostraca, Notostraca, and Conchostraca is mainly confined to the flood plains of the rivers Morava and Danube, and the shallow alkaline pans of the Seewinkel region in Burgenland province. Occasionally, large branchiopods can also be found in rain pools of the eastern and central Austrian lowlands, where topography and climate favour the existence of astatic water bodies. Differences in hydrology, temperature and water chemistry requirements may be reflected in local species compositions and species seasonal appearance. A survey conducted from 1994 through 1996 found that *Chirocephalus shadini*, *Eubranchipus grubii*, and *Lepidurus apus* occurred in late winter and spring, while *Branchinecta ferox*, *Branchinecta orientalis*, *Cyzicus tetracerus* and *Chirocephalus carnuntanus* were found exclusively in spring. *Streptocephalus torvicornis*, *Tanymastix stagnalis*, and *Eoleptestheria ticinensis* were present in spring and summer. *Branchipus schaefferi* was found in summer and fall, whereas *Imnadia yeyetta*, *Leptestheria dahalacensis*, *Limnadia lenticularis*, and *Triops cancriformis* occurred throughout spring, summer and fall. *Streptocephalus torvicornis* was documented for Austria for the first time since 1965.

Introduction

Austria is dominated by the Alpine region in the central and western parts of the country. However, eastern Austria presents wide lowlands biogeographically belonging to the Pannonian region (Figure 1), where a continental, semi-arid climate with high precipitation in spring and autumn favours the existence of astatic water bodies.

The documentation of large branchiopod distribution in Austria has been fragmentary in the past, mainly due to their ephemeral occurrence. Only a few local systematic investigations, most of them unpublished, have been performed. Eight anostracan species representing 6 genera and 4 families, two notostracan species representing 2 genera and 1 family, and six conchostracan species belonging to 6 genera and 4 families were documented in Austria (Vornatscher, 1968; Löffler, 1993). However, Löffler (1993) reported eight of the sixteen known Austrian large branchiopod species to be extinct, primarily due to agricultural activities and artificial changes of hydrologic conditions.

Occasional sampling between 1978 and 1993 (Hödl, 1994) along the Morava River at sites not previously known for conchostracans, revealed occurrences of *Cyzicus tetracerus* (Krynicki, 1830) and *Imnadia yeyetta* Hertzog, 1935, both species thought to be extinct in Austria. Further information from revisits to all known large branchiopod habitats in Vienna, Lower Austria and Burgenland described in the literature (Jungwirth, 1973; Lechthaler, 1993; Löffler, 1957; Marschitz & Käfel, 1993; Metz & Forró, 1989; Paar et al., 1993; Pesta, 1939, 1942; Vornatscher, 1955, 1968 and unpubl.; Winkler, 1980), and screening of astatic water bodies formerly not known to contain branchiopods resulted in the rediscovery of the conchostracans *Leptestheria dahalacensis* (Rüppell, 1837) and *Eoleptestheria ticinensis* (Balsamo-Crivelli, 1859) in 1994 (Hödl & Eder, 1996a) and the anostracans *Chirocephalus carnuntanus* (Brauer, 1877) and *Tanymastix stagnalis* (L., 1758) in 1995 (Eder & Hödl,

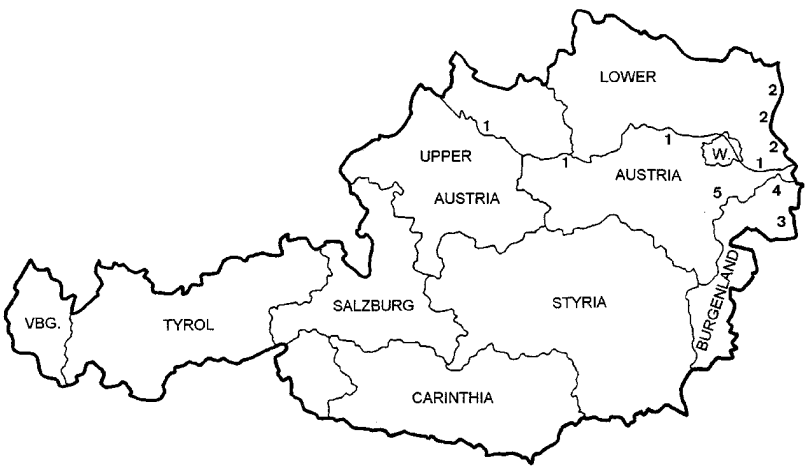

Figure 1. Main large branchiopod regions in Austria. 1 Danube river, 2 Thaya and Morava rivers, 3 Seewinkel region, 4 Parndorfer Heide plain, 5 Wiener Becken depression. VBG = Vorarlberg, W = Wien (Vienna).

