EcoAnalysts, Inc.

Development of Idaho Macroinvertebrate Temperature Occurrence Models

Final Report

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Introduction

Federal regulations implementing the Clean Water Act (CWA) require states to specify appropriate uses to be achieved and protected for their waters (40 CFR 131.10). The CWA requires that, wherever attainable, all waters of the nation be protected for "propagation of fish and shellfish, and wildlife and provides for recreation in and on the water." This is often shortened to the statement that waters must be "fishable and swimmable." These are the minimum set of uses, unless unattainable. The federal regulations also say that states must consider the value of water for public water supply, agricultural and industrial uses, navigation, and aquatic life in specifying uses of their waters. States may also adopt sub-categories of a use with appropriate criteria to reflect the varying needs of such uses. Collectively these are known as beneficial uses.

Aquatic Life Existing Uses

The State of Idaho uses three major categories of aquatic life use: cold, seasonal cold and warm. These are mostly temperature driven distinctions, for example the cold-water aquatic life use has temperature criteria that require the water to have an instantaneous temperature < 22^0 C or a daily average of < 19^0 C. Benthic macroinvertebrates are the preferred indicator fauna because they have either limited migration patterns or a sessile form of life. This makes them well suited for managers to evaluate local environmental conditions. Some macroinvertebrate species only reside in streams with cold temperatures. If these species are present, then one can conclude that the stream likely has consistently cold temperatures. Lists of macroinvertebrate cold-water indicator species are being developed from two sources: 1) this analysis and 2) review of published literature reports.

In addition, the State of Idaho needs a list of indicator species that would help them identify those streams that support seasonal cold-water aquatic life criteria. These criteria are slightly less stringent than the cold-water: instantaneous temperatures below 26^0 C with daily average no greater than 23^0 C. The temperature criteria for seasonal cold only apply from June 20 to Sept 20. Outside of that time period those waters would have the same temperature criteria as

the cold-water streams. The idea behind these two categories is to acknowledge that in some cases streams in Idaho are naturally warmer in the summer.

Goal

The purpose of this analysis was to identify and develop a list of cold-water obligate macroinvertebrate taxa that the State of Idaho can use to determine if cold-water aquatic life is a currently existing use in streams being assessed in Idaho. An additional goal was to evaluate and potentially identify macroinvertebrate taxa that may be indicators of seasonal cold-waters.

Methods

221,240 records of macroinvertebrate abundance counts and 6151 instantaneous temperature records were analyzed. Data were collected from various locations in Idaho, between 1993 and 2010, and stored in Microsoft Access format database with Idaho DEQ. Data were used to generate temperature occurrence models for individual taxa. Temperature records of $< 0^{o}$ C (N = 7) or $\geq 45^{o}$ C (N = 6) were removed because they were either considered data entry errors or may have been recorded in ^{o}F instead of ^{o}C. The index period determined for using macroinvertebrate sampling results in the Idaho ambient monitoring program is July 1 through September 30. All records in the database that were collected outside of this July to September window were also removed.

Individual macroinvertebrate taxa occurrences and instantaneous temperature records were then combined such that each taxon occurrence had an associated temperature value from when and where it was collected. Combined records were then filtered based on recent macroinvertebrate taxonomic name changes or misidentifications. Those taxa that had name changes were combined with the currently accepted nomenclature, while those that were misidentified or were not known to occur in Idaho were removed from the dataset. Of the remaining records, those that had $\leq$ 20 taxa records were either merged up to the generic level, if they were reported as a species, or they were removed from the dataset. Removal of taxa with $\leq$ 20 taxa records was requested by IDEQ biologists. Taxa with $\leq$ 20 are considered rare

taxa and will not provide enough information in the final analysis to be statistically relied upon as indicators of cold water conditions. Final filtering resulted in instantaneous temperature records (N = 175,557) for 453 taxa with the number of records for individual taxa ranging from 21 to 4264.

Descriptive statistics of temperature relationships for each of the 453 taxa were calculated and two types of the most commonly used graphics used to evaluate temperature occurrences were generated: 1) empirical cumulative distribution functions (ECDF), and 2) vertical box and whisker interval plots.

Descriptive statistics included: samples size (N), minimum, maximum, range, 1st quartile, median, 3rd quartile, mean, standard deviation, standard error of mean, lower and upper 90% confidence intervals, and 5th, 90th, and 95th percentile intervals. This long list of descriptive statistics provides managers with additional statistical summaries for any future evaluations or temperature modeling needs.

Cold-water indicators were suggested by IDEQ biologists to be taxa that showed the 90th percentiles of occurrence below 20^0 C. Consequently, ECDF graphs were fitted with 90th percentiles and with their associated temperature values for each taxon separately to more easily visualize this relationship. CDF curves were then fitted to the empirical data to determine if temperature occurrences (weighted by abundances) for each taxon followed a normal or log normal distribution. Normal CDF curves fit the empirical temperature values for all taxa quite well; therefore normal CDF curves for all 453 taxa were plotted on the same graph to visually compare temperature occurrence distributions. In addition, seasonal cold-water indicator taxa were preliminarily defined by IDEQ biologists as those that had 5th to 95th percentiles between 15 and 26^0 C. Taxa statistics were filtered to include only those taxa that met these qualifications and to determine if this proposed definition was appropriate, or to suggest alternative criteria.

Temperature values used in this analysis predominately ranged between 10 and 15^0 C and consequently represented a truncated, non- random distribution. Temperatures outside of this range, including colder water temperatures ($<10^0$ C) and warmer water temperatures ($>20^0$ C),

were severely underrepresented and as a result, biased the ECDFs (See Results section**:** Effect of Sampling Bias on Taxa Temperature Occurrence Ranges). To compensate for this bias, additional analyses were conducted. Vertical box and whisker interval plots of temperatures values for each taxon were graphed using medians, 25th and 75th quartiles (Q1 and Q3), and general extent of the data (i.e. whiskers: where lower limit = Q1 – 1.5 (Q3 – Q1); upper limit = Q3 + 1.5 (Q3 – Q1). Widths of 25th and 75th quartile boxes were also adjusted for sample size (number of records), i.e. narrower boxes had fewer samples than wider boxes. Descriptive statistics of temperature values were generated and the mean temperature value (13^0 C) was added to the vertical box and whisker interval plots to help select first round cold water taxa. S-Plus 8.0 for Windows (Insightful Corp. 2007)(an R code based statistical package), Minitab 14 (2003), and XLSTAT (2013) were used for statistical and graphical analyses.

Results

Empirical Cumulative Distribution Function of Temperature Occurrences for each Taxon

Empirical cumulative distribution functions (ECDF) of all 453 taxa are in the following graphs (Figure 1 – 18). Each taxon had a unique ECDF but all followed the same general pattern with most occurring within a range of about 10 to 17^0 C at 50% probability (Figure 19). This in part, was an artifact of sampling bias towards those temperature ranges.

