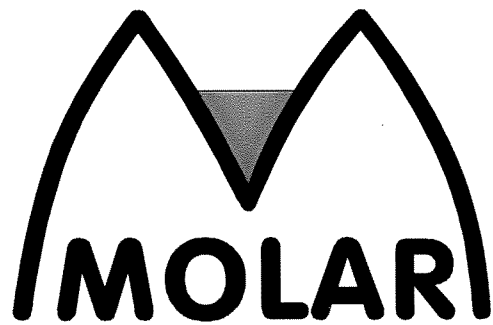


REPORT SNO 3710-97

Project Manual

Annex



Mountain Lake Research

Measuring and modelling
the dynamic response of
remote mountain lake ecosystems
to environmental change

A programme of **Mo**untain **L**ake **R**esearch
MOLAR

GUIDELINES FOR THE IDENTIFICATION OF CHIRONOMID LARVAE IN THE MOLAR PROJECT

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INTRODUCTION

In order to ensure a standardised treatment of the chironomid larvae found in the MOLAR project it was decided to write a manual discussing the taxa found in the Al:Pe 1 & 2 projects, and to give recommendations about what literature to use when identifying the larvae collected in the MOLAR project. The MOLAR chironomid material will most likely turn out to be similar in taxonomic composition to that found in the Al:Pe projects, with only a few taxa in addition. All taxa found in the Al:Pe projects are treated here. Hopefully such a manual will result in greater harmonisation, i.e. that the same names are used for the same taxa, which is very important for the interpretation of the results.

The manual clearly shows the difficulties involved in identifying many chironomid larvae. Rather few are described, and few generic revisions are published. Often the only way to get a species name is when a prepupa is found. Sometimes it is possible to assume the species name after having found one larval type and pupal exuviae belonging to the same genus in a species-poor habitat like high altitude lakes. But caution should be exercised, and «cf.» should be inserted between the generic and specific name. Often only a species-group name can be assigned, and in some larger genera which have not been revised, for instance *Psectrocladius s.str.* and *Tanytarsus*, no good keys exist even to species groups. In some important genera, for instance *Procladius* and partly *Chironomus*, it is not even possible to identify the male imagines based on morphology.

Harmonising the taxonomy is very problematic when it comes to the large, unrevised or difficult genera like *Procladius*, *Corynoneura*, *Cricotopus* + *Orthocladius*, *Psectrocladius s.str.*, *Thienemanniella*, *Chironomus*, *Micropsectra*, *Paratanytarsus*, and *Tanytarsus*. Several keys exist to parts of these genera, but they often contradict each other, and it is not possible to put a species name on most of the larvae. One way to make clear what taxon is in question is to specify what key that has been used to identify it. For instance, if a *Corynoneura* larva is identified as *scutellata* using Hirvenoja (1988), it should be reported as *Corynoneura scutellata sensu* Hirvenoja 1988. Other examples are *Psectrocladius (Psectrocladius) sordidellus sensu* Cranston 1982, *Thienemanniella sp. D sensu* Schmid 1993, etc. For some genera, where no key exist at all, harmonisation is nearly impossible. This is the case in *Tanytarsus*, where almost no larvae are described at all. The genus is large, with almost 80 valid species in the Palearctic region only (Ashe & Cranston 1990), and maybe 10 of these are adequately described as larva. The taxonomic status of the genus is simply too poor to achieve any degree of harmonisation.

Even greater problems are present when studying subfossil material from the sediment cores. Many of the characters used in identifying chironomid larvae falls off in subfossil material, often leaving only the head capsule itself with no attached structures. This means that it is often difficult to go beyond the genus level on subfossil material. And in many instances even the genus cannot be determined.

For the identification of prepupae, pupae and pupal exuviae, Wiederholm (1986) and Langton (1991) are the most important publications. Wiederholm (1989) gives keys to the males of all chironomid genera, and also gives information about important work done on the various genera.

SUBFAMILY TANYPODINAE

The larvae of subfamily Tanypodinae are in general very difficult to identify at the species level, and prepupae are normally necessary for reliable determination in this stage. The genera are easily separated using the key in Fittkau & Roback (1983). However, quite few species are described as larva, and within each genus the larvae are very similar and without good characters for separation of the species. This is evident by Roback's works (1978, 1980, 1981), which are very detailed studies of immatures of Tanypodinae from U.S.A. Perhaps the best work on Tanypodinae larvae is Pankratova (1977), which unfortunately is only available in Russian.

Subfossil material of Tanypodinae is often difficult to identify even to the genus level. Kowalyk (1985), who used the position of the setae on the head capsule, is useful for determining many common genera. However, he was not able to separate *Conchapelopia* and *Thienemannimyia*, and *Arctopelopia* is not included.

Genus *Ablabesmyia*: *longistyla* Fittkau, *monilis* (Linné), *Ablabesmyia* sp.

Three species of the genus are found in Europe (Ashe & Cranston 1990), and the larvae are easily separated by the basal segment of the maxillary palp (Fittkau & Roback 1983). However, in figure 5.1 on p. 74 in Fittkau & Roback the illustrations of the maxillary palps for *longistyla* and *monilis* are exchanged. Figure 5.1 J shows the basal segment of *monilis* while figure 5.1 K shows the same for *longistyla*.

If maxillary palps are present, also subfossil *Ablabesmyia* can be identified to species level.