1995a). This paper summarizes the present knowledge on the distribution and phenological appearance of all large branchiopods documented in Austria between 1994 and 1996. This will hopefully provide a current, more complete evaluation of large branchiopod diversity in this region.

Methods

During 1994 and 1995, we intensively sampled throughout eastern Austria; Additional data are derived from occasional excursions in 1996. All habitats known from Vienna, Lower Austria and Burgenland were revisited in 1994 and 1995 at the time of year of the originally reported large branchiopod occurrence. A search for further, yet undocumented branchiopod sites was undertaken between February and October. Live sampling was performed using a 1.6 mm net of 32 cm diameter. For phenological studies in the lower Morava area, a 42 μm plankton net of 17 cm in diameter was used additionally to register early developmental stages.

The floodplains between the city of Marchegg (48° 16′ 48″ N, 16° 55′ 00″ E) and the mouth of the Morava River (48° 10′ 27″ N, 16° 58′ 40″ E), which exhibit the highest large branchiopod diversity in Austria (Hödl & Eder, 1996b), were visited at least weekly between 1 February 1995 and 27 July 1995 and from 8 October 1995 to 1 November 1995. Habitats where large branchiopods were detected were subsequently revisited every second day to document the phenology and development of the species present (Gottwald & Hödl, 1996).

Vouchers of the recorded species were preserved in 70% ethanol and stored at the Naturhistorisches Museum (NHMW), Vienna, the OÖ. Landesmuseum (LI), Linz, and the Institute of Zoology, University of Vienna (private collection, E.E.).

Distribution

In Austria, large branchiopods mainly occur: (a) in the floodplains of the Danube river, Upper and Lower Austria (Eder & Hödl, 1996a) (b) in the wetlands of the rivers Thaya and Morava, Lower Austria (Hödl & Eder, 1996b), and (c) in the shallow alkaline lakes of the Seewinkel region in Burgenland province (Eder et al., 1996). Additionally, they are found in rain pools located in the eastern Austrian lowlands (Burgenland & Lower Austria), and at a very restricted number of sites outside these regions (Eder & Hödl, 1996b) (Figure 1). During the study period, we found all large branchiopod species ever reported from Austria, except *Lynceus brachyurus* O. F. Müller, 1776, which formerly occurred at sites along the rivers Danube and Morava, the Wiener Becken, a tertiary depression, and the Parndorfer Heide, an intensively agricultural plain in the northern part of Burgenland province (Vornatscher, 1968 and unpubl.).

(a) *Danube river flood plains* (Figure 1). With a length of almost 2900 km and a catchment area of approximately 800 000 km^2, the Danube River is the

second largest river of Europe. On its 350 km Austrian course, the river is characterised as a mountainous river with an average descent of 44 cm km^{-1} (Liepolt, 1967). Highwaters of the Danube River are significantly affected by the Alpine Inn River. Aestival snowmelt in the Alps and heavy rains in summer usually cause highwaters in July and August (Schiemer, 1987), favouring the presence of eurythermal and thermophilic large branchiopod species in astatic pools. Six species were documented in the Austrian floodplains of the Danube River (Vornatscher, 1968).

With the construction of hydroelectric power plants starting in 1954, the Danube has undergone fundamental ecological changes between the German border and Vienna: large parts of former wetlands were cut off from the river's influence. With the exception of the occurrence of *Branchipus schaefferi* (Fischer, 1834) and an undetermined conchostracan near the city of Stockerau (T. Schlosser, pers. comm.), we did not find any large branchiopods in the Austrian Danubian wetlands west of Vienna. Between Vienna and the Hungarian border, *Lepidurus apus* (L., 1758), *Triops cancriformis* (Bosc, 1801), *C. tetracerus*, *E. ticinensis*, *I. yeyetta*, *L. dahalacensis*, and *Limnadia lenticularis* (L., 1761) were documented in the Danubian floodplains between 1994 and 1996 (Eder & Hödl, 1996a; Figures 3, 4).