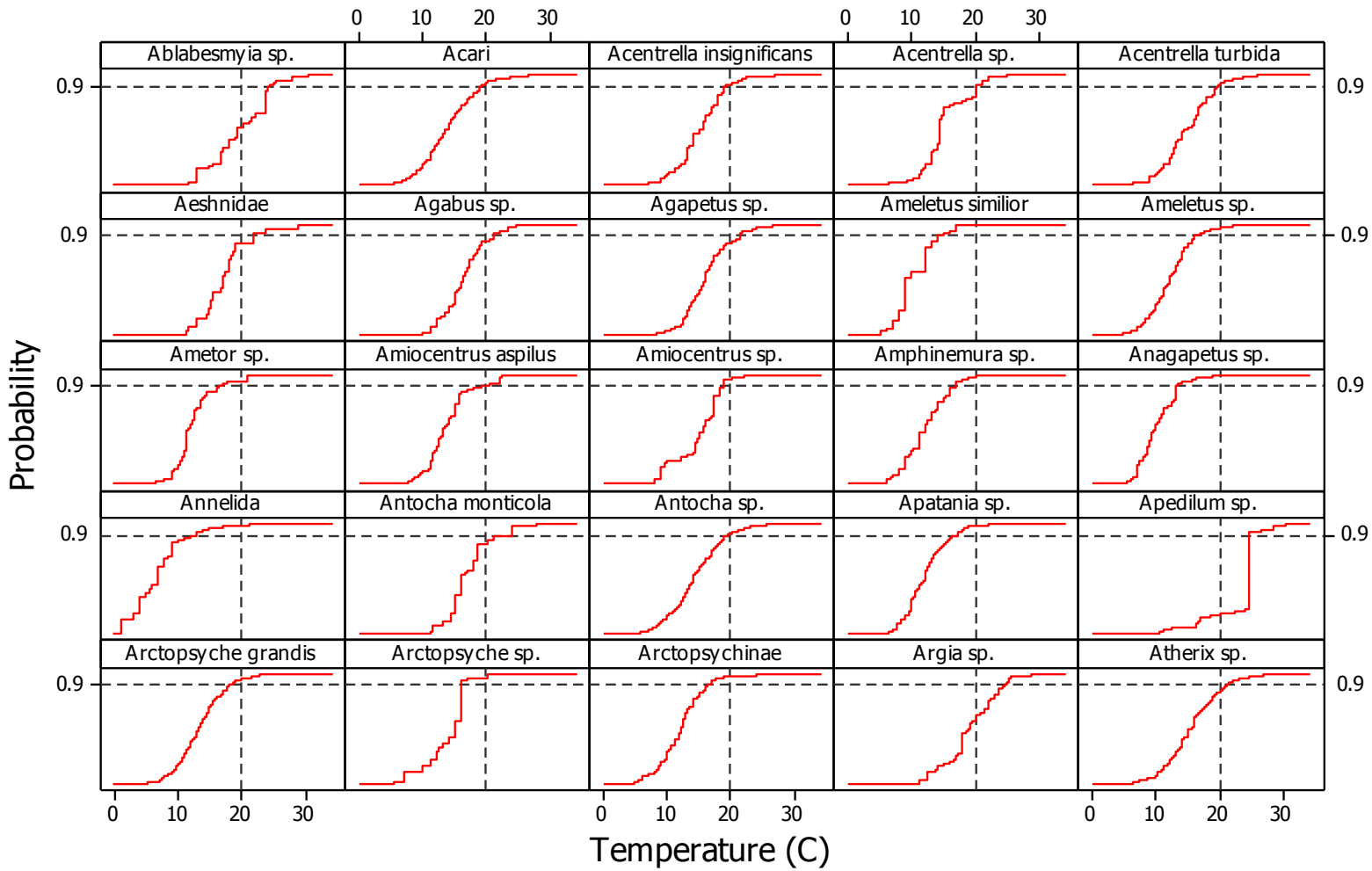


Figure 1. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Ablabesmyia* sp. to *Atherix* sp. ECDFs of temperature occurrences were weighted by their abundances in each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

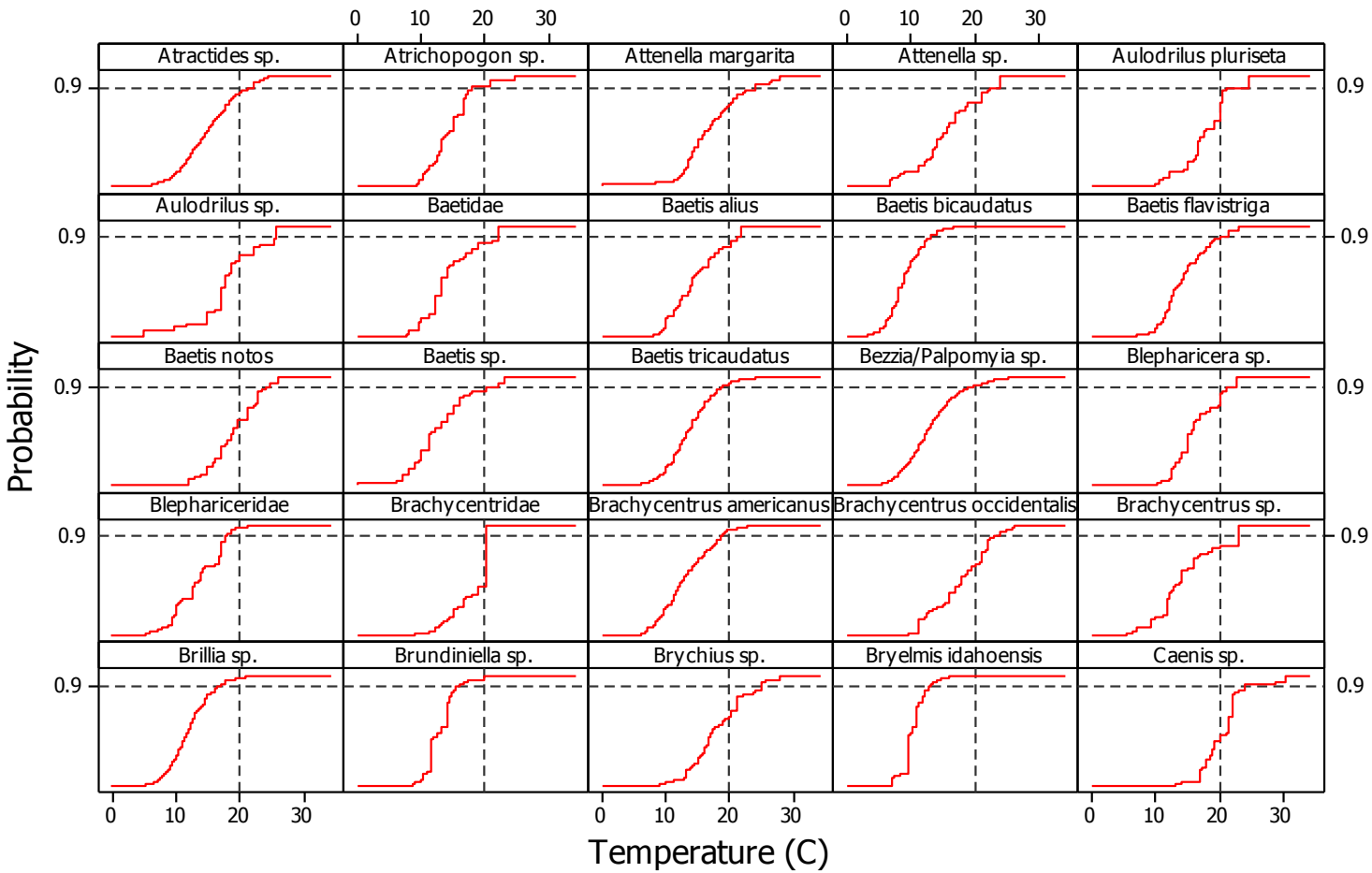


Figure 2. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Atractides* sp. to *Caenis* sp. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