***Apsectrotanypus trifascipennis* (Zetterstedt)**

Easily separable from the similar *Macropelopia*-larvae by the characters used by Fittkau & Roback (1983). Only *A. trifascipennis* is found in western Palearctic region (Ashe & Cranston 1990).

Genus *Arctopelopia*: *barbitarsis* (Zetterstedt), *melanosoma* (Goetghebuer), cf. *griseipennis* (Wulp), *Arctopelopia* spp.

Only the larva of *A. griseipennis* is described (Zavrel 1936). All three species from the Palearctic region were found in Al:Pe 2, and the determinations were based on prepupae and pupae found in the samples. The species of the genera *Arctopelopia*, *Conchapelopia*, *Thienemannimyia*, and *Zavrelimyia* all have relatively long setae on the body, as long as or longer than the corresponding segment. This character makes it easy to separate them in the binocular from the otherwise similar *Ablabesmyia*.

Genus *Conchapelopia*: *melanops* (Meigen), *Conchapelopia* sp.

The larvae of two species (*C. melanops*, *C. pallidula* (Meigen)) from the Palearctic region were superficially described by Moller Pillot (1984a).

Genus *Macropelopia*: *adaucta* (Kieffer), *nebulosa* (Meigen), *Macropelopia* spp.

Macropelopia larvae from the Palearctic region cannot be identified to species level. Pankratova (1977) described some larvae. The specimens of *M. adaucta* (formerly *M. goetghebueri* (Kieffer)) from Lille Hovvatn and Maam were identified on prepupae.

Genus *Pentaneurella*: *katterjokki* Fittkau & Murray, *Pentaneurella* sp.

Monotypical genus previously found only in Lappland in Sweden and in northern Norway (Fittkau & Murray 1983). The records from Agulio and Redó in Spain are surprising, and these specimens might conceivably belong to a new species of the genus. However, only immatures were found, and adults are needed in order to verify the status of these specimens.

Genus *Procladius* (*Holotanypus*): *choreus* (Meigen), *sagittalis* (Kieffer), *signatus* (Zetterstedt), *Procladius* spp.

Taxonomically this genus is in a complete mess in all stages. According to Ashe & Cranston (1990) there are 18 valid species in *Procladius* (*Holotanypus*) in the Palearctic region, with 10 synonyms listed. Most likely there are several more synonyms among those regarded as valid species. Except for Roback (1980), nobody has made a serious attempt to make a key to the larvae of the genus in the Holarctic region. According to Roback, «the larvae, especially in the subgenus *Procladius* (now *Holotanypus*) have, except for size, few differential characters», and «with few exceptions, structural characters do not seem to exist in the subgenus

Procladius (now *Holotanypus*)». Taking this into consideration, it's a waste of time to make slide mounts of *Procladius* larvae, if one feels certain they belong to this genus. At high altitudes they can be mixed mainly with the larvae of *Apsectrotanypus* and *Macropelopia*. *P. (Holotanypus)* and *Macropelopia* larvae are easily separated in the binocular by the colouration of the head capsule. The head capsule of *Holotanypus* is completely white, while on relatively fresh material of *Macropelopia* it is golden. The head capsule colouration of *Apsectrotanypus* is not know.

***Rheopelopia* sp.**

Normally lotic species living in the lower reaches of rivers (Fittkau & Roback 1983). Only one (*R. ornata* (Meigen)) out of 4 Palearctic species is described as larva (Klink 1982).

***Telmatopelopia nemorum* (Goetghebuer)**

One specimen was found in the sediment core from Estany Redo. Reported in the AI:Pe 2 report as *Telmatopelopia* sp., but the genus is monotypical, and nothing indicates that this specimen represents a new species.

Genus *Thienemannimyia*: *fusciceps* (Edwards), *Thienemannimyia* sp.

Eleven species of *Thienemannimyia* are found in the Palearctic region (Ashe & Cranston 1990), but only the larva of *T. northumbrica* (Edwards) has been properly described (Laville 1971).

Genus *Trissopelopia*: *longimana* (Staeger), cf. *longimana* (Staeger), ?*Trissopelopia* sp.

The larvae of the 2 species from the Palearctic region are not described. *T. longimana* from Paione Inferiore was a prepupa, and the pupae are readily identified by the thoracic horn (Langton 1991).

Genus *Zavrelimyia*: *melanura* (Meigen), cf. *barbatipes* (Kieffer), *Zavrelimyia* spp.

Larvae of the genus are easy to separate from the other Pentaneurini genera *Arctopelopia*, *Conchapelopia*, and *Thienemannimyia*. One of the claws on the posterior parapods have a large point on the inner margin. Also the larvae of *Zavrelimyia* are quite hairy, although not as much as *Arctopelopia* and *Conchapelopia*. Separation of the larvae within *Zavrelimyia* is very difficult. Reared larvae of *Zavrelimyia barbatipes* from Norway has Lauterborn Organs on antennal segment 2 shaped as a tuning fork. This character makes the larva key to couplet 21 in Fittkau & Roback (1983, p. 37), however, the above mentioned point on the inner margin of one claw will show it is a *Zavrelimyia*.

SUBFAMILY DIAMESINAE

Also the larvae of many Diamesinae are difficult to identify, in particular species in the genus *Diamesa*. Several of the other genera contains very few species, and sometimes biogeographical information can be used to arrive at a species name.