(b) *Thaya and Morava river flood plains* (Figure 1). The rivers Thaya and Morava represent the frontiers between Austria, Czechia, and Slovakia, respectively. Most parts of the 26 642 km^2 catchment area consist of the Slovakian highlands. Highwaters are usually caused by vernal snowmelts, and occur most frequently in March and April (Zulka, 1991). The cold-stenothermal species *Eubranchipus grubii* (Dybowski, 1860) and *L. apus* can be found along the lower Thaya river and the river Morava north of the village of Schloßhof (48° 12′ 50″ N, 16° 56′ 20″ E) between late January and early May (Eder & Hödl, 1995b). In addition to the vernal highwaters, the lower Morava is affected by the aestival inundations of the Danube River (Table 1). Both vernal and aestival floodings are observed regularly in this region (Zulka, 1991). It is possible that this exceptional hydrological status, providing a diversity of thermal regimes, is the reason for the highest large branchiopod diversity in Austria.

Between 1994 and 1996, ten species were documented in the Morava floodplains. With the exception of *E. grubii* and *L. apus* all species were reported only from the wetlands of the last 38 km of the Morava River. In Austria, the fairy shrimp *Chirocephalus shadini* (Smirnov, 1928) inhabits exclusively the 'Pulverturm'-ponds near Marchegg. *Branchipus schaefferi* is presently known along the Morava River only from two sites near the village of Markthof (48° 11′ 40″ N, 16° 57′ 30″ E). The northernmost occurrence of conchostracans along the Austrian part of the Morava flood plains was found in 1996 at a site near the village of Grub/Stillfried (48° 25′ 00″ N, 16° 50′ 30″ E), where *L. dahalacensis* co-occurred with *T. cancriformis*. *Cyzicus tetracerus* was found near Marchegg in the 'Lange Lüsse', a natural retention basin of approximately 3 km^2, where the regulation dam along the lower Morava River is omitted, and the 'Blumengang', a silted former Danubian riverbranch near the mouth of the Morava River. *Eoleptestheria ticinensis* is known exclusively from the 'Blumengang' depression. *Imnadia yeyetta* and *L. lenticularis* were recorded from the 'Lange Lüsse' and the 'Blumengang', *I. yeyetta* was additionally reported from the 'Dammwiese', a former soccer field near Marchegg (Hödl & Eder, 1996b). *Triops cancriformis* and *L. dahalacensis* have been reported between Grub/Stillfried and the 'Blumengang'. Similar-sized individuals of *T. cancriformis* and *L. apus* were found syntopically in the 'Lange Lüsse' in early May both 1994 and 1996 (Hödl & Rieder, 1993; Eder & Hödl 1995b).

(c) *The Seewinkel pans* (Figure 1). The Seewinkel region, located between the Pannonian lake Neusiedlersee and the Hungarian border, is characterised by numerous shallow alkaline pans. Their high sodium carbonate content most probably originated from salt rich tertiary and quaternary sediments (Löffler, 1959; Nelhiebel, 1980). Due to its continental semiarid climate (Neuwirth, 1976; Köllner, 1983), most of the Seewinkel region's water bodies are highly astatic, usually drying in midsummer. Only the large pans of the central Seewinkel area are in connection with ground water and do not dry out regularly (Metz & Forró, 1989). The pans of the Seewinkel region, Austria's first national park meeting the IUCN criteria (Dick et al., 1994), present a unique habitat for large branchiopods. Eight branchiopod species were reported from the astatic Seewinkel pans (Vornatscher, 1968), seven species were documented in recent studies (Metz & Forró, 1989; Eder et al., 1996).

The anostracans *Branchinecta orientalis* G. O. Sars, 1901 and *Branchinecta ferox* (Milne-Edwards, 1840) are highly adapted to sodic waters (Petkovski, 1991). The fairy shrimp *C. carnuntanus* was rediscovered for Austria in the Seewinkel pans in 1995 (Eder & Hödl, 1995a). The notostracan *T. cancriformis* was

Table 1. Hydrologic aspects of the rivers Danube, Thaya and Morava (after Farasin & Lazowski, 1990).