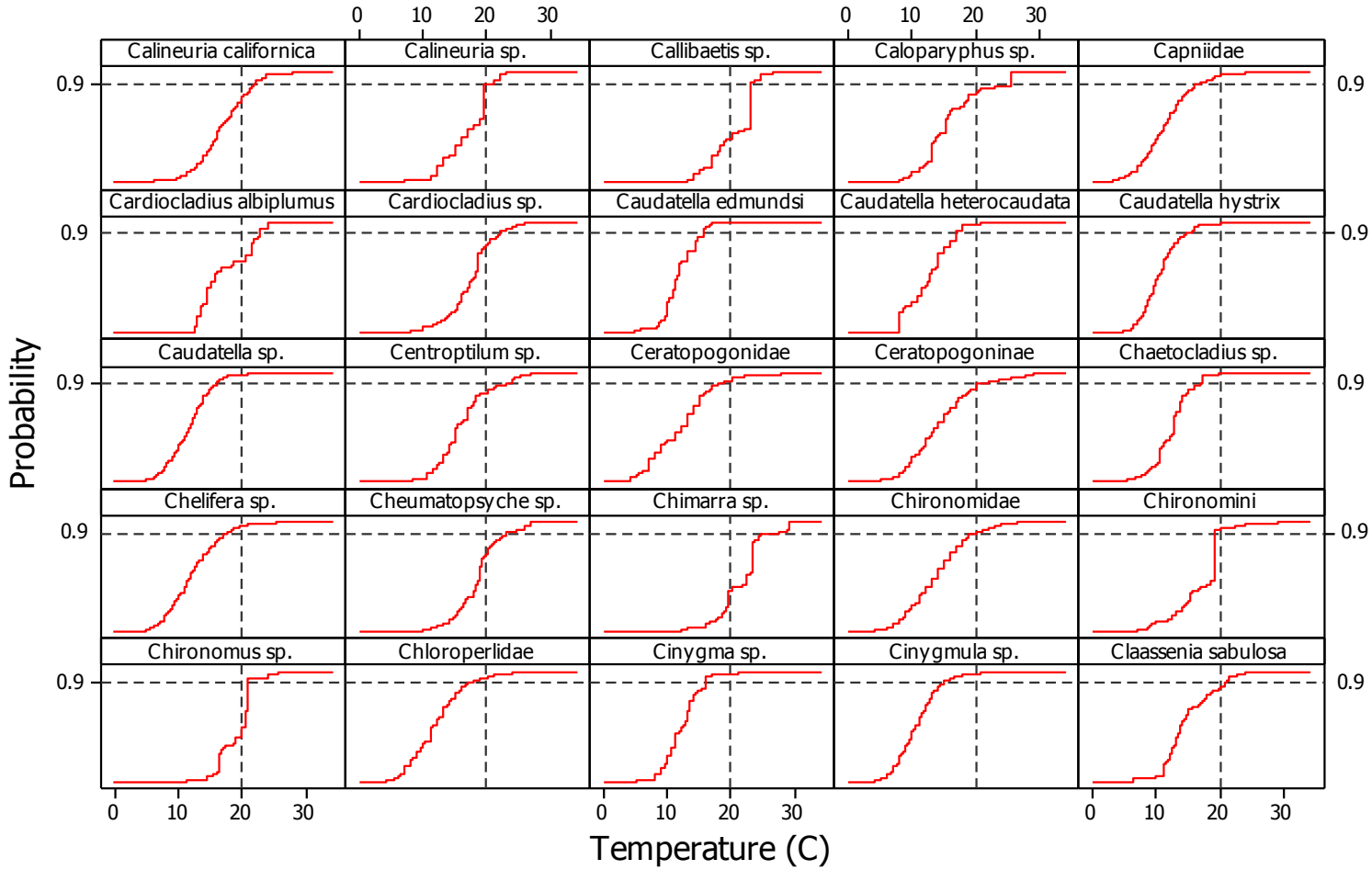


Figure 3. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Calineuria californica* to *Claassenia sabulosa*. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

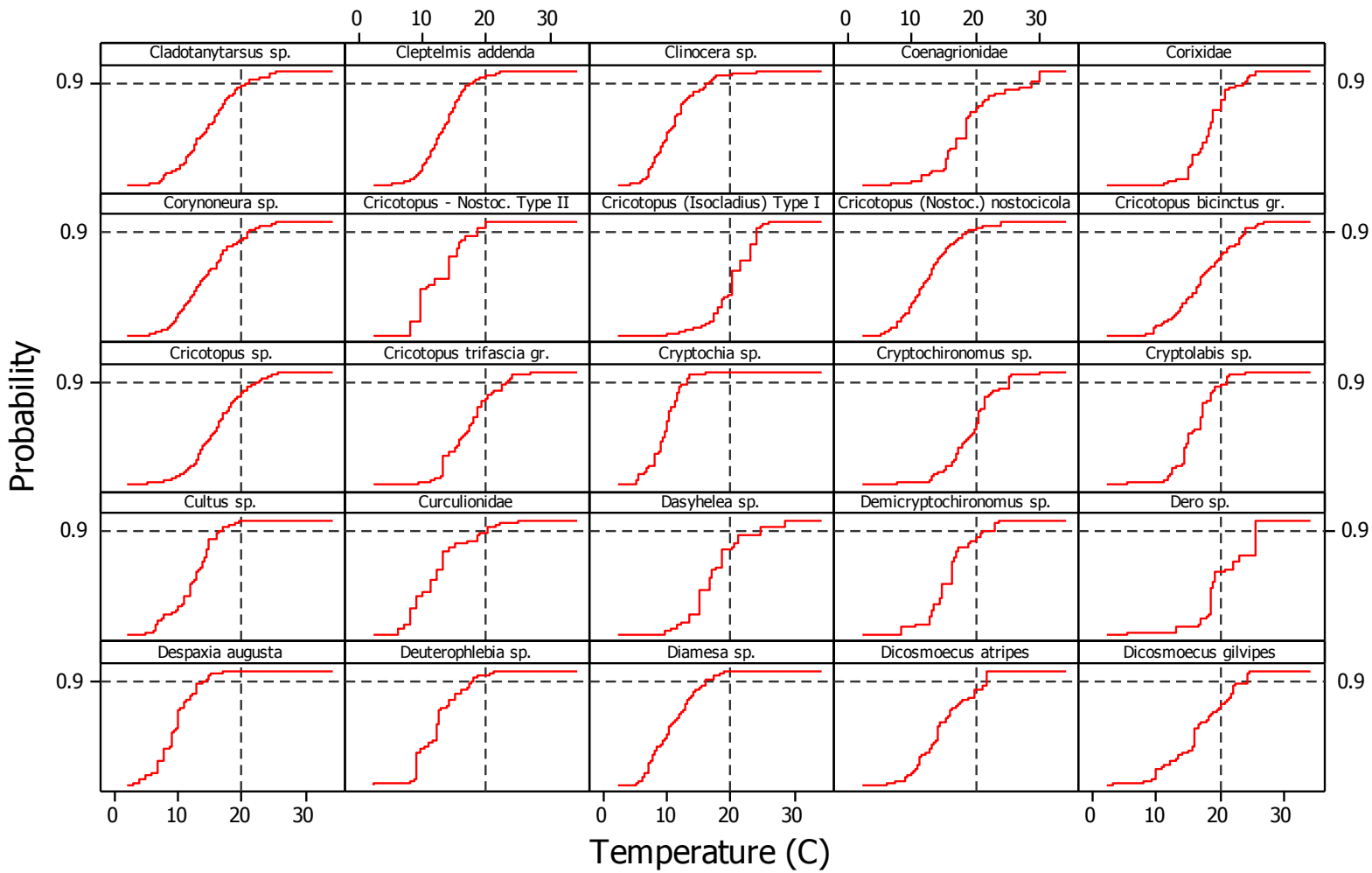


Figure 4. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Cladotayntarsus* sp. to *Dicosmoecus gilvipes*. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