Genus *Diamesa*: *aberrata* (Lundbeck), *arctica* (Boheman), *bertrami* (Edwards), *bohemani* Goetghebuer, *hyperborea* Holmgren, *Diamesa* spp. (A, B)

The larvae of the genus are difficult to separate from each other. Some keys are available to a few species, but the larva of many species are undescribed and reliable identification is normally not possible except on prepupae. Probably the most comprehensive key so far was published by Schmid (1993). One major problem is that in the 4th instar larvae the mentum and mandibles very often are strongly worn down, making identification impossible. The pupae of *Diamesa* are treated by Langton (1991). All the species identified in Al:Pe 2 were found as prepupae or pupae at Svalbard.

***Potthastia longimana* Kieffer**

The genus is divided into two species groups on the larval stage, the *longimana* and the *gaedii* group, which are easily separated in the key to Diamesinae given by Oliver (1983). However, the larvae of the genus are very little studied (E. Willassen pers. comm.), and species identification in this stage can only be done on prepupae.

Genus *Protanypus*: *morio* (Zetterstedt), *Protanypus* spp.

The genus was revised by Sæther (1975a). According to Ashe & Cranston (1990) there are three species in west Palearctic region (*caudatus* Edwards, *forcipatus* (Egger), and *morio* (Zetterstedt)). According to Brundin (1952) *caudatus* and *forcipatus* are very similar, and he consider them to be a boreoalpine species pair. Sæther use the number of labral scales to separate *caudatus* and *morio*. In material from Norway this character varies more than stated by him, and cannot be used for separation of the larvae.

Genus *Pseudodiamesa*: cf. *branickii* (Nowicki), cf. *nivosa* (Goetghebuer), *Pseudodiamesa* (*Pachydiamesa*) sp., *Pseudodiamesa* (*Pseudodiamesa*) sp., *Pseudodiamesa* sp. (A, B)

Oliver (1959) divided the genus into two subgenera, *Pachydiamesa* and *Pseudodiamesa*, based on characters in the adults. One species, *P. arctica* (Malloch), was ascribed to *Pachydiamesa*. Later, Oliver

(1983) found that the larva of this species had pectinate labral lamellae, while the larvae of *Pseudodiamesa* s.str. lack labral lamellae. Two species were known from the west Palearctic region, (*branickii* and *nivosa* (Ashe & Cranston 1990)), until *P. arctica* was found in 3 alpine lakes in western Norway (Schnell & Willassen 1991). The adult characters Oliver used for splitting the genus varies a lot according to material from Norway, and does not hold for separating the subgenera. Schnell & Willassen took chromosome samples of *P. arctica* which were analysed in Novosibirsk. It was concluded that the chromosome patterns were identical to those of *nivosa* (E. Willassen pers. comm.). It then looks like *arctica* and *nivosa* are synonyms, and that some populations have and others lack the pectinate labral lamellae. Schmid (1993) stated in his key that *nivosa* does have labral lamellae.

***Pseudokiefferiella parva* (Edwards)**

Only one species is found in the Palearctic region (Ashe & Cranston 1990).

SUBFAMILY PRODIAMESINAE

A small subfamily with only 3 genera in the Palearctic region.

***Monodiamesa bathyphila* (Kieffer)**

The genus was revised by Sæther (1972), and the larvae are readily identified using his key.

***Prodiamesa olivacea* (Meigen)**

The only species in the genus found in Al:Pe projects. Schmid (1993) gave a key to 3 out of the 4 species found in the west Palearctic region.

SUBFAMILY ORTHOCLADIINAE

Orthocladiinae is, together with Chironominae, the largest subfamily among the Chironomidae. It is normally the most species-rich subfamily of chironomids in high mountain and high latitude biotopes, with many genera. Some of the more important genera are revised, but often only a few larvae are known and included, or none are. The genera are normally easy to identify using the key in Cranston & al. (1983), while keys to species are spread over a wide range of publications. The most important for each genus are included below.

***Acamptocladius submontanus* (Edwards)**

The genus was revised by Cranston & Sæther (1982), who did not know the larvae of *submontanus*. However, they described all stages of the new species *A. reissi*, close to *submontanus*. Material from Store Hovvatn indicates that the two species are synonyms.

***Brillia* sp.**

One specimen was found in the sediment core from Lagoa Escura.

Genus *Bryophaenocladus*: *Bryophaenocladus* sp. Stavsvatn, *Bryophaenocladus* spp.

A key to some *Bryophaenocladus* larvae was given by Thienemann (1944). Most species are terrestrial, but *B. subvernalis* Edwards has been found in the littoral zone of two alpine lakes (Strenzke 1942).

Genus *Chaetocladius*: *laminatus* (Brundin), cf. *laminatus* (Brundin), *Chaetocladius* spp. (A, B)

No species key exists to the larvae of the genus. Cranston & al. (1983) gave a key to some species-groups, but without stating which species are included in the different groups. This makes the key of limited value.

Genus *Corynoneura*: *arctica* Kieffer, *coronata* Edwards, *lacustris* Edwards, *lobata* Edwards, *scutellata* Winnertz, cf. *lobata* Edwards, *Corynoneura* spp. (A, B)

Identifying larvae of *Corynoneura* is a frustrating business. The keys published by Cranston (1982) and Hirvenoja & Hirvenoja (1988) in several cases gives different species name on the same specimen. Only reared material can be identified with certainty using the key given by Schlee (1968) for imago. Also Schmid (1993) has a key to some *Corynoneura*.