	Danube River	Thaya/Morava Rivers	Lower Morava River
Catchment area	Alps	Slovakian highlands	Slovakian highlands
Period of snowmelt	Summer	Spring	Spring
Main precipitations in catchment area	Aestival rainfalls	Vernal (and autumnal) rainfalls	Vernal (and autumnal) rainfalls
River characteristics	Mountainous river	Lowland river	Lower course situation: slow speed, influence of Danube river
Most frequent inundations	July–August	March–April	March–August
Large branchiopod characteristics	Eurythermal/ Thermophil	Cold stenothermal	Cold stenothermal eurythermal and thermophil

also found in alkaline pans. The anostracans *B. schaefferi*, *T. stagnalis* (rediscovered in Austria in 1995; Eder & Hödl, 1995a), and the conchostracans *I. yeyetta* and *L. dahalacensis* were documented in various species associations on irregularly flooded meadows, caused by heavy rainfalls, in most cases co-occurring with *T. cancriformis*. *Limnadia lenticularis* was last documented in the Seewinkel region in 1972 (Vornatscher, unpubl. data).

(d) *Records outside of the main large branchiopod distribution areas in Austria*: Large branchiopods were recorded from 6 Austrian provinces (Figures 2–4). In the northern part of Burgenland, in addition to the Seewinkel region, large branchiopods have been found in the Parndorfer Heide, with recent records of *B. schaefferi*, *T. stagnalis*, *L. apus* and *T. cancriformis* (Eder & Hödl, 1996b). The single known occurrence of *L. brachyurus* in Burgenland was last documented in the Parndorfer Heide in 1965 (Vornatscher, 1968 and unpubl. data).

In the Wiener Becken, *Streptocephalus torvicornis* (Waga, 1842), was last recorded in Austria in 1965 (Vornatscher, 1968), but was rediscovered near the village of Steinbrunn (47° 50′ 00″ N, 16° 23′ 00″ E) in late May 1996, co-occurring with *B. schaefferi* and *T. cancriformis* (N. Weissenböck, pers. comm.). *Streptocephalus torvicornis* taken from the rediscovery site was kept in artificial open air tanks until late September.

In Middle and Southern Burgenland, only three sites with single occurrences of *B. schaefferi*, *T. cancriformis*, and *E. grubii* were found during the study period (Figures 2, 3).

In Lower Austria south of the river Danube, *B. schaefferi* was found in several rain pools near the city of Wiener Neustadt in 1995 and 1996 (Eder & Hödl, 1996b), near the Vienna airport Schwechat in 1996 (M. Plöchl, pers. comm.) and in the village of Neureisenberg (48° 01′ 14″ N, 16° 29′ 34″ E) in 1996 for the first time since 1975, where it co-occurred with *L. dahalacensis* and *T. cancriformis* (H. Palme, pers. comm.). *Branchipus schaefferi* was additionally documented on the Hohe Wand Mountain at an altitude of approximately 880 m (E. Kusel, pers. comm.) and north of the Danube at the Bisamberg mountain near Vienna, near the village of Großmugl (48° 30′ 00″ N, 16° 13′ 50″ E) and at the village of Kollnbrunn (48° 27′ 40″ N, 16° 35′ 30″ E; M. Pintar, pers. comm.).

The city of Vienna, formerly hosting 7 species (*B. schaefferi*, *S. torvicornis*, *C. tetracerus*, *E. ticinensis*, *L. dahalacensis*, *L. lenticularis* and *T. cancriformis*), did not show any large branchiopod occurrences since the last recording of *T. cancriformis* in 1952 (Vornatscher, 1955).

In Upper Austria only two large branchiopod species were reported during the three-year observation period: in 1996, *I. yeyetta* was found in a rain pool near the village of Perg (48° 15′ 00″ N, 14° 38′ 00″ E; U. Straka, pers. comm.), and an undetermined anostracan (most probably *B. schaefferi*) was reported from an army training area north of the city of Wels (A. Schuster, pers. comm.).

Figure 2. Distribution of Anostraca in Austria. 1 *Branchinecta ferox*, 2 *Branchinecta orientalis*, 3 *Branchipus schaefferi*, 4 *Chirocephalus carnuntanus*, 5 *Chirocephalus shadini*, 6 *Eubranchipus grubii*, 7 *Streptocephalus torvicornis*, 8 *Tanymastix stagnalis*, 0 former anostracan occurrences that could not be reconfirmed during the study period.