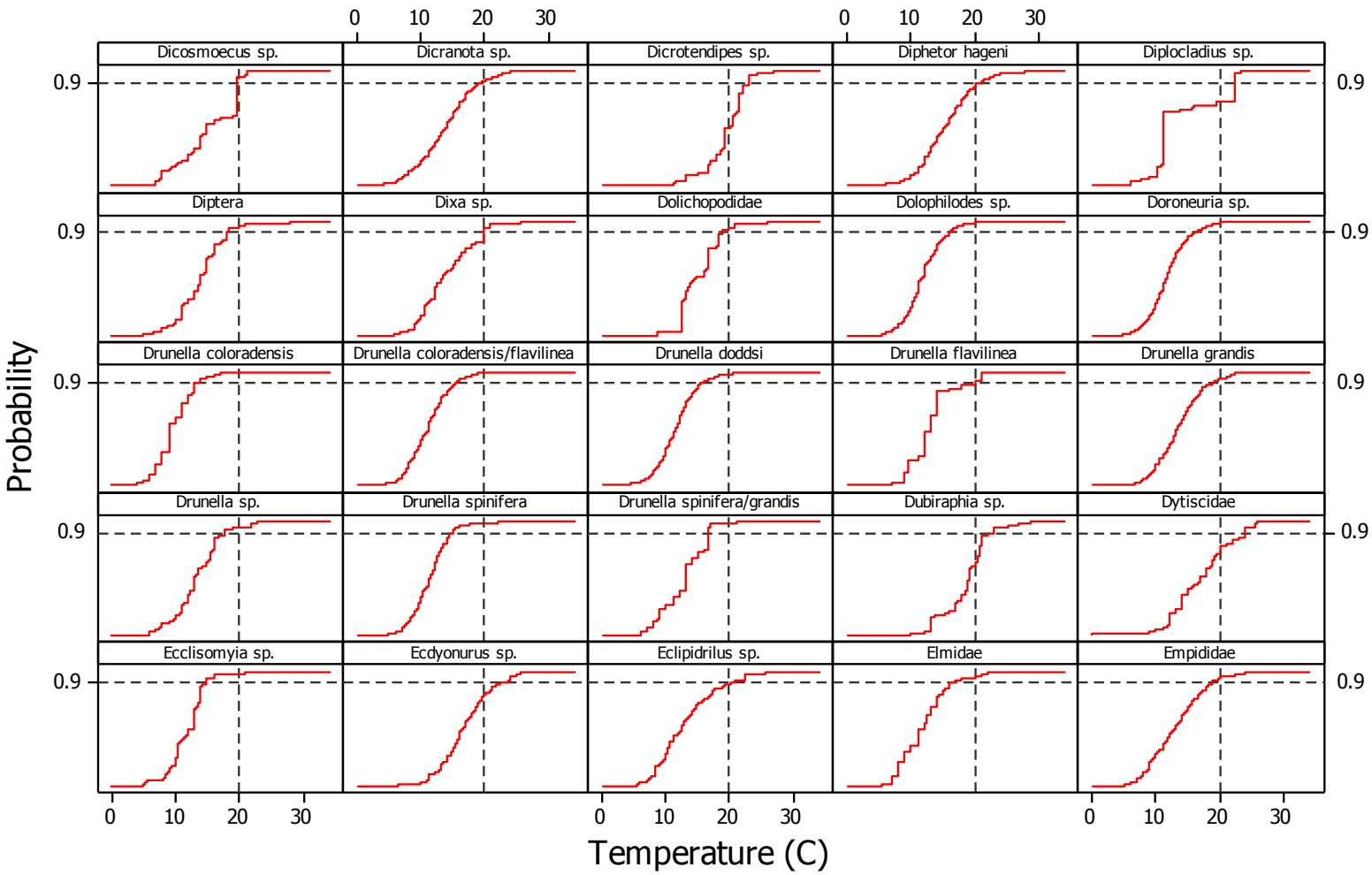


Figure 5. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Dicosmoecus* sp. to Empididae. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

