

# THE INVERTEBRATE SPECIES OF A GRAVEL STREAM

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## ABSTRACT

Based on information obtained from several studies, and some new taxonomical assessment since 1980, a compilation list is given of the invertebrate and vertebrate species inhabiting both the surface and the hyporheos of the experimental reach of the gravel stream Oberer Seebach. A total of 569 invertebrate species belonging to micro-, meio- and macrobenthic assemblages inhabit the bed sediments. The high species richness is explained by different scales of habitat patchiness, heterogeneous grain size distribution with a high porosity, availability of biofilm, variations in water through flow and the dispersal patterns of major meio- and macrobenthic taxa.

## INTRODUCTION

There are a number of environmental and biotic factors to which the species richness of a community can be related. Firstly, it is possible to find geographically related characteristics namely latitude, altitude as well as productivity of the environment, climatic variability, spatial heterogeneity, the "age", and the "harshness" of the environment (Begon et al. 1986). Secondly, biological attributes of a community may comprise the successional state of the community, and the potential interspecific interactions such as predation and competition.

It is obviously clear that without species, ecosystems per definition would not exist. Lawton (1994) in his review of what species do in an ecosystem, stressed that some processes varied significantly with species richness. However, not all mechanisms related to these responses are well understood, and all species are not equal in their impacts on ecosystem processes. Lately, van de Bund, Goedkoop & Johnson (1994) have demonstrated that in sediments macroinvertebrate bioturbation has a profound effect on bacterial densities and production, and can be both taxa- and density-dependent.

On the other hand, streams and rivers are clear centres of high biodiversity (Zwick 1991). The same author has reported that the Breitenbach stream in Germany contains 1000 species ranging from Protozoa to Insecta. Unfortunately, many species lists failed to report small-sized organisms, and there is meanwhile a bulk of listings based only on macrofaunal groups.

The long-term stream project (Ritrodat) was founded in 1976 with the basic purpose to understand the dynamics of a gravel stream. The

research aimed the examination of hydrophysical characteristics, organic matter, and the dynamics and distribution of the biocoenosis. At the same time, a great effort was done on creating, modifying and/or adapting quantitative sampling methods for the general objectives under study.

Throughout nearly two decades, many studies examining the distribution of invertebrates at the streambed surface and the hyporheos have focused on diverse invertebrate taxa.

The present contribution was undertaken in order to make a compilation of all invertebrate and fish species found in the gravel stream Oberer Seebach.

## MATERIAL AND METHODS

The study compiles invertebrate species and fish species which inhabit the stream Oberer Seebach in Lower Austria ( $47^{\circ}51' N$ ,  $5^{\circ}04' E$ , 610 m a.s.l.). Emphasis has been given to invertebrate taxa occurring within the 100 m research area „Ritrodat“ in the stream. In general, the Oberer Seebach is a coldwater gravel stream (mean maximum water temperature  $10.2^{\circ}C$ .) The stream sediments have a median grain size composition of 23.1 mm, and a distinct oxygen saturation in the upper 60 cm of the streambed (Bretschko 1991). The riparian vegetation is dominated by *Fraxinus excelsior* L., *Acer pseudoplatanus* L., willows (*Salix caprea* L.), beeches (*Fagus sylvatica*), and spruces (*Picea abies*) (Moser 1992). A full description of the study site is given by Bretschko (1983, 1991).

Data was mainly collected from literature sources, and additionally, new listings were made for some macroinvertebrate taxa and fish species (Table 1).

Tab. 1: Summary of invertebrate taxa found in the Oberer Seebach, and sampling methods used by diverse researchers. Sampling methods used: Hess modified sampler (HS), Stand-pipe traps (SP) (Klemens & Bretschko 1986), Cage pipes (CP) (Panek 1991), Freeze-core with electropositioning (FC) (Klemens & Bretschko, 1986; Schmid, 1987), Drift sampler (DR) (Siegl, 1993), Emergence traps (ET). (\*\* denotes a partial taxonomical assessment).

|        |                 | No. taxa | Sampling method | Author                          |
|--------|-----------------|----------|-----------------|---------------------------------|
| I      | PROTOZOA        | (29)**   | HS, SP          | Schmid-Araya, this paper        |
| II     | CNIDARIA        | 2        | HS, DR          | ibid                            |
| III    | TURBELLARIA     | (13)**   | HS, SP          | ibid                            |
| IV     | TREMATODA       | 2**      | DR              | ibid                            |
| V      | GASTROTRICHA    | 7        | HS, SP          | W. Hummon, pers.comm.           |
| VI     | ROTIFERA        | 101      | HS, SP, DR      | Schmid-Araya, 1993              |
| VII    | NEMATODA        | (45)     | SP              | Loof, 1991                      |
| VIII   | GASTROPODA      | 1        | CP              | Panek, 1991                     |
| IX     | POLYCHAETA      | 1        | SP              | Schmid-Araya, this paper        |
| X      | OLIGOCHAETA     | 21       | all             | ibid                            |
| XI     | TARDIGRADA      | (3)**    | HS, SP          | ibid                            |
| XII    | ACARI           | 20       | all             | ibid                            |
| XIII   | EPHEMEROPTERA   | 19       | HS, DR          | Siegl, 1993; Wagner, pers.comm. |
| XIV    | PLECOPTERA      | 47       | HS, ET          | Stummer, 1979                   |
| XV     | TRICHOPTERA     | 38       | SP              | Waringer, 1986                  |
| XVI    | MEGALOPTERA     | 1        | SP              | Schmid, this paper              |
| XVII   | COLEOPTERA      | (7)**    | HS              | Kowarc, pers. comm.             |
| XVIII  | PSYCHODIDAE     | (1)**    | HS              | Schmid, this paper              |
| XIX    | CHIRONOMIDAE    | 103      | FC              | Schmid, 1987, 1993a, 1993b      |
| XX     | CERATOPOGONIDAE | 2        | HS              | Schmid, this paper              |
| XXI    | SIMULIIDAE      | 13       | HS              | Car, 1981, 1993                 |
| XXII   | TIPULIDAE       | 9        | HS              | Schmid, this paper              |
| XXIII  | ATHERICIDAE     | 1        | HS              | ibid                            |
| XXIV   | EMPIDIDAE       | 4        | HS              | ibid                            |
| XXV    | COLLEMBOLA      | 42       | SP              | Bretschko & Christian, 1989     |
| XXVI   | CLADOCERA       | 4        | all             | Schmid-Araya, this paper        |
| XXVII  | CYCLOPOIDA      | 2        | all             | ibid                            |
| XXVIII | HARPACTICOIDA   | 12       | FC              | Kowarc, 1990                    |
| XXIX   | OSTRACODA       | 16       | SP              | Marmonier, 1984                 |
| XXX    | AMPHIPODA       | 2        | SP              | Marmonier, 1985                 |
| XXXI   | ISOPODA         | 1        | SP              | Marmonier, 1985                 |
| XXXII  | PISCES          | 6        |                 | Adamicka, Kummer, pers.comm.    |