Genus *Cricotopus* van der Wulp:

The best keys to *Cricotopus* larvae are found in Hirvenoja's revision of the genus from 1973. The keys are constructed phylogenetically, which makes them more difficult to use than is necessary. However, as soon as one gets used to them, they are really good. An English translation and simplification of Hirvenoja's keys were given by Simpson & al. (1983). The keys relies much on ratios and number of setae in the setal tufts of the 4th instar larva, and thus it is not always easy to identify younger instars. Many species of *Cricotopus* described from the Palearctic zone are also found in the Nearctic zone, and the larvae of some were treated by LeSage & Harrison (1980) and Oliver & Dillon (1988).

Subgenus *Cricotopus*: *annulator* Goetghebuer, *curtus* Hirvenoja, *pulchripes* Verrall, *tibialis* (Meigen), *cylindraceus*-group, *tremulus*-group, *Cricotopus* (*Cric.*) spp.

C. annulator, *curtus* and *pulchripes* all belong to the *tremulus* group. The larva of *C. pulchripes* was described by Cranston (1982). Many species in the *tremulus* group are not described as larvae.

Subgenus *Isocladius*: *laricomalis*-group, *reversus*-group, *Cricotopus* (*Isocl.*) spp.

Also the 4th instar larvae of *Isocladius* are readily identified using the keys of Hirvenoja and Simpson & al. The larvae of the *laricomalis* group and *reversus* group were found in Al:Pe 1, but they were too small to be identified to species level.

***Cricotopus* + *Orthocladius* indet.**

It is normally no problem to separate recent larvae of these two genera. The larvae of all *Cricotopus* species have setal tufts on most of the abdominal segments, and these are present also in the 1. instar larvae, although the number of setae in each tuft is much reduced. So far only the larva of *Orthocladius* (*Orthocladius*) *annectens* Sæther has been found to have setal tufts in this genus (Fagnani & Soptonis 1987). However, separating subfossil material of the genera is very difficult. Sometimes the paralabial plates (Soptonis 1977) are useful, with some *Orthocladius* having long plates, while they are normally short or not present in *Cricotopus*.

***Diplocladius cultriger* Kieffer**

Only one species of the genus is present in the Holarctic region (Ashe & Cranston 1990).

Genus *Eukiefferiella* Thienemann: *brevicalcar* (Kieffer), *claripennis* (Lundbeck), *corulescens* (Kieffer), *devonica* (Edwards), *lobifera* Goetghebuer, *minor* (Edwards), *tiroloensis* Goetghebuer, cf. *minor* (Edwards), *Eukiefferiella* *gracei*-group, *Eukiefferiella* spp.

The larvae of the most common *Eukiefferiella* species are easily identified using the keys given by Schmid (1993) and Cranston (1982).

***Georthocladus luteicornis* (Goetghebuer)**

One specimen was found in the sediment core from Øvre Neådalsvatn.

***Heleniella* sp.**

Schmid (1993) described *Heleniella ornatocollis* (Edwards) and *serratosioi* (Ringe).

***Heterotanytarsus apicalis* (Kieffer)**

There are two species, *apicalis* and *brundini* Fittkau, in the Palearctic region (Ashe & Cranston 1990). The main difference is a projection on the gonostylus in *brundini*, while *apicalis* has a normal looking gonostylus. A specimen from Store Hovvatn has one *brundini* gonostylus, while the other looks like a normal *apicalis* gonostylus. This indicates that *apicalis* may be a senior synonym of *brundini*.

Genus *Heterotrissocladus* Spärk: *brundini* Sæther & Schnell, *grimshawi* (Edwards), *marcidus* (Walker), *Heterotrissocladus* spp.

Larvae of *Heterotrissocladus* are normally easy to identify using the revision of Sæther (1975b). There are 6 nominal species in Europe (5 in Ashe & Cranston 1990, *brundini* was not included). However, *grimshawi* and *scutellatus* Goetghebuer are most likely synonyms. They were synonymized by Brundin (1949), but Sæther (1975b) split them again, mainly based on the old concept of boreo-alpine species pairs, with *grimshawi* as the northern and *scutellatus* as the Alpine species. However, *grimshawi* has later been found in the Alpine region (Caspers & Reiss 1987), and *scutellatus* has been found in Norway (Schnell 1988). There seems to be no reason for keeping them as two separate species. Also *brundini* and *maeaeri* Brundin are most likely synonyms. *H. brundini*, *grimshawi*, and *marcidus* are easily separated as larvae. The submentum of *marcidus* can vary from jet black to light brown, and this might lead to uncertainty. However, *marcidus* is always much darker than *grimshawi*, which has a golden appearance in the microscope. *H. brundini* keys to *maeaeri* in Sæther's revision.

Genus *Krenosmittia*: *boreoalpina* (Goetghebuer), *Krenosmittia* spp.

According to Ashe & Cranston (1990) there are 3 species of *Krenosmittia* in the Palearctic region. In addition, *Rheosmittia halvorseni* Cranston & Sæther has later been transferred to the genus. Schmid (1993) described the larva of *boreoalpina* and gave a key separating this species and *camptophleps* (Edwards).

Genus *Limnophyes*: *asquamatus* Andersen, *Limnophyes* sp.