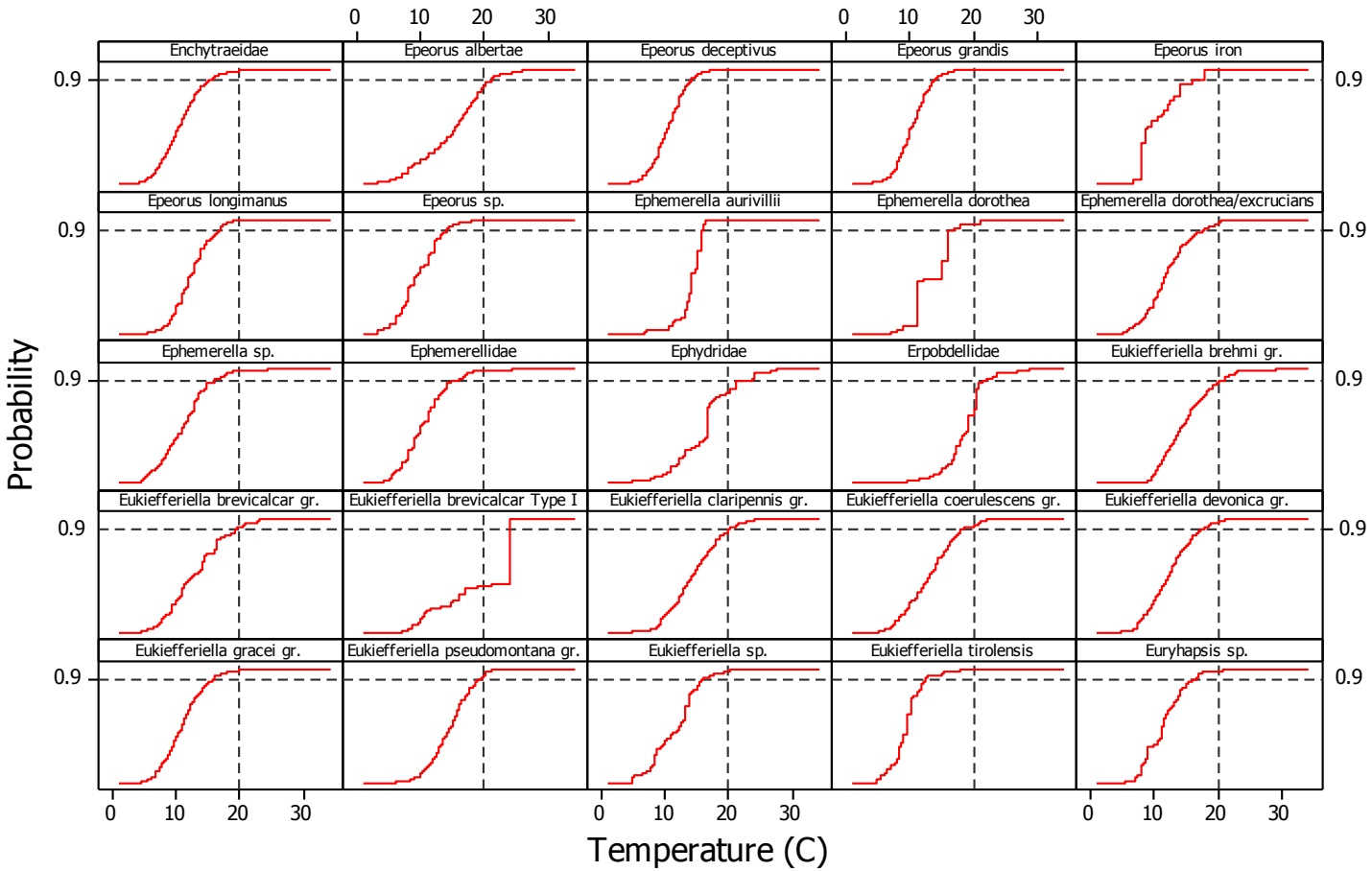


Figure 6. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for Enchytraeidae to *Euryhapsis* sp. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

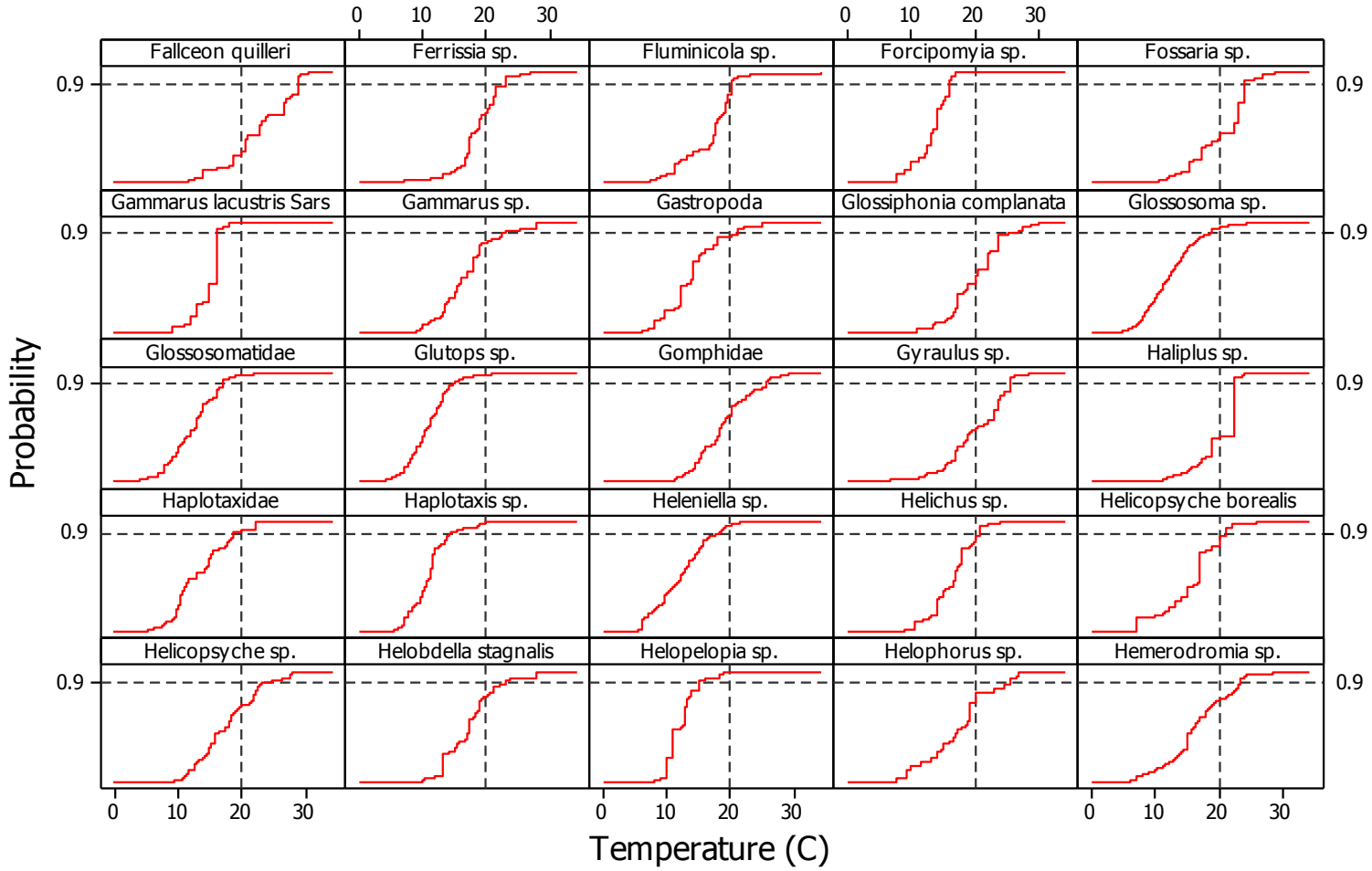


Figure 7. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Fallceon quilleri* to *Hemerodromia* sp. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