## RESULTS AND DISCUSSION

The taxa recorded from the Oberer Seebach are listed in the Appendix. A total of 569 invertebrate species and 6 fish species have been identified between 1979 and 1995. However, there are still many invertebrate groups which have not been thoroughly taxonomically examined. Among micro- and meiofaunal taxa not completely examined are Protozoa, Microturbellaria, and Tardigrada, while among the macrofauna some species of Diptera and Coleoptera need further investigations.

The number of species found within the 100 m experimental area is extremely high, compared to extensive studies conducted in other stream types such as the Breitenbach in Germany (Zwick 1991), and others in Britain (i.e. Townsend, Hildrew & Francis 1983, Wright et al. 1984). Only the work of

Zwick (1991) has shown that a high diversity can also be found among some meiofaunal taxa. At a high taxonomic order, the present invertebrate list gives a similar number of species as that reported by Zwick (1991) with respect to Gastrotricha, Rotifera, Hydrachnella, Crustacea, and Ephemeroptera. Benthic rotifers and larval Chironomidae constitute together 36.0 % of all 570 invertebrate species found in the bed sediments of the Oberer Seebach (Fig. 1). Moreover, the number of genera among the most abundant taxa declined logarithmically (Fig. 1). Interestingly, the majority of taxa is characterized by less than 15 genera. Rotifers, nematodes and chironomids are represented by 114 genera, which are 46.5 % of all genera in 19 major taxa occurring in the gravel stream Oberer Seebach (Fig. 1). Most rotifer and chironomid species were only represented by one genus (Appendix), but the rotifer and chironomid genera *Cephalodella* and *Eukiefferiella*, comprised 10 and 14 species,

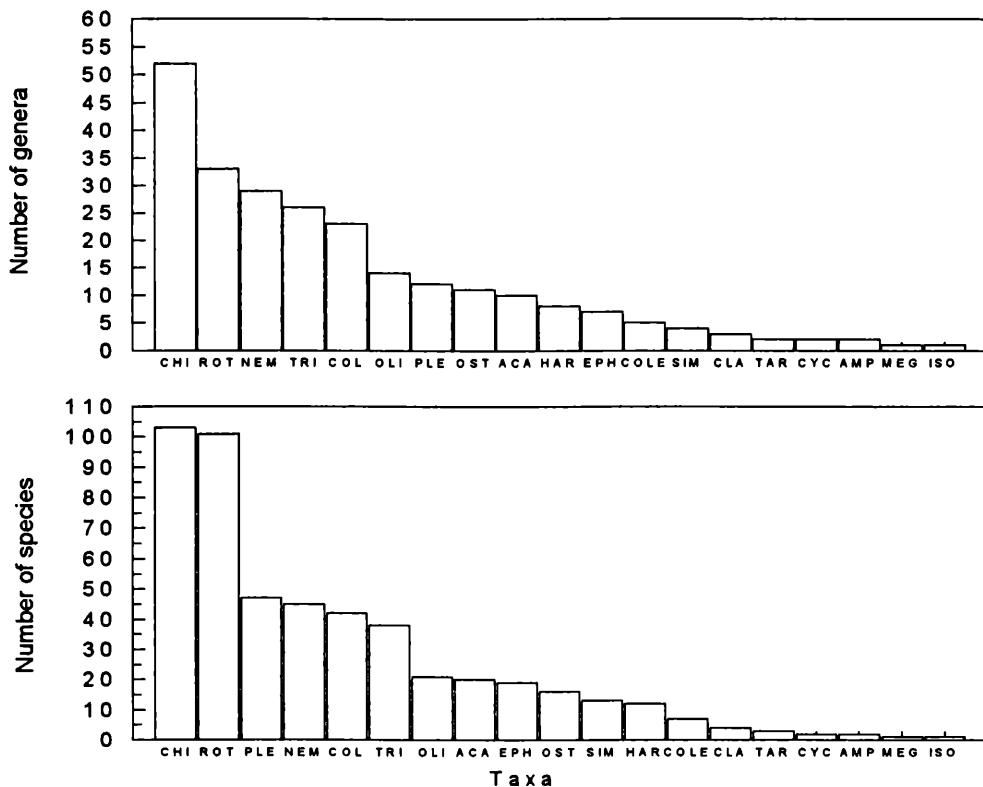


Fig. 1: Number of genera and species of the 19 most abundant benthic taxa found in the bed sediments of the Oberer Seebach from 1980 through 1995.

respectively (Appendix, Fig. 2). Both abundant and species-rich taxa, are mainly represented by highly motile and dispersive species which follow the hydrophysical variations in the stream, and can have consequently fast spatio-temporal turnover rates (Schmid, in press).

A heterogeneous and fractionated habitat such as the bed sediments, combined with variable hydrophysical conditions may increase the probability for congeneric and conspecific coexistence. The hyporheic zone has often been considered as a refuge for many benthic invertebrates with respect to spates (Williams & Hynes 1974). In the Oberer Seebach many authors have found a similar invertebrate depth distribution, in average with a maximal peak between 20 to 40 cm depth (Marmonier 1984, 1985; Kowarc 1990, 1992, Schmid-Araya 1994 and in press). These authors have mostly used the stand-pipe trap method, which can reveal animal activity and abundances if the exposure time is kept constant through all sampling occasions (Waringer 1987). Similar depth distribution patterns using other sampling method such as the *in-situ* freeze core technique with prior electropositioning, have been reported by Schmid (1987, 1992) and Ratulangi (1993).