Only one large branchiopod site each is known for the Austrian provinces Carinthia and Styria. In Carinthia, *L. apus* was found in the 'Zollfeld' fields north of the city of Klagenfurt in 1969 (Sampl, 1969), with latest records from 1995 (H. Sampl, pers. comm.). In Styria, *B. schaefferi* was found on the Schöckl Mountain north of the city of Graz in 1940 (Vornatscher, 1968). No more recent occurrences have been reported there.

Phenology

The occurrence of large branchiopods highly depends on the time of habitat inundation which varies from year to year (Schiemer, 1987; Zulka, 1991). However, our sampling results between 1994 and 1996 show clear differences between species in seasonal appearance (Tables 2, 3).

In 1995, during the phenological examination of selected sites along the lower Morava River, three main events caused flooding of the study area: vernal Morava inundations, aestival Danubial high waters, and heavy autumnal rainfalls, respectively. Among the examined pools, different inundation times could be distinguished: (a) the two northernmost sites with continuous inundation between early January and July 1996 (sites near Marchegg), (b) sites showing two periods of inundations, in June/July, and in October 1995, respectively (three sites at the Lange Lüsse). The 'Blumengang' site, located near the mouth region of the Morava, was inundated exclusively in June and July.

Chirocephalus shadini, *E. grubii*, and *L. apus*, cold stenothermal species (Flößner, 1972; Hödl & Rieder, 1993), were active at the sites WT and PT near

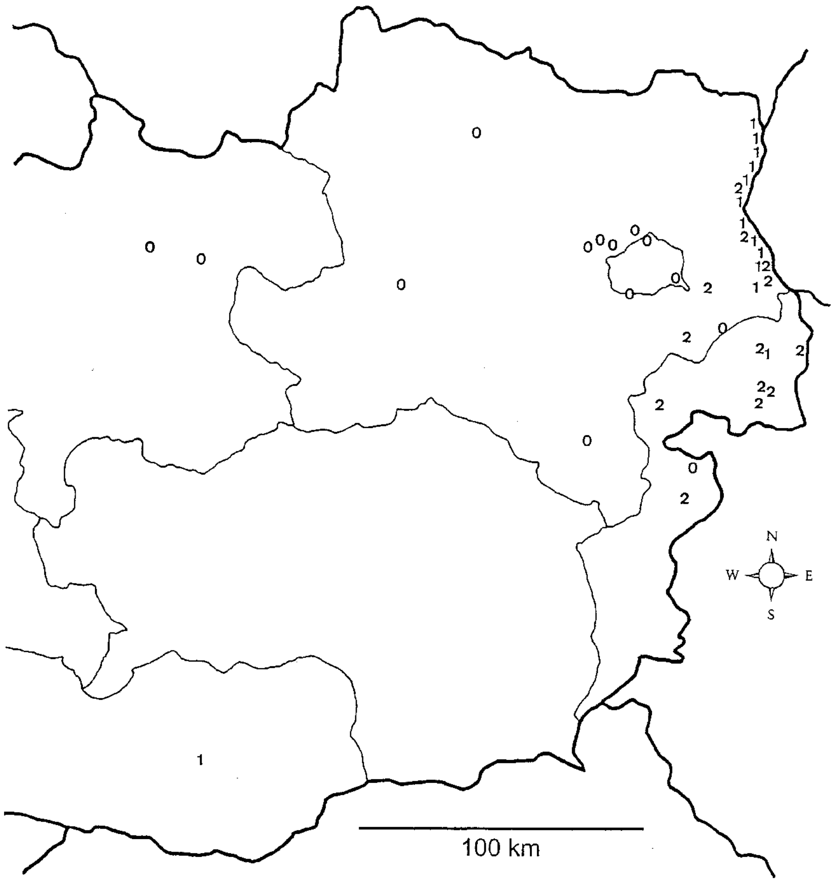

Figure 3. Distribution of Notostraca in Austria. 1 *Lepidurus apus*, 2 *Triops cancriformis*, 0 former notostracan occurrences that could not be reconfirmed during the study period.

Table 2. Seasonal appearance of large branchiopods (larvae and adulti) in selected astatic waters of the lower Morava region in 1995 (after Gottwald & Hödl, 1996). X site inundated, – site dry, 0 no specimens found, hatched panels: larval specimens, black panels: adults.