The genus was revised by Sæther (1990), who described some larvae and gave a key. However, only 6 species, out of 36, are known as larvae.

***Mesocricotopus thienemanni* (Goetghebuer)**

Only *thienemanni* is found in the Palearctic region, and is easily identified using Cranston & al. (1983).

***Metriocnemus obscuripes* (Holmgren)**

Metriocnemus was partly revised by Sæther (1989), who synonymised many species and described and illustrated several larvae, but did not provide a key. Thienemann (1944), Pankratova (1970) and Schmid (1993) gave keys to many species.

Genus *Nanocladius*: *parvulus* K., *rectinervis* (Kieffer), cf. *rectinervis* (Kieffer)

The genus was revised by Sæther (1977), who gave keys to all stages. *N. rectinervis* is very close to *N. spiniplenus* Sæther, which was described as a Nearctic species. Later *spiniplenus* has been found in Norway (Schnell & Aagaard 1996), and there seems to be little reason for not synonymising the species.

***Oliveridia tricornis* (Oliver)**

A characteristic species of the high Arctic regions. In the Palearctic region only found at Svalbard, in the Nearctic region found in northern Canada and in Greenland. In Cranston & al. (1983) it is illustrated with a single median mental tooth, but in reality the species has double mental teeth. The illustrated specimen is most likely an old 4th instar larva with a worn mentum. There is also the possibility that the Svalbard animals represents an undescribed species.

Genus *Orthocladius* van der Wulp:

Subgenus *Eudactylocladius* Thienemann: *mixtus* (Holmgren), *Eudactylocladius* spp.

No good key exist to the larvae of the subgenus. Cranston (1982) included 4 species in his key, of which two are merely called sp. A and sp. B. He described the larva of *mixtus*, and later (Cranston 1984) the larvae of *fuscimanus* (Kieffer).

Subgenus *Euorthocladius* Thienemann

Euorthocladius of the Holarctic region were revised by Soponis (1990), who gave a key to all known larvae.

Subgenus *Orthocladius* van der Wulp: *dentifer* Brundin, *frigidus* (Zetterstedt), *rubicundus* (Meigen), cf. *frigidus* (Zetterstedt), *Orthocladius* (*Orth.*) spp. (A)

Soponis (1977) revised the Nearctic species of *Orthocladius s.str.*, however, many of the species in the subgenus are Holarctic, and her key is also useful in the Palearctic region. Cranston (1982) gave a key to some larvae. The pupae of Palearctic species were revised by Langton & Cranston (1991).

***Paracricotopus niger* (Kieffer)**

According to Ashe & Cranston (1990) there are two species in the Palearctic region, *niger* and *uliginosus* Brundin. In addition Langton (1991) described a pupal exuvia he called *Pe 2*. Sæther (1980a) redescribed *niger* in all stages. Schmid (1993) gave a key to two species; cf. *niger* and sp. *A*.

Genus *Parakiefferiella* Thienemann: *bathophila* (Kieffer), *fennica* Tuiskunen

Schmid (1993) gave a key to four species of *Parakiefferiella*. Cranston (1982) described the larvae of two species, *bathophila* and *coronata* (Edwards), while Walker & al. (1993) described the larvae of *P. nigra* Brundin. *P. bathophila* is easy to identify with due to the two small notches, one on each side, on the median mental tooth. However, sometimes this tooth may be worn down in old 4th instar larvae. Also, the median mental tooth is lighter in colour than the rest of the teeth. The larvae of *P. fennica* has not been properly described yet. It was found as a prepupa in Øvre Neådalsvatn, and the mentum is similar to what Hofmann (1971, Abb. 7) calls *Cricotopus triquetrus* Chernovski. Tuiskunen (1986) revised the Fennoscandian males and pupae of the genus, with notes on the other European species.

***Parametricnemus borealpinus* Gowin**

Schmid (1993) separated *borealpinus* from *stylatus* Kieffer by the number of teeth on the premandible. *P. borealpinus* has 6 teeth while *stylatus* has 3. There is one more species, *aciger* Kieffer, in the Palearctic region (Ashe & Cranston 1990), most likely not described as larva.

***Paratrichocladus* sp.**

As stated by Schmid (1993) it is difficult to separate this genus from *Orthocladus*. The main character used by Cranston & al. (1983) is the bulbous shape of the first lateral mental tooth, but several *Orthocladus* s.str. has a similar shaped tooth (see Soptonis 1977). Schmid (1993) gave a key to five species of *Paratrichocladus*. Some adult males of the genus were described by Rossaro (1990).

***Parorthocladus* sp.**

Two species of *Parorthocladus* are reported from the west Palearctic region (Ashe & Cranston 1990), one (*nudipennis* (Kieffer)) was described by Schmid (1993). The specimens found in Paione Superiore and Latte were called *Parorthocladus* because they had three middle teeth on the mentum. However, they had both I_2 and I_4 setae developed as a setal brush, which is characteristic of *Synorthocladus*, a genus closely related to *Parorthocladus* in all stages. The larvae could therefore as well be called *Synorthocladus*. The larvae very likely belongs to an undescribed species.

Genus *Psectrocladius* Kieffer:

Subgenus *Allopsectrocladius*: *platypus* (Edwards)

Two species, *obvius* (Walker) and *platypus*, are found in the Palearctic region (Ashe & Cranston 1990). The larvae cannot be separated, and pupal exuviae material from Lille Hovvatn indicates that they might be synonyms.