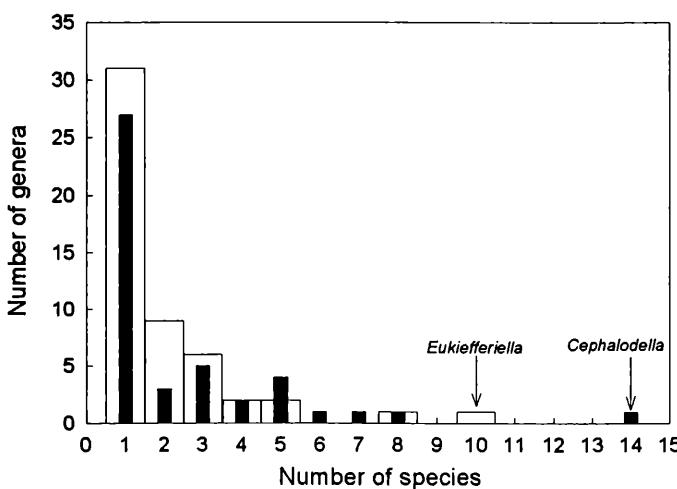


Fig. 2: Number of species in genera of benthic rotifers and chironomids found in the bed sediments of the Oberer Seebach from 1990 through 1995.  
Solid bars: rotifera, Open bars: chironomidae.

The high species richness shown within this gravel stream may be explained by a variety of abiotic and biotic factors. Generally, the bed sediments are well oxygenated down to depths of 60 cm. A heterogeneous grain-size distribution within this streambed indicates that interstitial spaces vary among sediment depth layers and in time. Consequently, the size of colonizable microhabitats may shift continuously both horizontally and vertically in space. Fluctuations in water through-flow within the hyporheos lead to spatio-temporal variations in particle movement and sedimentation, which in turn may change interstitial spaces and the availability of particle-associated food (i.e. biofilm). Particles must be resident for a certain time in order to be fed upon by organisms such as browsers (i.e. gastrotrichs, rotifers). In addition, at the streambed surface small-scale variations in current velocity and hydraulic shear stress may change microhabitat characteristics and alter species' colonization patterns. Within the bed sediments, a high meio- and macrozoobenthic species diversity may be explained by the active movement of species in all major spatial directions reducing the probability of exploitation and interference competition; most species found within this gravel stream are motile and many species-rich taxa such as rotifers and chironomids colonize within hours newly formed habitats. Certain taxa and species even appear to occur most of their developmental periods within the hyporheos such as certain monogonont rotifers, harpacticoid copepods, Orthocladiinae (Chironomidae), habroleptid mayfly nymphs and leuctrid stonefly nymphs, all showing spatial speciation patterns due to particle-associated feeding habits. Species occurring both at the uppermost sediment layer and within deeper sediments such as tanypod predators, mirror active prey searching behaviour. Some detritivorous species such as Orthocladiinae might generally colonize deeper sediment layers in early developmental stages, using these zones as comparatively 'protected' habitats; other surface dwelling species might actively search for refuge microhabitats at periods of high water discharge. This magnitude of scale-dependent spatio-temporal unpredictability and the extent of both abiotic and biotic factor variations contribute to a high species diversity within the bed sediments of a headwater stream such as the Oberer Seebach.

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**Appendix: The invertebrate and vertebrate species composition found in the experimental area Ritrodat since 1979.**

**I. PROTOZOA**

**CILIATA**

S.C. HOLOTRICHIA

O. GYMNOSTOMATIDA

FAM. COLEPIDAE

1. *Coleps sp.*

FAM. ENCHELYIDAE

2. *Prorodon sp.*

3. *Lacrymaria sp.*

FAM. AMPHILEPTIDAE

4. *Litonotus sp.*

FAM. DIDINIIDAE

5. *Didinium sp.*

FAM. TRACHELIIDAE

6. *Trachelius ovum* EHRB.

7. *Dileptus sp.*

O. HYMENOSTOMATIDA

FAM. TETRAHYMENIDAE

8. *Tetrahymena sp.*

9. *Glaucoma sp.*

10. *Colpidium colpoda* (EHRB.)

FAM. PARAMECIIDAE

11. *Paramecium caudatum* EHRB.

12. *Paramecium sp.*

FAM. FRONTONIIDAE

13. *Frontonia sp.*

14. *Lembadion sp.*

15. *Turania vitrea* BRODSKY

FAM. CYCLIDIIDAE

16. *Cyclidium sp.*

S.C. PERITRICHIA

O. PERITRICHIDA

FAM. VORTICELLIDAE

17. *Vorticella campanula* EHRB.

18. *Vorticella sp.*

FAM. EPISTYLIDAE

19. *Opercularia sp.*

S.C. SPIROTRICHIA

O. HETEROTRICHIDA

FAM. BURSARIDAE

20. *Bursaria sp.*

FAM. STENTORIDAE

21. *Stentor sp.*

FAM. SPIROSTOMIDAE

22. *Spirostomum sp.*

O. OLIGOTRICHIDA

FAM. STROMBILIDAE

23. *Strombilidium sp.*

O. HYPOTRICHIDA

FAM. ASPIDISCIDAE

24. *Aspidisca sp.*

FAM. EUPLOTIDAE

25. *Euploites sp.*

FAM. OXYTRICHIDAE

26. *Styloynchia sp.*

27. *Oxytricha sp.*

**TESTACEA**

FAM. DIFFLUGIIDAE

28. *Difflugia sp.*

29. *Centropyxis sp.*

**II. CNIDARIA**

Class HYDROZOA

O. HYDROIDA

30. *Hydra viridis*

31. *Hydra sp.*

**III. TURBELLARIA**

O. CATENULIDA

FAM. CATENULIDAE

32. *Catenula lemnae* ANT. DUGES

FAM. STENOSTOMIDAE

33. *Rhynchoscolex sp.*

34. *Stenostomum leucops* ANT. DUGES

35. *S. unicolor* O. SCHMIDT

O. MACROSTOMIDA

FAM. MACROSTOMIDAE

36. *Macrostomum appendiculatum* (O. FABR.)