Locality	Species	JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEP				OCT				NOV				DEC			
WT (Marchegg, "Wienertortümpel")		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																							
	Eubranchipus grubii			0															0	0	0																												
PT (Marchegg, "Pulverturmtümpel")		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	-	-	-																
	Chirocephalus shadini																																																
	Lepidurus apus																																																
TL (Lange Lüsse, "T/L-Lacke")																							X	X	X	X	X	X	X	-	-	-	-						X	X	X	-							
	Imnadia yeyetta																											0	0											0									
	Limnadia lenticularis																												0																				
	Triops cancriformis																									0	0	0	0																				
HL (Lange Lüsse, "Hoffnungslacke")																							X	X	X	X	X	X	X	-	-	-	-						X	X	X	-							
	Imnadia yeyetta																								0	0	0	0	0											0	0								
	Limnadia lenticularis																								0	0	0	0	0												0								
	Triops cancriformis																								0	0	0	0	0																				
RL (Lange Lüsse, "Reiherlacke")																																							X	X	X	X							
	Limnadia lenticularis																																								0								
BG (Markthof, "Blumengang")		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-							
	Eoleptestheria ticinensis																						0	0	0	0		0																					
	Imnadia yeyetta																												0																				
	Leptestheria dahalacensis																																																
	Limnadia lenticularis																											0	0																				
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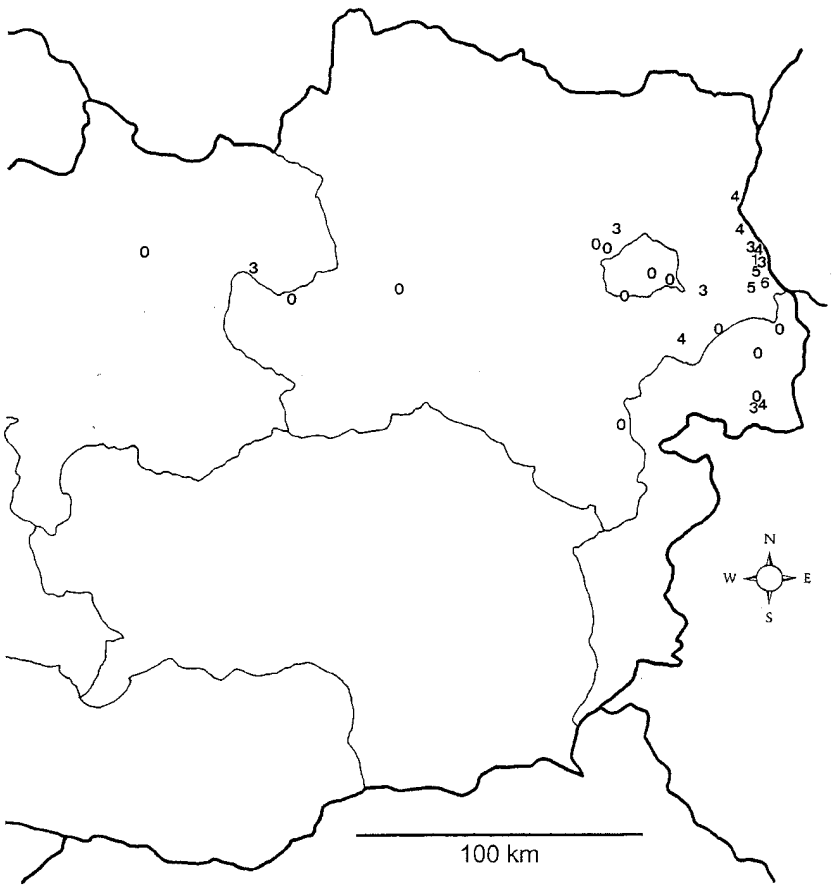


Figure 4. Distribution of Conchostraca in Austria. 1 *Cyzicus tetracerus*, 2 *Eoleptestheria ticinensis* (see 6), 3 *Imnadia yeyetta*, 4 *Leptestheria dahalacensis*, 5 *Limnadia lenticularis*, 6 all five species, 0 former conchostracan occurrences that could not be reconfirmed during the study period.

Marchegg from early February and March, respectively, until early May. Although these sites were still filled with water in June and July, no thermophilic species appeared. All other sites contained eurythermal or thermophilic large branchiopods, which were observed in different species associations. No large branchiopods were found at site HL, located on intensively cultivated land, in summer; however, *I. yeyetta*, *L. lenticularis* and *T. cancriformis* were active in autumn, when the field was already harvested.