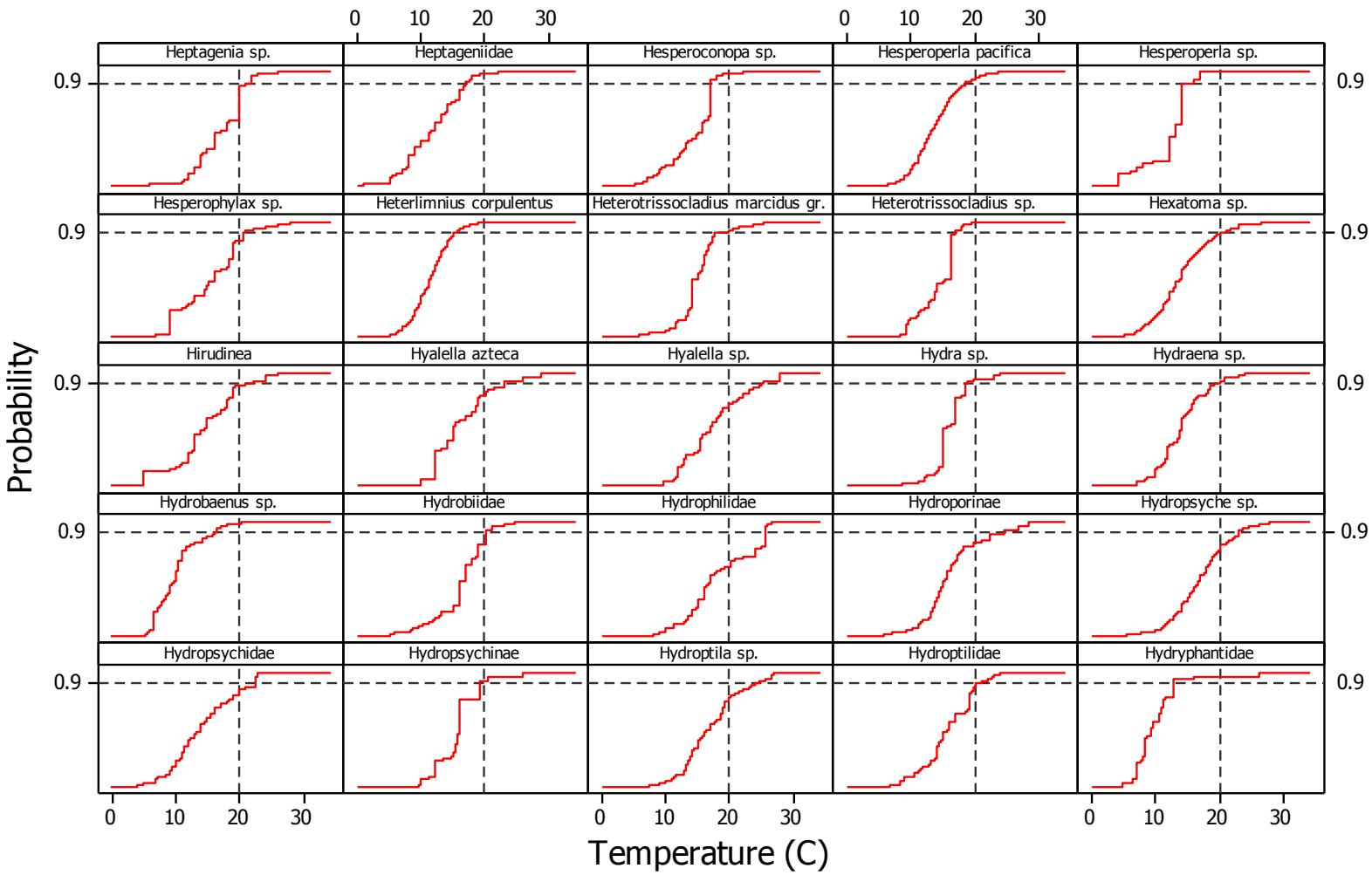


Figure 8. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Heptagenia* sp. to Hydryphantidae. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

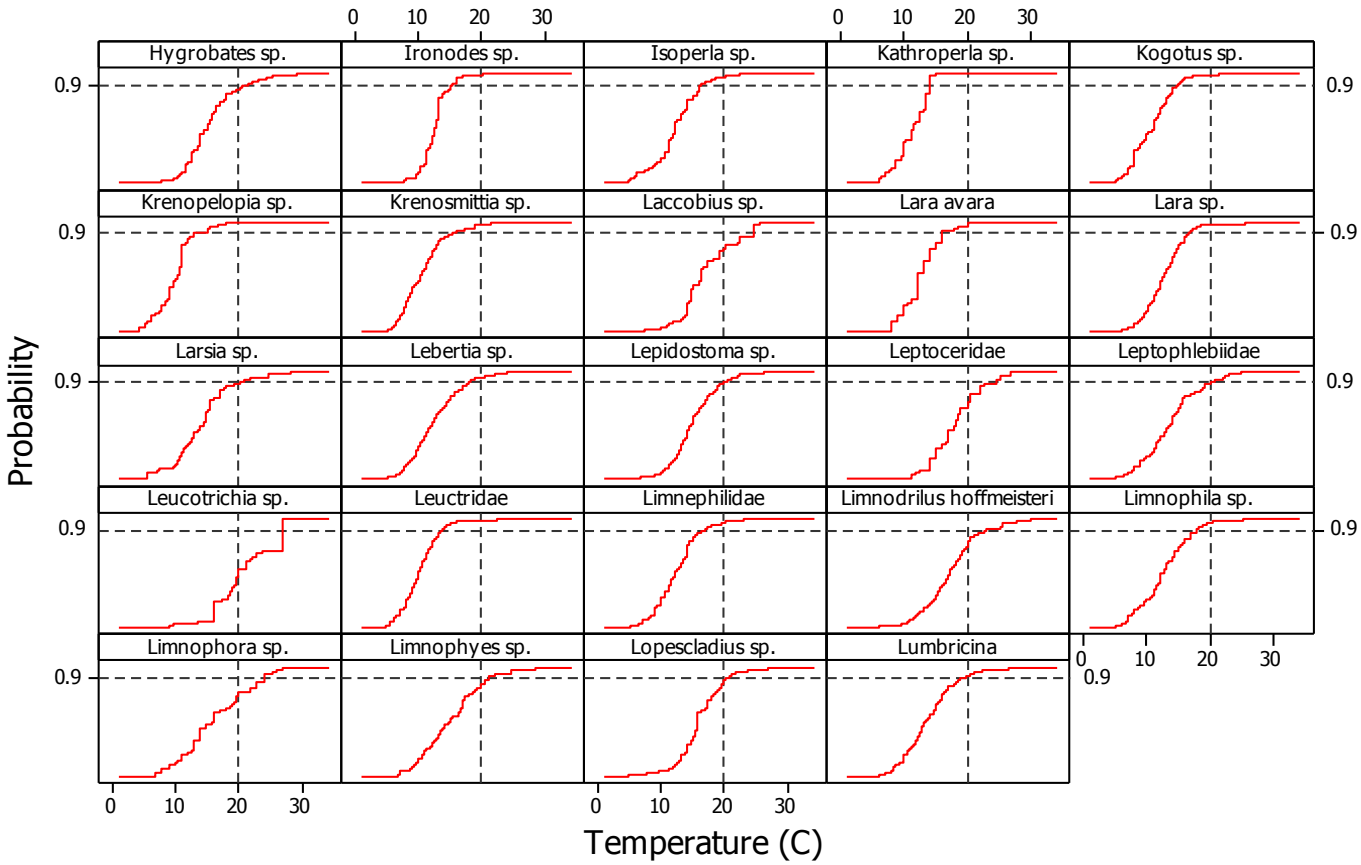


Figure 9. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Hygrobates* sp. to Lumbricina. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