37. *M. tuba* GRAFF

38. *M. viride* E. BENED.

39. *Macrostomum sp. 1*

40. *Macrostomum sp. 2*

O. PERILECITHOPHORA

41. *Geocentrophora sp.*

O. NEORHABDOCOELA DALYELLIODA

FAM. DALYELLIIDAE

42. *Castrella truncata* ABILDG.

O. NEORHABDOCOELA KALYPTORHYNCHIA

43. *Gyratrix hermaphroditus* EHRB.

O. SERIATA TRICLADIDA

44. *Crenobia alpina* (DANA)

**IV. TREMATODA**

O. MONOGENEA

45. *Gyrodactylus sp.*

O. DIGENEA

46. *Opisthorchis sinensis*

**V. GASTROTRICHA**

O. MACRODASYOIDEA

47. *Marinellina flagellata?* RUTTNER-KOLISKO

FAM. CHAETONOTIDAE

48. *Chaetonotus laroides* MARCOLONGO

49. *C. maximus* EHRB.

50. *Chaetonotus n. sp. A*

51. *Chaetonotus n. sp. B*

52. *Chaetonotus n. sp. C*

53. *Chaetonotus n. sp. D*

54. *Chaetonotus n. sp. E*

**VI. ROTIFERA**

MONOGONONTA

O. PLOIMIDA

FAM. BRACHIONIDAE

55. *Notholca foliacea* (EHRB.)

56. *N. labis* GOSSE

57. *N. squamula* (O.F.M.)

FAM. EUCHLANIDAE

58. *Euchlanis deflexa* (GOSSE)

FAM. MYTILINIDAE

59. *Mytilina ventralis* (EHRB.)

60. *Lophocharis salpina* (EHRB.)

FAM. COLURELLIDAE

61. *Colurella colurus* (EHRB.)

62. *Colurella sp.*

63. *Lepadella acuminata* (EHRB.)

64. *L. ovalis* (O.F.M.)

65. *L. triptera* EHRB.

FAM. LECANIDAE

66. *Lecane* (s.str.) *flexilis* (GOSSE)

67. *L. luna* (O.F.M.)

68. *L. (Monostyla) lunaris* (EHRB.)

69. *L. (Monostyla) sp.*

## FAM. PROALIDAE

70. *Proalinopsis caudatus* (COLLINS)  
 71. *Proales globulifera* (HAUER)  
 72. *P. fallaciosa* WULF.  
 73. *P. similis* DE BEAUCHAMP  
 74. *Proales theodora* (GOSSE)  
 75. *Proales* sp.

## FAM. LINDIIDAE

76. *Lindia torulosa* DUJARDIN

## FAM. NOTOMMATIDAE

77. *Drilophaga bucephalus* VEJDovsky  
 78. *Itura aurita* f. *intermedia* (WULF.)  
 79. *Monommata* sp.  
 80. *Resticula nyssa* H.& M.  
 81. *R. vermisculus* WULF.  
 82. *Resticula* sp.  
 83. *Pleurotrocha petromycon* EHRB.  
 84. *Notommata thopica* H.& M.  
 85. *Cephalodella catellina* (O.F.M.)  
 86. *C. forceps* DONNER  
 87. *C. sorficula* (EHRB.)  
 88. *C. gibba* (EHRB.)  
 89. *C. gibba macrodactyla* KOCH-ALTHAUS  
 90. *C. cf. gobio* WULF.  
 91. *C. cf. gracilis* DONNER  
 92. *C. cf. incila* WULF.  
 93. *C. megalcephala* (GLASCOTT)  
 94. *C. oxydactyla* WULF.  
 95. *C. reimanni* DONNER  
 96. *C. cf. rigida* DONNER  
 97. *C. tenuior* (GOSSE)  
 98. *Cephalodella* sp.

## FAM. TRICHOCERCIDAE

99. *Trichocerca* (*Diurella*) *porcellus* (GOSSE)  
 100. *T. (Diurella) taurocephala* (HAUER)  
 101. *T. (Diurella) tigris* (O.F.M.)

## FAM. GASTROPODIDAE

102. *Ascomorpha eucadis* (PERTY)

## FAM. SYNCHAETIDAE

103. *Synchaeta tremula* (O.F.M.)

## FAM. DICRANOPHORIDAE

104. *Dicranophorus diffugiarum* (PENARD)  
 105. *Dicranophorus forcipatus* (O.F.M.)  
 106. *D. liepolti* DONNER  
 107. *D. lutkeni-sigmoides* (BERGENDAL)  
 108. *D. uncinatus* MILNE  
 109. *Aspelta* sp.  
 110. *Wierzejskiella velox* (WISZNIOWSKI)  
 111. *Encentrum* (s.str.) *gulo* WULF.  
 112. *E. incisum* WULF.  
 113. *E. cf. lupus* WULF.  
 114. *E. mucronatum* WULF.  
 115. *E. mustela* (MILNE)  
 116. *E. putorius* WULF.  
 117. *Encentrum* sp.  
 118. *Encentrum* (*Paraencentrum*) *longipes* (WULF.)  
 119. *Myersinella tetraglena* (WISZNIOWSKI)

## S. O. DIGONONTA

## O. BDELLOIDEA

## FAM. HABROTROCHIDAE

120. *Habrotrocha collaris* (EHRB.)  
 121. *H. proxima* DONNER  
 122. *Habrotrocha* cf. *pusilla* (BRYCE)  
 123. *Habrotrocha* sp. A  
 124. *Habrotrocha* sp.B