At sites WT and PT, first adult individuals appeared 4 to 6 weeks after nauplius larvae were observed, whereas adults of species in sites TL, HL, and BG were found after 5 to 7 days after inundation (Gottwald & Hödl, 1996).

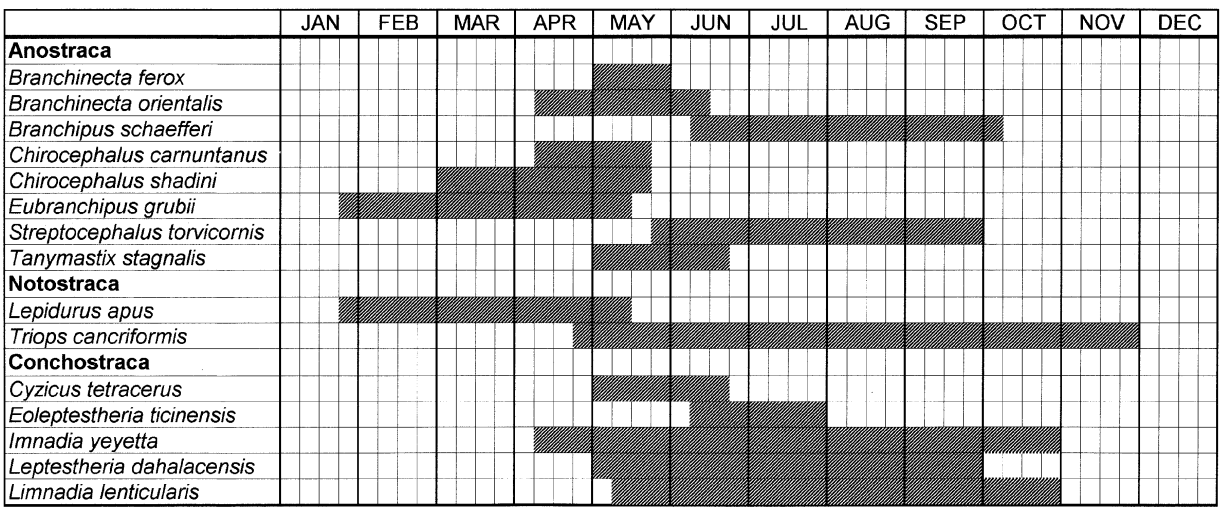
Summarising phenological appearance of large branchiopods in Austria between 1994 and 1996 (Table 3), *C. shadini*, *E. grubii*, and *L. apus* occurred in late winter and spring, *B. ferox*, *B. orientalis*, *C. tetracerus*, and *C. carnuntanus* were found exclusively in spring. *Streptocephalus torvicornis*, *T. stagnalis*, and *E. ticinensis* were registered in spring and summer, *B. schaefferi* was found in summer and fall, whereas *I. yeyetta*, *L. dahalacensis*, *L. lenticularis*, and *T. cancriformis* occurred throughout spring, summer and fall.

Discussion

'It is often true that the known ranges of many smaller, less charismatic animal species more accurately reflect the distribution of their (few) experts than that of the animals themselves...' (Dumont et al., 1995).

In Austria, 46% of the European anostracan genera, both European notostracan genera, and 71% of

Table 3. Seasonal appearance of postembryonic stages of large branchiopods in Austria (January 1994 until December 1996). Hatched panels: occurrence of species.



European conchostracan genera are represented. So far, more than 95% of all Austrian large branchiopod sites have been documented in the Pannonian lowlands as defined by Löffler (1993). However, this does not imply a general limitation of most of these species to the Pannonian regions or exclusively to eastern Europe. Most large branchiopod species present in Austria show a widespread distribution all over Europe, such as *B. schaefferi*, *T. stagnalis*, and *E. grubii* (Brtek & Thiéry, 1995), *L. apus* and *T. cancriformis* (Zaffagnini & Trentini, 1980), *C. tetracerus*, *L. dahalacensis*, and *L. lenticularis* (Brtek & Thiéry, 1995). Both *Branchinecta* species are widespread, as well, but limited to steppic pools and in Europe only known from central Spain, the Pannonian lowlands and steppe regions in eastern European countries.