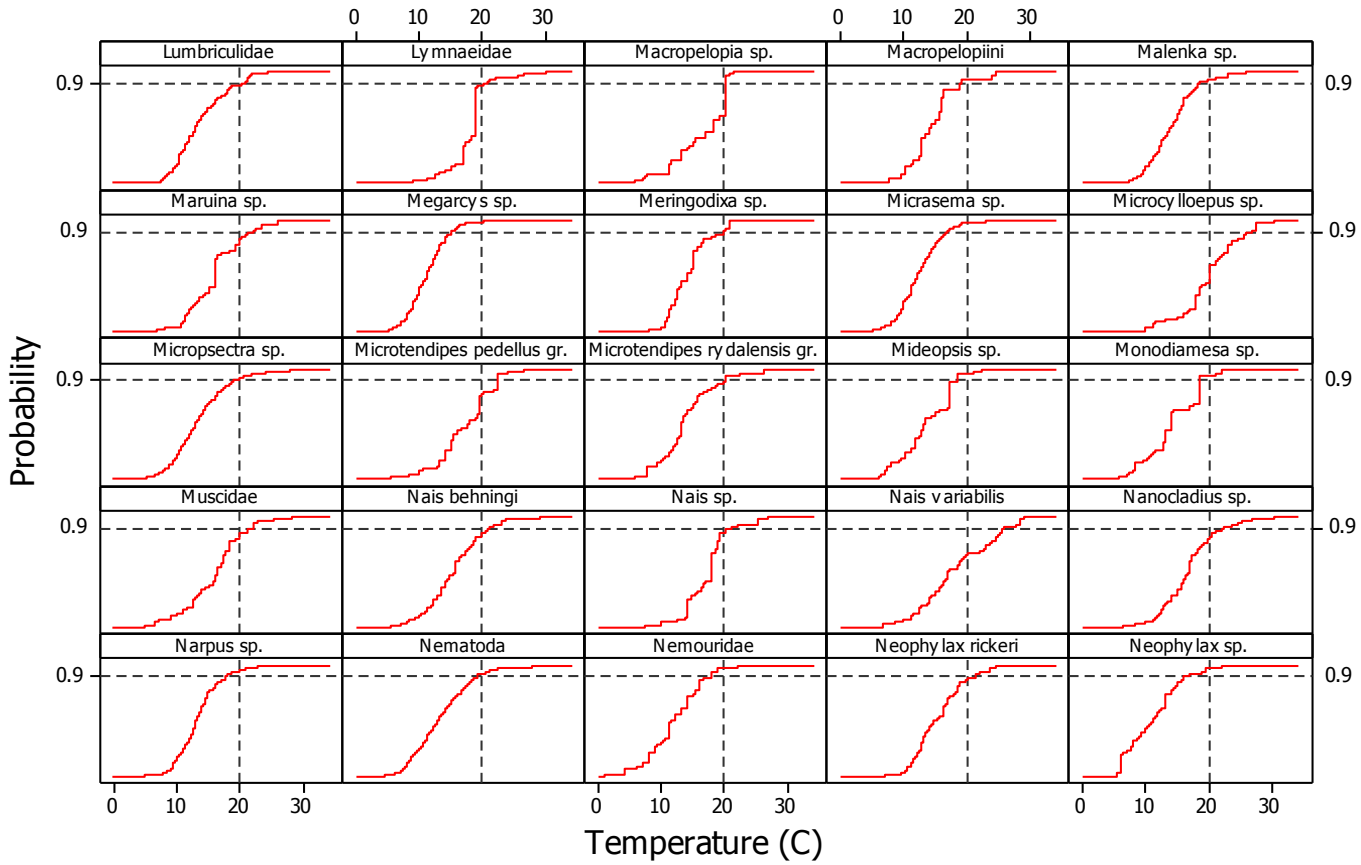


Figure 10. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for Lumbriculidae to *Neophylax* sp. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

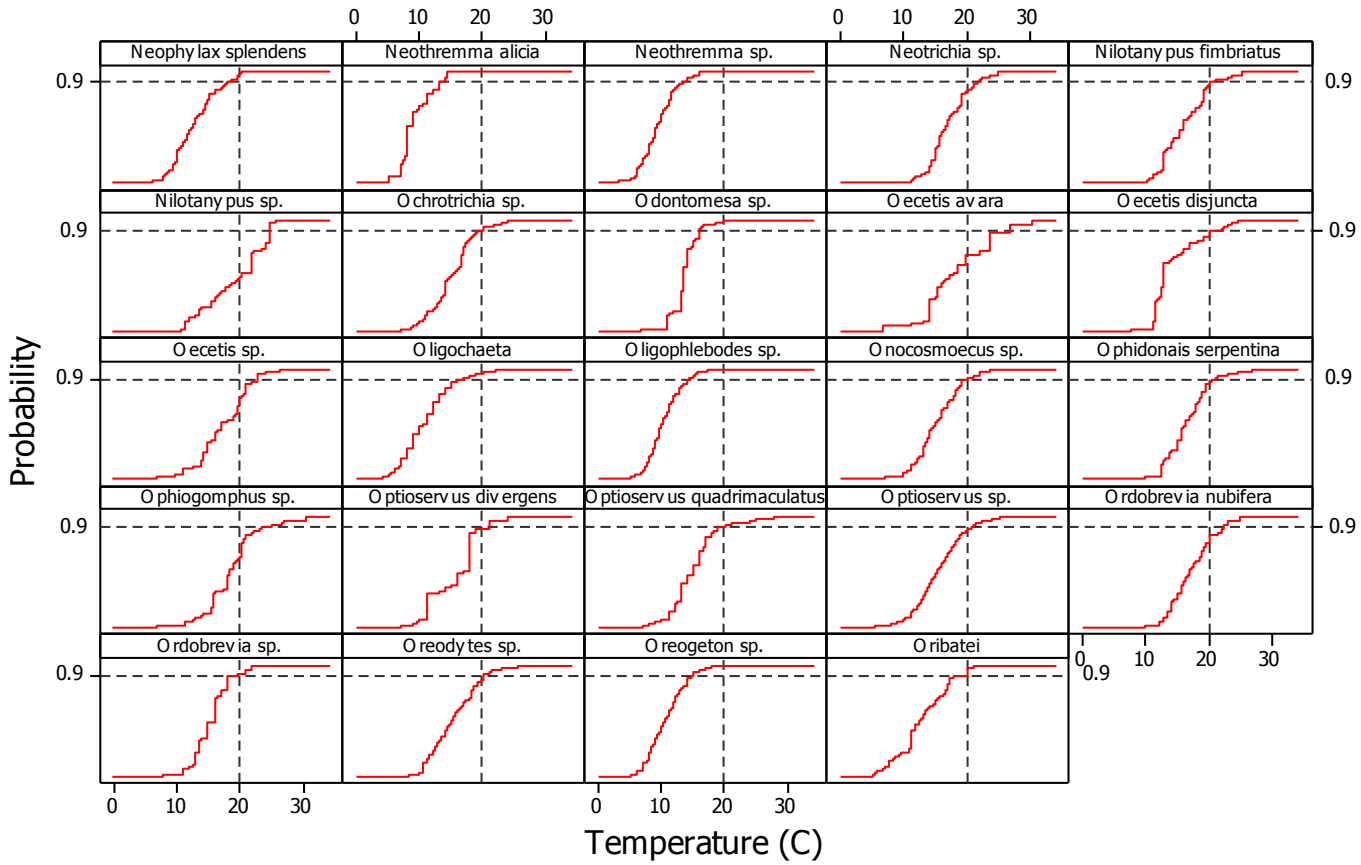


Figure 11. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Neophylax splendens* to *Orbatei* sp. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