## FAM. PHILODINIDAE

125. *Philodina acuticornis* MILNE  
 126. *P. flaviceps* BRYCE  
 127. *P. nemoralis* BRYCE  
 128. *P. plena* (BRYCE)  
 129. *P. vorax* (JANSON)  
 130. *Embata laticeps* MURRAY  
 131. *E. hamata* (MURRAY)  
 132. *Dissotrocha aculeata* (EHRB.)  
 133. *D. macrostyla* (EHRB.)  
 134. *Rotaria macroceros* (GOSSE)  
 135. *R. rotaria* (PALLAS)  
 136. *R. sordida* (WESTERN)  
 137. *R. socialis* KELLICOTT  
 138. *Rotaria* sp. A  
 139. *Rotaria* sp. B  
 140. *Macrotrachela* cf. *habita* (BRYCE)  
 141. *Macrotrachela papillosa* (THOMPSON)  
 142. *M. plicata* (BRYCE)  
 143. *M. quadricornifera* MILNE  
 144. *M. timida* MILNE  
 145. *M. vesicularis* (MURRAY)  
 146. *Macrotrachela* sp.  
 147. *Mniobia obtusicornis* MURRAY  
 148. *Mniobia scarlatina* (EHRB.)  
 149. *Mniobia* sp.

## FAM. ADINETIDAE

150. *Adineta barbata* JANSON  
 151. *A. steineri* BARTOŠ  
 152. *Adineta vaga* (DAVIS)  
 153. *Adineta* sp.

## FAM. PHILODINAVIDAE

154. *Philodinavus paradoxus* (MURRAY)  
 155. *Henoceros falcatus* (MILNE)

## VII. NEMATODA

## TORQUENTIA

## FAM. DESMOSCOLECIDAE

156. *Desmoscolex aquaedulcis* STAM.

## SECERNANTIA

## FAM. ANGUINIDAE

157. *Subanguina* sp.  
 158. *Ditylenchus* sp.

## FAM. NEOTYLENCHIDAE

159. *Hexatylus* sp.

## FAM. HOPLOLAIMIDAE

160. *Helicotylenchus* sp.

## FAM. CRICONEMATIDAE

161. *Hemicyclophora aquatica* (MICOLETZKY)  
 162. *Criconema sphagni* MICOLETZKY

## PENETRANTIA

## FAM. MONONCHIDAE

163. *Mononchus aquaticus* COETZEE  
 164. *M. truncatus* BASTIAN  
 165. *Clarkus papillatus* (BASTIAN)  
 166. *Iotonchus zschokkei* (MENZEL)  
 167. *Prionchulus muscorum* (DUJARDIN)  
 168. *P. punctatus* COBB

## FAM. MYLONCHULIDAE

169. *Mylonchulus cavensis* (W.SCHNEIDER)  
 170. *Mylonchulus* sp.

## FAM. ANATONCHIDAE

171. *Anatonchus tridentatus* (de MAN)

## FAM. NYGOLAIMIDAE

172. *Paravulvus hartingii* (de MAN)  
 173. *Nygolaimus*(?) *asymmetricus* ANDRASSY

## FAM. PRODORYLAIMIDAE

174. *Prodorylaimus longicaudatooides* ALTHERR  
 175. *P. acris* (THORNE)  
 176. *P. mas* LOOF  
 177. *P. uliginosus* LOOF

## FAM. DORYLAIMIDAE

178. *Dorylaimus stagnalis* DUYARDIN  
 179. *Mesodorylaimus aberrans* LOOF  
 180. *Mesodorylaimus* sp.

## FAM. QUDSIANEMATIDAE

181. *Eudorylaimus agilis* (de MAN)  
 182. *Eudorylaimus carteri-grp.*  
 183. *Eudorylaimus* sp.

## FAM. APORCELAIMIDAE

184. *Sectonema macroscopicum* (ALTHERR)  
 185. *Aporcelaimellus obtusicaudatus* (BASTIAN)  
 186. *A. simplex* (THORNE & SWANGER)  
 187. *A. ronnebergi* ALTHERR  
 188. *Aporcelaimellus* sp.

## FAM. NORDIIDAE

189. *Pungentus engadinensis* (ALTHERR)  
 190. *Enchodelus macrodorus* (de MAN)  
 192. *E. vulvostriatus* (STEFANSKI)  
 193. *Enchodelus* sp.

## FAM. LONGIDORIDAE

194. *Longidorus caespiticola* HOOPER  
 195. *L. picenus* ROCA, LAMB. & AGOST.  
 196. *Longidorus* sp.

## FAM. DORYLAIMOIDAE

197. *Dorylaimoides limnophilus* (de MAN)

## FAM. CRATERONEMATIDAE

198. *Chrysonemoides holsaticus* (W.SCHNEIDER)

## FAM. BELONDIRIDAE

199. *Axonchium coronatum* (de MAN)

## FAM. TYLENCHOLAIMELLIDAE

200. *Tylencholaimus proximus* THORNE

## FAM. DIPHTHEROPHORIDAE

201. *Diphtherophora communis* (de MAN)

## VIII. MOLLUSCA: GASTROPODA

## S.C. PROSOBRANCHIA

## O. MESOGASTROPODA

## FAM. HYGROBIDIAE

202. *Bythinella austriaca* FRAUENFELD

## IX. POLYCHAETA

## FAM. NERILLIDAE

203. *Troglochaetus beranecki* DEL.

## X. OLIGOCHAETA

## FAM. AELOSOMATIDAE

204. *Aelosoma hemprichi* EHRB.  
 205. *Aelosoma quaternarium* EHRB.

## FAM. NAIDIDAE

206. *Chaetogaster cristallinus* VEJDovsky  
 207. *C. langui* BRETSCHER  
 208. *Nais alpina* SPERBER  
 209. *N. elinguis* MÜLLER  
 210. *N. pardalis* PIGUET  
 211. *Naididae* gen.sp.

## FAM. ENCYTRAEIDIDAE

212. *Achaeta eiseni* VEJDovsky  
 213. *Marionina argentea* (MICHAELSEN)  
 214. *Cernosvitoviella atrata* (BRETSCHER)  
 215. *Mesenchytraeus armatus* LEVINSEN  
 216. *Enchytraeididae* gen. sp.1  
 217. *Enchytraeididae* gen. sp.2  
 218. *Enchytraeididae* gen. sp.3

## FAM. LUMBRICULIDAE

219. *Lumbriculus variegatus* MÜLLER  
 220. *Stylodrilus heringianus* CLAP.  
 221. *Rhynchelmis limonella* HOFFMAN.  
 222. *Lumbriculidae* gen.sp.