Chirocephalus shadini and *C. carnuntanus* have their westernmost point of distribution in Austria, disregarding the appearance of the latter species in the northern Bohemian Lowland. For the disjunct species *E. ticinensis*, known from Southern Europe, Asia Minor and Northern China (Brtek & Thiéry, 1995), the Austrian rediscovery site 'Blumengang' (Hödl & Eder, 1996a, c) lies within the northern boundary of its range in Europe. With the exception of one record in southern France, the European species *I. yeyetta* is only found between eastern Austria and Romania (Brtek & Thiéry, 1995). *Streptocephalus torvicornis* is reported as an African-Arabian species reconquering Europe from west and east of the Alpine range after the last ice age, Würm-III (Dumont et al., 1995), and is represented in Austria by the eastern subspecies *S. t. torvicornis*.

The Alpine region seems to form an obstacle for large branchiopod distribution, as discussed for *S. torvicornis* by Dumont et al. (1995). With the exception of three mountainous habitats of *B. schaefferi*, at a maximum elevation of 880m (Eder & Hödl, 1996b), no large branchiopod sites are known from the Austrian Alps. Known records from high altitudes in Italy (Mura, 1993), Macedonia (S. Petkovski, 1997) and Turkey (J. Mertens, pers. comm.) belong to mediterranean climatic regions with aestival drought periods, whereas Austrian Alpine regions show high precipitation throughout the year. Additionally, wooded zones, in their full development, characteristic of large parts of central and western Austria, seem unsuitable for large branchiopods (Brtek & Thiéry, 1995). However, no systematic sampling at all has been undertaken in Alpine regions (Hödl, 1994). Closer examinations of the Austrian Alps in regard to large branchiopod occurrence are needed in order to verify large branchiopod presence or absence in the central Alpine mountain range.

No additional records of other large branchiopod species are expected to be found in Austria, following the distribution patterns of European species (Brtek & Thiéry, 1995). Two species known from neighbouring countries, though never found in Austria, are *Chirocephalus diaphanus* Prévost, 1803, with its near-

est occurrence in northern Italy (Mura, 1993), and *Eubranchipus (Drepanosurus) hankoi* (Dudich, 1927), with its nearest records in Czechia and Slovakia (Brtek & Thiéry, 1995).

Occurrence and species composition of large branchiopods is partially dependent on hydrology, temperature, and water chemistry (Gonzalez et al., 1996; Hathaway & Simovich, 1996; King et al., 1996; Metz & Forró, 1989; Wiggins et al., 1980). This is presumably why habitats which differ in their inundation periods, such as the Danube and Morava flood plains, show different large branchiopod composition (Eder & Hödl, 1996a; Hödl & Eder, 1996b).

Cold-stenothermal species, thermophilic and eurythermal species are expected to differ in distribution and seasonal occurrence as well as in the length of larval development (Tables 2, 3). *Lepidurus apus* and *T. cancriformis*, when present in the same habitat, hatched and reached maturity at different times, due to different preferences of water temperature and/or salinity (Eder & Hödl, 1995b).

Common classifications of temperature tolerance are often observational and have no experimental data to support. *Tanymastix stagnalis*, classified as cold-stenothermal by Müller (1918) and Flößner (1972), as well as *I. yeyetta* (Hödl & Rieder, 1993), were found in Austria at water temperatures above 30 °C (Eder & Hödl, 1995b). *Cyzicus tetracerus*, described as a 'Früform' by Flößner (1972), was found in Austria between May and June. The presence of the 'summer species' *T. cancriformis* in late November 1996 (Table 3) at the 'Lange Lüsse' and the 'Blumengang' was due to exceptionally high temperatures. This cohort died before reaching maturity.

In addition to observations under natural conditions, laboratory data on nauplar hatching temperature are needed to complete knowledge of the autecology of each species.

Acknowledgments

Our investigations on the status of large freshwater branchiopods in eastern Austria were supported by the provincial governments of Lower Austria (dep. RU-5) and Burgenland (dep. IV). Additionally, we are grateful to C. Baumgartner, G. Bieringer, B. Brychta, J. Gruber, B. Kohler, I. Korner, E. Kusel, M. Maslo, N. Milasowszky, I. Oberleitner, H. Palme, M. Pintar, M. Plöchl, E. Rieder, H. Sampl, W. Schedl, T. Schlögl, T. Schlosser, A. Schuster, U. Straka, U. Tessenow, and N. Weissenböck for their useful hints on literature and historic or recent large branchiopod sites, and to S. Eder-Steiner, E. Hödl, E. Kaiser, B. Korinek, and numerous colleagues not mentioned by name for their support during sampling excursions.

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