Subgenus *Mesopsectrocladius*: *barbatipes* (Kieffer)

The larva of *Mesopsectrocladius* can be separated from those of *Allopsectrocladius* by the split S III seta on the labrum. Only one species is found in the Palearctic region (Ashe & Cranston 1990).

Subgenus *Monopsectrocladius*: *calcaratus* (Edwards), *septentrionalis* Chernovski

According to Ashe & Cranston (1990), *calcaratus* is the only species in this subgenus in the Palearctic region. *P. septentrionalis* was listed among nomen dubia of genus *Psectrocladius* by these authors. However, *septentrionalis* was clearly defined as larva by Chernovski (1949, 1961). In Lille and Store Hovvatn most of the larvae found are *septentrionalis*, but the middle tooth of the mentum is highly variable. It always

has a high middle point, and normally also a pair of lower lateral points, like the mentum illustrated for *septentrionalis* by Cranston *et al.* (1983, fig. 9.61C). Sometimes this lateral pair of small points is missing, and then the mentum looks like *calcaratus*, as illustrated by Cranston *et al.* (1983, fig. 9.61D). However, in some specimens one of the lateral points is missing, making the mentum look like *septentrionalis* on one side and *calcaratus* on the other. Only *calcaratus* has been found as pupa and imago. Both larvae and pupae/imagines are very common in Lille and Store Hovvatn, and most likely the two species are synonyms.

Subgenus *Psectrocladius*: *fennicus* (Storå), *limbatellus* (Holmgren), *octomaculatus* Wülker, *psilopterus* (Kieffer), *sordidellus* (Zetterstedt), cf. *limbatellus* (Holmgren), *Psectrocladius limbatellus*-group, *Psectrocladius* (*Psectrocl.*) spp.

It is very difficult to separate the larvae of most *Psectrocladius* s.str., especially species in the *limbatellus-sordidellus* complex. Moller Pillot (1984b) gave an overview of the groups based on number of branches on the S I seta of the larvae. However, material from Norway shows that the number of branches on the S I seta can vary considerably within the same species. Cranston (1982) gave a key to many of the species, but reliable species determination can only be done on prepupa, using Langton's key (1991). Schmid (1993) described and illustrated two species; cf. *octomaculatus* and *sordidellus*, and the specimens called *octomaculatus* and *sordidellus* here agrees well with his illustrations. A couple of species, i.e. *fennicus* and *psilopterus*, are quite easy to determine on larval material alone.

Genus *Rheocricotopus*: *effusus* (Walker), *Rheocricotopus* sp.

The genus was revised by Sæther (1985), who gave a key to the known larvae.

***Rheosmittia spinicornis* (Brundin)**

Cranston & Sæther (1986) revised *Rheosmittia* and described the larva of *spinicornis*. The larva of the other Palearctic species, *languida* Brundin, is not known.

***Smittia* sp.**

Taxonomically *Smittia* is a mess, and species identification is normally not possible on any life stage. Ashe & Cranston (1990) list 26 valid species, with 14 synonyms and 38 nomen dubia probably in *Smittia*. Pankratova (1970) published a key to some larvae of the genus, but most of the species names in her work are not even mentioned by Ashe & Cranston.

***Synorthocladius semivirens* (Kieffer)**

Only one species is known from the Palearctic region (Ashe & Cranston 1990). See the comments for *Parorthocladius*.

Genus *Thienemanniella*: Pe 2b Langton 1991, *Thienemanniella* sp.

In the Palearctic region 11 species are known (Ashe & Cranston 1990). Schmid (1993) gave a key to the larvae of 7 species, of which 5 were named. The genus has never been revised, and the taxonomy is chaotic.

***Tokunagaia* sp.**

No key exist to the larvae of *Tokunagaia*, the two known (*rectangularis* (Goetghebuer) and *parexcellens* Tuiskunen (*sub scutellata* Brundin in Halvorsen & Sæther (1987), G.A. Halvorsen pers. comm.)) were described by Halvorsen & Sæther.

***Trissocladius* n. sp.**

Sæther (1976) revised the genus, and redescribed the two known species: *brevipalpis* Kieffer and *heterocerus* Kieffer. Later (1980b) he improved the generic diagnoses of *Trissocladius*, and described the larva of *brevipalpis* properly. *T. brevipalpis* and *heterocerus* are very similar and were described from specimens collected at the same site and date in Germany. Ashe & Cranston (1990) regarded *heterocerus* as a questionable junior synonym of *brevipalpis*.

The larvae found at Svalbard (6 specimens; 3 in the inlet river, 3 in a small pond in the outlet river) differ in one important respect from the larva of *brevipalpis*. The outer edge of the premandible has 6-8 long spinules and looks like the premandible of certain Diamesinae, for instance as the one illustrated by Oliver (1983, fig. 7.5 H). Such a character state has not earlier been found in Orthoclaadiinae (O.A. Sæther, pers. comm.). The specimens may possibly belong to a new genus.

Genus *Tvetenia*: *bavarica* (Goetghebuer), *calvescens* (Edwards), *calvescens/dicoloripes* (Goetghebuer)

Five species of *Tvetenia* are found in the west Palearctic region (Ashe & Cranston 1990), but in alpine regions *bavarica* (Goetghebuer) and *calvescens* are the most common. Schmid (1993) gave a key to 4

named and one unnamed species. *T. calvescens* and *discoloripes* can normally be easily separated, but the specimen found in d'Aubé was damaged during preparation, and the inner margin of the mandible could not be seen.