## FAM. HAPLOTAXIDAE

223. *Haplotaxis gordiooides* (HARTMANN)

## FAM. LUMBRICIDAE

224. *Eiseniella tetraedra* (SAVIGNY)

## XI. TARDIGRADA

## O. EUTARDIGRADA

225. *Macrobiotus ampullaceus* THULIN  
 226. *Macrobiotus* sp.A  
 227. *Milnesium tardigradus* DOYÉRE

## XII. ACARI

## HYDRACHNELLAE

## FAM. HYDRYPHANTIDAE

228. *Partnunia angusta* KOENICKE

## FAM. SPERCHONTIDAE

229. *Sperchon brevirostris* (KOENICKE)  
 230. *S. glandulosus* (KOENICKE)  
 231. *S. denticulatus* (KOENICKE)

## FAM. LEBERTIIDAE

232. *Lebertia (Pseudolebertia) glabra* THOR  
 233. *Lebertia* sp.

## FAM. TORRENTICOLIDAE

234. *Torrenticola elliptica* MAGLIO

## FAM. HYGROBATIDAE

235. *Hygrobates foreli* LEBERT  
 236. *Atractides gibberipalpis* PIERS.  
 237. *A. loricatus* PIERSIG  
 238. *A. mitisi* WALTER  
 239. *A. nodipalpis nodipalpis* (THOR)  
 240. *A. nodipalpis* var. *robustus* SOKOLOW  
 241. *A. vaginalis* var. *adnatus* LUNDBLAND  
 242. *A. walteri* VIETS

## FAM. FELTRIIDAE

243. *Feltria setigera* (KOENICKE)  
 244. *F. minuta* (KOENICKE)

## FAM. ATURIDAE

245. *Ljania bipapillata* THOR  
 246. *Aturus fontinalis* LUNDBLAND

## POROHALACARIDA

247. *Walterella weberi*

## INSECTA

## XIII. EPHEMEROPTERA

## FAM. HEPTAGENIIDAE

248. *Epeorus alpicola* EATON  
 249. *E. sylvicola* PICTET  
 250. *Ecdyonurus dispar* CURTIS  
 251. *E. helveticus* EATON  
 252. *E. picteti* MEYER-DÜR  
 253. *E. venosus* FABRICIUS  
 254. *Rhithrogena alpestris* EATON  
 255. *Rhithrogena cf. hybrida* EATON

## FAM. BAETIDAE

256. *Baetis alpinus* PICTET  
 257. *B. melanonyx* PICTET  
 258. *B. muticus* L.  
 259. *B. rhodani* PICTET  
 260. *B. vernus* CURTIS  
 261. *Centroptilum luteolum* MÜLLER

## FAM. ÉPHEMERELLIDAE

262. *Ephemerella ignita* PODA  
 263. *E. mucronata* BENGTSSON

## FAM. LEPTOPHLEBIIDAE

264. *Habroleptoides confusa* SART. & JAKOB

**XIV. PLECOPTERA**

FAM. TAENIOPTERYGIDAE

265. *Taeniopteryx hibaulti* AUBERT

FAM. NEMOURIDAE

266. *Amphinemura sulcicollis* STEPHENS267. *A. standfussi* RIS268. *A. triangularis* RIS269. *Nemoura cinerea* (RETIUS)270. *N. flexulosa* AUBERT271. *N. marginata* PICTET272. *N. minima* AUBERT273. *N. mortoni* RIS274. *N. sinuata* (RIS)275. *Nemurella* sp.276. *Protonemura auberti* ILLIES277. *P. brevistyla* (RIS)278. *P. intricata* (RIS)279. *P. lateralis* (PICTET)280. *P. nimborella* MOSELY281. *P. nitida* STEPHENS

FAM. LEUCTRIDAE

282. *Leuctra albida* KEMPNY283. *L. armata* KEMPNY284. *L. aurita* NAVAS285. *L. braueri* KEMPNY286. *L. cingulata* KEMPNY287. *L. fusca* (L.)288. *L. hexacantha* DESPAX289. *L. hippopus* KEMPNY290. *L. inermis* KEMPNY291. *L. maior* BRINCK292. *L. mortoni* KEMPNY293. *L. moseleyi* MORTON294. *L. nigra* (OLIVER)295. *L. prima* KEMPNY296. *L. rosinae* KEMPNY

FAM. CAPNIIDAE

297. *Capnia nigra* PICTET

FAM. PERLODIDAE

298. *Dictyogenus alpinum* PICTET299. *D. fontium* RIS300. *Isoperla difformis* (KLAPALEK)301. *I. grammatica* (PODA)302. *I. oxylepis* (DESPAX)303. *Perlodes intricata* (PICTET)304. *P. microcephala* (PICTET)

FAM. PERLIDAE

305. *Dinocras cephalotes* CURTIS306. *Dinocras* sp.307. *Perla bipunctata* (PICTET)308. *P. marginata* (PANZER)309. *P. maxima* SCOPOLI310. *Chloroperla susemicheli* (ZWICK)311. *C. torrentium* (PICTET)**XV. TRICHOPTERA**

FAM. RHYACOPHILIDAE

312. *Rhyacophila aurata* BRAUER313. *R. dorsalis* CURTIS314. *R. hirticornis* Mc.L.315. *R. tristis* PICTET316. *R. vulgaris* PICTET

FAM. HYDROPTILIDAE

317. *Ithytrichia lamellaris* EATON318. *Hydroptila ivisa* MAL.319. *H. martini* MARSHALL320. *Hydroptila* sp.

## FAM. PHILOPOTAMIDAE

321. *Philopotamus ludificatus* Mc.L.322. *Wormaldia copiosa* Mc.L.323. *W. pulla* Mc.L.

## FAM. HYDROPSYCHIDAE

324. *Hydropsyche* sp.

## FAM. POLYCENTROPODIDAE

325. *Plectrocnemia geniculata* Mc.L.326. *P. conspersa* CURTIS

## FAM. PSYCHOMYIDAE

327. *Tinodes dives* PICTET

## FAM. BRACHYCENTRIDAE

328. *Brachycentrus montanus* KLAP.329. *Micrasema minimum* Mc.L.

## FAM. LIMNEPHILIDAE

330. *Drusus biguttatus* PICTET331. *Ecclisopteryx guttulata* PICTET332. *Metanoea rhaetica* SCHMID333. *Limnephilus germanus* Mc.L.334. *L. rhombicus* L.335. *Colpotaulius incisus* CURTIS336. *Potamophylax cingulatus* STEPHENS337. *Halesus digitatus* SCHRANK338. *H. radiatus* CURTIS339. *H. rubricollis* PICTET340. *Melampophylax melampus* Mc.L.341. *Allogamus auricollis* PICTET342. *A. uncatus* BRAUER343. *Chaetopteryx fusca* BRAUER344. *Pseudopsiloptyryx zimmeri* Mc.L.345. *Chaetopterygopsis maclachlani* STEIN346. *Annitella obscurata* Mc.L.

## FAM. GOERIDAE

347. *Silo nigricornis* PICTET

## FAM. LEPIDOSTOMATIDAE

348. *Crunoecia kempnyi* MORTON

## FAM. SERICOSTOMATIDAE

349. *Sericostoma slavicorne* SCHNEIDER**XVI. MEGALOPTERA**

## FAM. SIALIDAE

350. *Sialis fuliginosa* PICTET**XVII. COLEOPTERA**

## FAM. DYTISCIDAE

351. *Oreodytes (?) borealis*

## FAM. HYDRAENIDAE

352. *Haenya gracilis* GERM.353. *H. lapidicola* KIESW.354. *H. truncata* REY

## FAM. ELMIDAE

355. *Esolus angustatus* PH. MÜLL.356. *Riolus subviolaceus* PH. MÜLL.357. *Elmis* sp.**DIPTERA**

## S.O. NEMATOCERA

**XVIII. FAM. PSYCHODIDAE**358. *Pericomia* sp.**XIX. FAM. CHIRONOMIDAE**

## S.F. PODONOMINAE

359. *Paraboreochlus minutissimus* (THIEN.)

## S.F. TANYPODINAE

360. *Conchapelopia pallidula* (MEIGEN)361. *Macropelopia notata* (MEIGEN)362. *Nilotanypus dubius* (MEIGEN)363. *Paramerina divisa* (WALKER)364. *Thienemannimyia geijskesi* (GOET.)365. *T. laeta* (MEIGEN)366. *Trissopelopia longimana* (STAEBER)367. *Zavrelimyia signatipennis* (KIEFFER)

## S.F. DIAMESINAE

368. *Diamesa cinerella* (MEIGEN)  
 369. *D. hamaticornis* (KIEFFER)  
 370. *D. insignipes* (KIEFFER)  
 371. *D. permacer* (WALKER)  
 372. *D. thienemanni* (KIEFFER)  
 373. *Pothastia gaedii* (MEIGEN)  
 374. *P. longimana* (KIEFFER)  
 375. *Pseudodiamesa branickii* (NOWICKI)

## S.F. PRODIAMESINAE

376. *Prodiamesa olivacea* (MEIGEN)

## S.F. ORTHOCLADIINAE

377. *Brillia longifurca* (KIEFFER)  
 378. *B. modesta* (MEIGEN)  
 379. *Bryphaenocladius ictericus* (MEIGEN)  
 380. *B. muscicola* grp.  
 381. *Chaetocladius laminatus* (BRUN.)  
 382. *Chaetocladius sp. A*  
 383. *Corynoneura edwardsi* BRUN.  
 384. *C. lobata* EDWARDS  
 385. *Cricotopus (Cricotopus) annulator* (GOET.)  
 386. *C. (C.) curtus* HIRVENOJA  
 387. *C. (C.) fuscus* (KIEFFER)  
 388. *Cricotopus (C.) sp.cf similis* GOET.  
 389. *C. (Cricotopus) tremulus* (L.)  
 390. *Eukiefferiella brevicalcar* (KIEFFER)  
 391. *E. claripennis* LUNDBECK  
 392. *E. clypeata* KIEFFER  
 393. *E. coerulescens* (KIEFFER)  
 394. *E. devonica* (EDWARDS)  
 395. *E. ilkleyensis* (EDWARDS)  
 396. *E. lobifera* GOET.  
 397. *E. minor* (EDWARDS)  
 398. *E. similis* GOET.  
 399. *E. tirolensis* (GOET.)

400. *Heleniella ornaticollis* (EDWARDS)  
 401. *Heterotriaccocladius marcidus* (WALKER)  
 402. *Krenosmittia boreoalpina* (GOET.)  
 403. *Limnophyes prolongatus* (KIEFFER)  
 404. *Metriocnemus hygropetricus* (KIEFFER)  
 405. *Nanoacladius rectinervis* (KIEFFER)  
 406. *Orthocladius (Euorthocladius) ashei* SOPONIS  
 407. *O. (Orthocladius) excavatus* (BRUNDIN)  
 408. *Orthocladius (Eu.) frigidus* (ZETTERSTEDT)  
 409. *Orthocladius (Eu.) rivulorum* KIEFFER  
 410. *Orthocladius (Eu.) rivicola* KIEFFER  
 411. *Orthocladius (O.) sp.cf.saxicola* KIEFFER  
 412. *Orthocladius (Eu.) luteipes* GOET.  
 413. *Orthocladius (O.) wetterensis* (BRUNDIN)  
 414. *Paracladius alpicola* (ZETTERSTEDT)  
 415. *Parametriocnemus boreoalpinus* GOWIN  
 416. *P. stylatus* (KIEFFER)  
 417. *Paraphaenocladius impensus* (WALKER)  
 418. *P. irritus* (WALKER)  
 419. *P. pseudirritus* STRENZKE  
 420. *Paraphaenocladius sp. I*  
 421. *Paratrichocladius nivalis* (GOET.)  
 422. *P. rufiventris* (MEIGEN)  
 423. *P. skirwithensis* (EDWARDS)  
 424. *Paratriscocladius excerptus* (WALKER)  
 425. *Parorthocladius nudipennis* (KIEFFER)  
 426. *Pseudosmittia gracilis* (GOET.)  
 427. *P. holsata* (THIEN. & STREN.)  
 428. *P. recta* (EDWARDS)  
 429. *Rheocricotopus effusus* (WALKER)  
 430. *R. fuscipes* (KIEFFER)  
 431. *R. gouini* (GOET.)