Genus *Zalutschia*: *tatica* (Pagast), *torotraeskensis* (Edwards), *zalutschicola* Lipina, *Zalutschia* spp.

Sæther (1976) revised the genus and gave a key to the known larvae. He did not know the larva of *torotraeskensis*, but wrote that two species described by Chernovski (1949, 1961) (i.e. *korosiensis* and *fontinalis*) probably are synonyms. This is probably true, as the specimens of *torotraeskensis* in our collection are similar to those of *korosiensis* as illustrated by Pankratova (1970).

SUBFAMILY CHIRONOMINAE

Besides Orthoclaadiinae this is the largest subfamily in family Chironomidae. The members of tribe Chironomini are most important in lowland habitats and at low latitudes, but a few species are commonly found in lakes in high mountain areas. Tribe Tanytarsini is much more common in such areas, and is often dominant in the deeper parts of lakes here. For the most part there is little taxonomic information about the larvae of this subfamily. The genera are easily identified using Pinder & Reiss (1983), but there are few revisions available, and almost none including the larvae of species found in high mountains.

The subfossil material of tribe Chironomini found in the Al:Pe projects is normally easy to identify to the generic level, but to go any further is normally difficult. Members of the tribe Tanytarsini are in general much more difficult to identify, it is for instance often impossible to separate *Micropsectra*, *Paratanytarsus* and *Tanytarsus*. Most *Micropsectra* and *Tanytarsus* have a more or less well developed postoccipital plate, while this has never been observed in *Paratanytarsus* and it is also absent in *Micropsectra radialis* Goetghebuer.

TRIBE CHIRONOMINI

Genus *Chironomus*: *anthracinus* Zetterstedt, cf. *anthracinus* Zetterstedt

Most *Chironomus* larvae cannot be identified with certainty without looking at the chromosomes. No *Chironomus* larva from Lille Hovvatn have been identified in this way, but no other species than *anthracinus* has been found in the lake during many years of investigation. Also, all the larvae fits the description of *anthracinus* given by Webb & Scholl (1985). A new key to many larvae of *Chironomus* is Vallenduuk & Moller Pillot (1997).

Genus *Cladopelma*: *viridula* (Linné), *Cladopelma* sp.

There is at present no key to the larvae of *Cladopelma*. *C. viridula* was identified from Lille Hovvatn, where it is the only species found.

Genus *Cryptochironomus*: cf. *psittacinus* (Meigen), *Cryptochironomus* spp.

Cryptochironomus is a large genus which has never been revised and very few larvae are described. In Lille Hovvatn only males and pupae of *psittacinus* have been found, and the larvae found in the lake most likely belong to this species.

Genus *Dicrotendipes*: *modestus* (Say), *Dicrotendipes* sp.

The genus was revised by Contreras-Lichtenberg (1986), who gave a key to all known larvae of the west Palearctic species.

***Glyptotendipes* sp.**

Four specimens were found in the sediment core from Lagoa Escura.

***Microtendipes pedellus* (de Geer)**

Moller Pillot (1984a) gave a key to the subgroups of the genus.

***Nilothauma* sp.**

A few specimens were found in the sediment core from Lagoa Escura.

***Pagastiella orophila* (Edwards)**

Only one species is found in the Palearctic region, and it is easily keyed using Pinder & Reiss (1983).

***Parachironomus* sp.**

Descriptions of *Parachironomus* are found many places, but no key to species has been made. Pinder & Reiss (1983) gave a key to species groups.

Genus *Paracladopelma*: cf. *camptolabis* (Kieffer), cf. *laminata* (Kieffer)

The genus was revised by Jackson (1977), who gave a key to the larvae of the Nearctic members of *Paracladopelma*. Some species are common to the Nearctic and the Palearctic regions. The larva of *camptolabis* was described by Chernovski (1949, 1961), and the larva of the closely related *laminata* by Lenz (1959).

Genus *Phaenopsectra*: *flavipes* (Meigen), *Phaenopsectra* sp. A

According to Ashe & Cranston (1990) only two species are found in the west Palearctic region. Both these species were found in Lille Hovvatn. *P. flavipes* has been reared from larva from the lake, and is similar to *flavipes* described by Rossaro (1985). *P. sp. A* is most likely *punctipes* (Wiedemann).

Genus *Polypedilum*: *albicorne* (Meigen), *pullum* (Zetterstedt), *Polypedilum* spp.

Rossaro (1985) revised parts of the genus, and included a key to the larvae of some common species in the west Palearctic region. The specimens called *pullum* (from Lille Hovvatn) key to *scalaenum* (Schrank) in Rossaro, and most likely *pullum* is a junior synonym of *scalaenum*. Morphologically these two species seem to be identical, but *scalaenum* has several dark spots on the wings. It may be that *scalaenum* is polymorphic in this character, and that some populations lack these spots. This also seems to be the case in some species of *Stictochironomus*.

***Sergentia coracina* (Zetterstedt)**

A revision of the genus, based both on morphology and cytotaxonomy, is under preparation (Wülker *et al.*). Larvae found in the Scandinavian high mountains normally belong to *coracina*.

***Stictochironomus rosenshoeldi* (Zetterstedt)**

Most *Stictochironomus*-larvae found in the deeper parts of Scandinavian lakes belong to the same species, called *rosenshoeldi*. It can be identified by the fact that the 2nd and 3rd antennal segments are partially grown together. In reality this is an unnamed species, as Zetterstedt's original *rosenshoeldi* (the holotype) is a much smaller species with faint blue markings on the wings (Ø.A. Schnell, pers. obs.).

TRIBE TANYTARSINI

***Corynocera ambigua* Zetterstedt**

Two specimens were found in the sediment core from Øvre Neådalsvatn.

Genus *Micropsectra*: *atofasciata* Kieffer, *bidentata* (Goetghebuer), *groenlandica* Andersen, *insignilobus* Kieffer, *radialis* Goetghebuer, cf. *contracta* Reiss, cf. *insignilobus* Kieffer, *Micropsectra* sp. «Pyrenees», *Micropsectra* Pe 5 Langton 1991, *Micropsectra* spp.

Micropsectra larvae are in most cases impossible to identify, except when they are prepupae. Few are described, and no key is available. The easiest species is *radialis*, which can be identified by the presence of a very small, third tooth on the premandible. This character state is not found in any other *Micropsectra* larva (Pinder & Reiss 1983). *M. insignilobus* can normally be identified by its short spur, slightly expanded apex of antennal segment 2, and size, which is as large as *radialis* and among the largest *Micropsectra* larvae. In deeper parts of Scandinavian lakes *insignilobus* is commonly the only *Micropsectra* species, in high mountain areas often together with *radialis*. *M. sp. «Pyrenees»* was found in d'Aubé and in Paione Superiore, and can be recognised by the very long, curved spur on the antennal pedestal.

Genus *Paratanytarsus*: *austriacus* (Kieffer), *hyperboreus* Brundin, *laccophilus* (Edwards), *penicillatus* (Goetghebuer), cf. *setosimanus* Goetghebuer, *Paratanytarsus* spp.

Males and pupae were revised by Reiss & Säwedal (1981), while Klink (1983) gave a key to many larvae of the genus. The larvae of *hyperboreus* and *penicillatus* were not treated by Klink, but are known. *P. penicillatus* has only two inner teeth on the mandible, (illustrated by Hofmann 1971, Abb. 42, as *Paratanytarsus*), and this will separate it from all other known larvae of the genus. The larva of *hyperboreus* is very similar to the larva of *austriacus*, with a pecten epipharyngis consisting of 4 lobes. It is normally found in lakes in Scandinavia, while *austriacus* is an eurytopic species (Reiss & Säwedal 1981). Also the pupae and the males of the two species are very similar, and they are probably synonyms. Reiss (1965) showed that *Paratanytarsus dimorphis* Reiss showed seasonal dimorphism in both the adult and pupal stage.

Especially the pupa showed large variation in the armament of tergites IV and V (Reiss 1965, Abb. 7). The main difference between *austriacus* and *hyperboreus* is, according to Reiss & Säwedal (1981), the number of setae in the anal lobe of the pupae. This may well be due to dimorphism too.

***Rheotanytarsus* sp.**

Lehmann (1970) revised the males and pupae of the Palearctic region, but few larvae are described, and no key is published.

***Stempellinella brevis* (Edwards)**

Brundin (1948) described the immatures of many species in the so called Tanytarsariae connectentes group.

Genus *Tanytarsus*: *bathophilus* Kieffer, *buchonius* Reiss & Fittkau, *chinyensis* Goetghebuer, *debilis* (Meigen), *signatus* (van der Wulp), cf. *gregarius* Kieffer, cf. *lugens* (Kieffer), cf. *niger* Andersen, *Tanytarsus* Pe 9, Langton 1991, *Tanytarsus* sp. *gregarius*-group, *Tanytarsus* sp. *lugens*-group, *Tanytarsus* spp.

As is the case with *Micropsectra*, *Tanytarsus* larvae are also more or less impossible to identify except when they are prepupae in an advanced stage. Reiss & Fittkau (1971) revised the male imagines, while Langton (1991) described many pupal exuviae. Not much is known about the larvae, and no key exist. Of the species found in AI:Pe 1 & 2, several are known as larvae. *T. bathophilus* was described by Laville (1971). The larva of *buchonius* is not described, but is reared from Lille Hovvatn. It has split S3 setae on the labrum and falls into the *pallidicornis* group (Pinder & Reiss 1983). Also the larva of *signatus* is undescribed, but it has been reared from Store Hovvatn. It is different from all other known larvae of *Tanytarsus* in that it has a second antennal segment like that illustrated for *Nimbocera patagonica* Reiss, with an unsclerotized ring near the base (Pinder & Reiss 1983, fig. 10.48). The *lugens*-group has a mandible as illustrated by Hofmann (1971, Abb. 47), and material from Norway confirms that the mandible of *T. lugens* looks like the one illustrated by Hofmann. *T. cf. niger* was found both in the sediment core and the contemporary samples from Paione Superiore. The association is not confirmed, but only one larval type of *Tanytarsus* was found in the lake, and all the *Tanytarsus* pupal exuviae and imagines were *niger*. The larva belongs to the *lugens* group.

***Zavrelia* Pe1 Langton 1991**

Identified on a pupal exuvia. According to Langton (1991) this species could as well belong to *Stempellinella*.

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