432. *Rheosmittia spinicornis* (BRUNDIN)

433. *Smittia paranudipennis* (BRUNDIN)  
 434. *Symbiocladius rhithrogenae* KIEFFER  
 435. *Symposiocladius lignicola* (KIEFFER)  
 436. *Synorthocladius semivirens* (KIEFFER)  
 437. *Thienemannia gracilis* KIEFFER  
 438. *Thienemannia clavicornis* KIEFFER  
 439. *T. morosa* (EDWARDS)  
 440. *T. partita* (SCHLEE)  
 441. *T. vittata* EDWARDS  
 442. *Trissocladius sp. I*  
 443. *Tvetenia bavarica* GOET.  
 444. *T. calvescens* EDWARDS  
 445. *T. discoloripes* (GOET.)

## S.F. CHIRONOMINAE

## TRIBE: CHIRONOMINI

446. *Cryptocladolopelma lateralis* (GOET.)  
 447. *Microtendipes pedellus* grp.  
 448. *Paracladolopelma camptolabis* (KIEFFER)  
 449. *Phaenopsectra flavipes* MEIGEN  
 450. *Polypedilum albicone* (MEIGEN)  
 451. *P. apselbecki* (STROBL)  
 452. *P. laetum* (MEIGEN)

## TRIBE: TANYTARSINI

453. *Micropsectra attenuata* (REISS)  
 454. *M. atrofasciata* KIEFFER  
 455. *M. notescens* (WALKER)  
 456. *Neozavrelia bernensis* REISS  
 457. *Rheotanytarsus nigricauda* FITTKAU  
 458. *Stempellina bausei* (KIEFFER)  
 459. *S. brevis* (EDWARDS)  
 460. *Tanytarsus gibbosiceps* (KIEFFER)  
 461. *T. palettaris* (VERNEAUX)

## XX CERATOPOGONIDAE

462. *Bezzia sp. I*  
 463. *Dasyhelea sp.*

## XXI. SIMULIIDAE

464. *Prosimulium hirtipes* (FRIES)  
 465. *P. latimucro* (ENDERLEIN)  
 466. *P. rufipes* (MEIGEN)  
 467. *Simulium (Eusimulium) aureum* FRIES  
 468. *Nevermannia brevidens* (RUBZOW)  
 469. *N. carthusiensis* (GRENIER & DORIER)  
 470. *N. cryophilum* (RUBZOW)  
 471. *Simulium maximum* (KNOZ)  
 472. *S. monticola* (FRIEDRICH)  
 473. *S. ornatum* MEIGEN  
 474. *S. reptans* (LINNAEUS)  
 475. *S. tuberosum* (LUNDSTRÖM)  
 476. *S. variegatum* MEIGEN

## XXII. TIPULIDAE

## S.F. TIPULINAE

477. *Tipula sp.*

## S.F. LIMONIINAE

478. *Antocha sp. I*  
 479. *Antocha sp. 2*  
 480. *Dicranota sp. I*  
 481. *Dicranota sp. 2*  
 482. *Limnophila sp. I*  
 483. *Hexatoma sp. I*  
 484. *Ormosia sp.*  
 485. *Rhypholophus sp.*

## S.O. BRACHYCERA

## XXIII. ATHERICIDAE

486. *Atherix cf. marginata* (F.)

**XXIV. EMPIDIDAE**487. *Hemerodromia* sp.488. *Chelisera* sp.489. *Wiedemannia* sp. 1490. *Wiedemannia* sp. 2**XXV. COLLEMBOLA**491. *Agrenia bidenticulata* (TULLBERG)492. *Anurida ellipsoidea* (STARCH)493. *Anurida cf. granulata* (AGRELL)494. *Anurophorus laricis* (NICOLET)495. *Arrhopalites caecus* (TULLBERG)496. *Ceratophysella armata* (NICOLET)497. *Ceratophysella* sp.498. *Deuterostomithurus bicinctus* (KOCH)499. *Dicyrtomina minuta* (FABRICIUS)500. *Dicyrtomidae* Gen. sp.501. *Entomobrya corticalis* (NICOLET)502. *Entomobrya multifasciata* (TULLBERG)503. *Entomobrya nivalis* (L.)504. *Entomobrya* sp.505. *Folsomia candida* WILLEM506. *Folsomia penicula* BAGNALL507. *Folsomia quadrioculata* (TULLBERG)508. *Friesea claviseta* AXELSON509. *Friesea truncata* (CASSAGNAU)510. *Friesea* sp. 1511. *Friesea* sp. 2512. *Heteromurus nitidus* (TEMPLETON)513. *Isotoma germanica* HÜTHER & WINTER514. *Isotoma notabilis* (SCHÄFFER)515. *Isotoma olivacea* TULLBERG516. *Isotomurus palustris* (MÜLLER)517. *Isotomurus* sp.518. *Lepidocyrtus lignorum* (FABRICIUS)519. *Lepidocyrtus* sp.520. *Onychiurus armatus* (TULLBERG)521. *Onychiurus cf. austriacus* (BUTSCHEK)522. *Onychiurus paradoxus* (SCHÄFFER)523. *Onychiurus pseudogranulosus* GISIN524. *Onychiurus* sp. 1525. *Onychiurus* sp. 2526. *Orchesella flavescens* (BOURLET)527. *Pseudodisotoma sensibilis* (TULLBERG)528. *Pseudosinella huetheri* STOMP529. *Proisotoma* sp.530. *Tomocercus* sp.531. *Triacanthella perfecta* DENIS532. *Xynella maritima* TULLBERG**CRUSTACEA****CLASS BRANCHIOPODA****XXVI. CLADOCERA**

## FAM. CHYDORIDAE

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