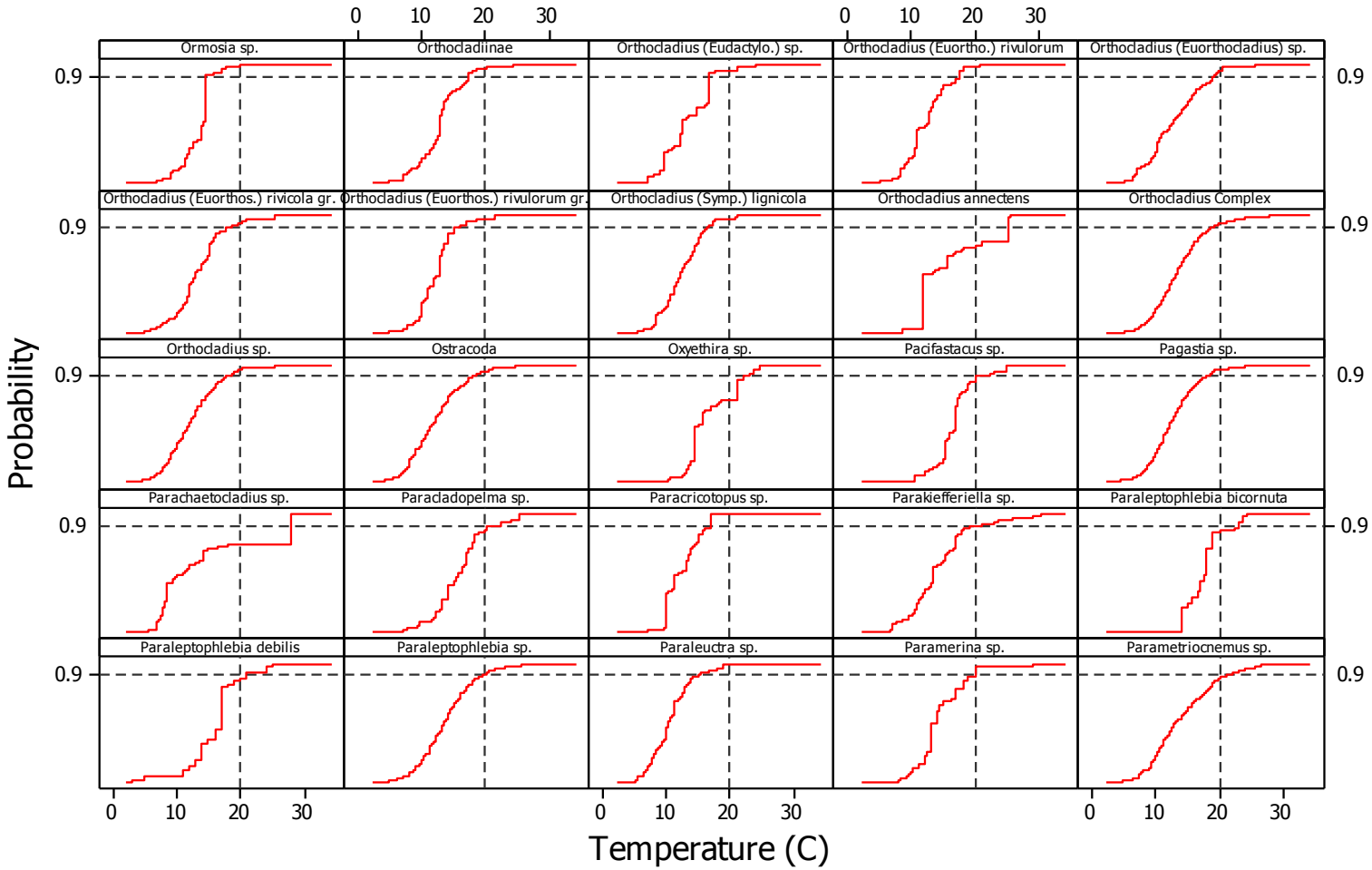


Figure 12. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Ormosia* sp. to *Parametriocnemus* sp. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

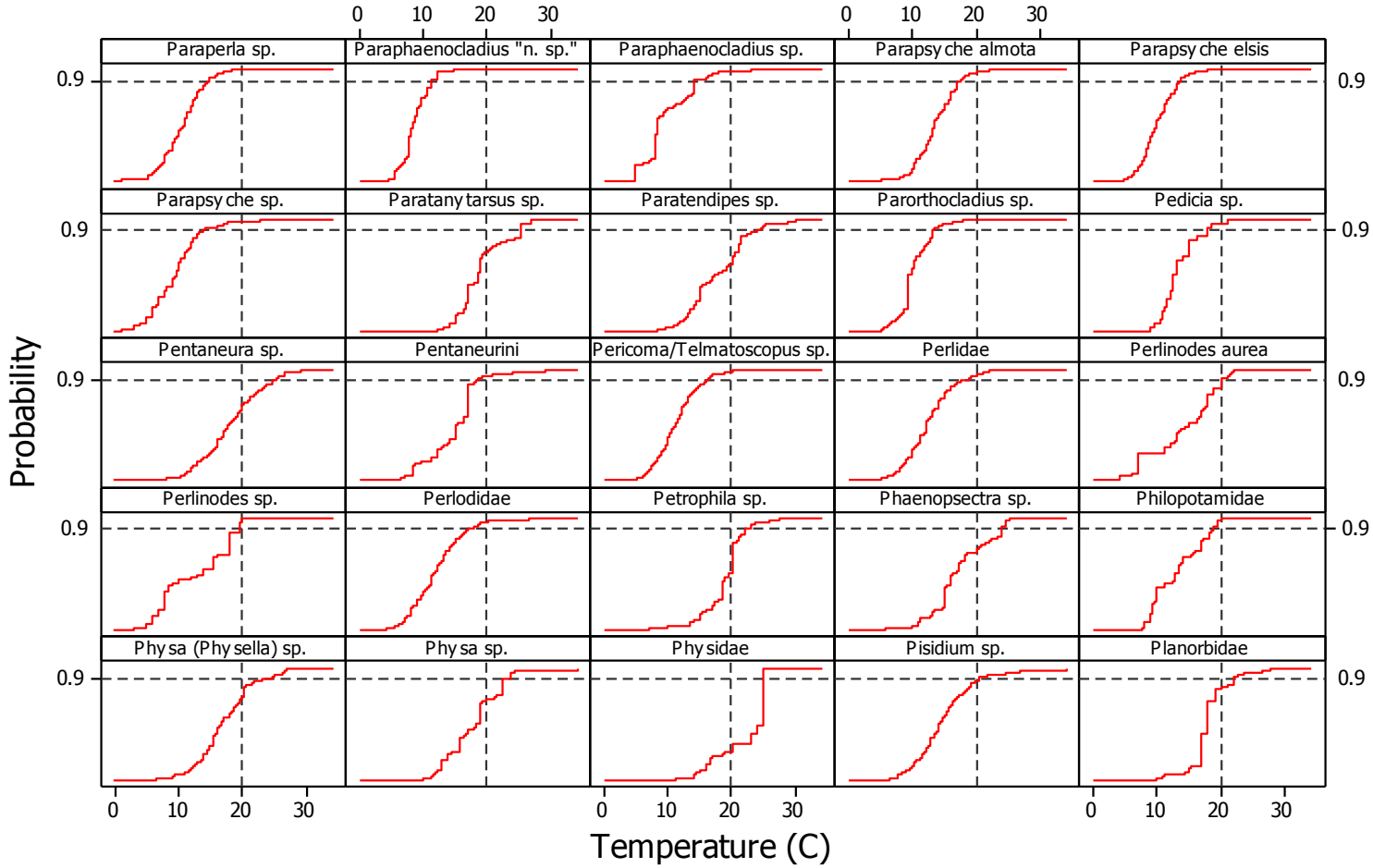


Figure 13. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Paraperla* sp. to Planorbidae at 0.90 probability and 20^0 C. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20 C^0. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C. Taxa with an 'n' (e.g. *Paraphaenocladius* "n sp.") are a morphologically distinct taxon but unnamed at this time.

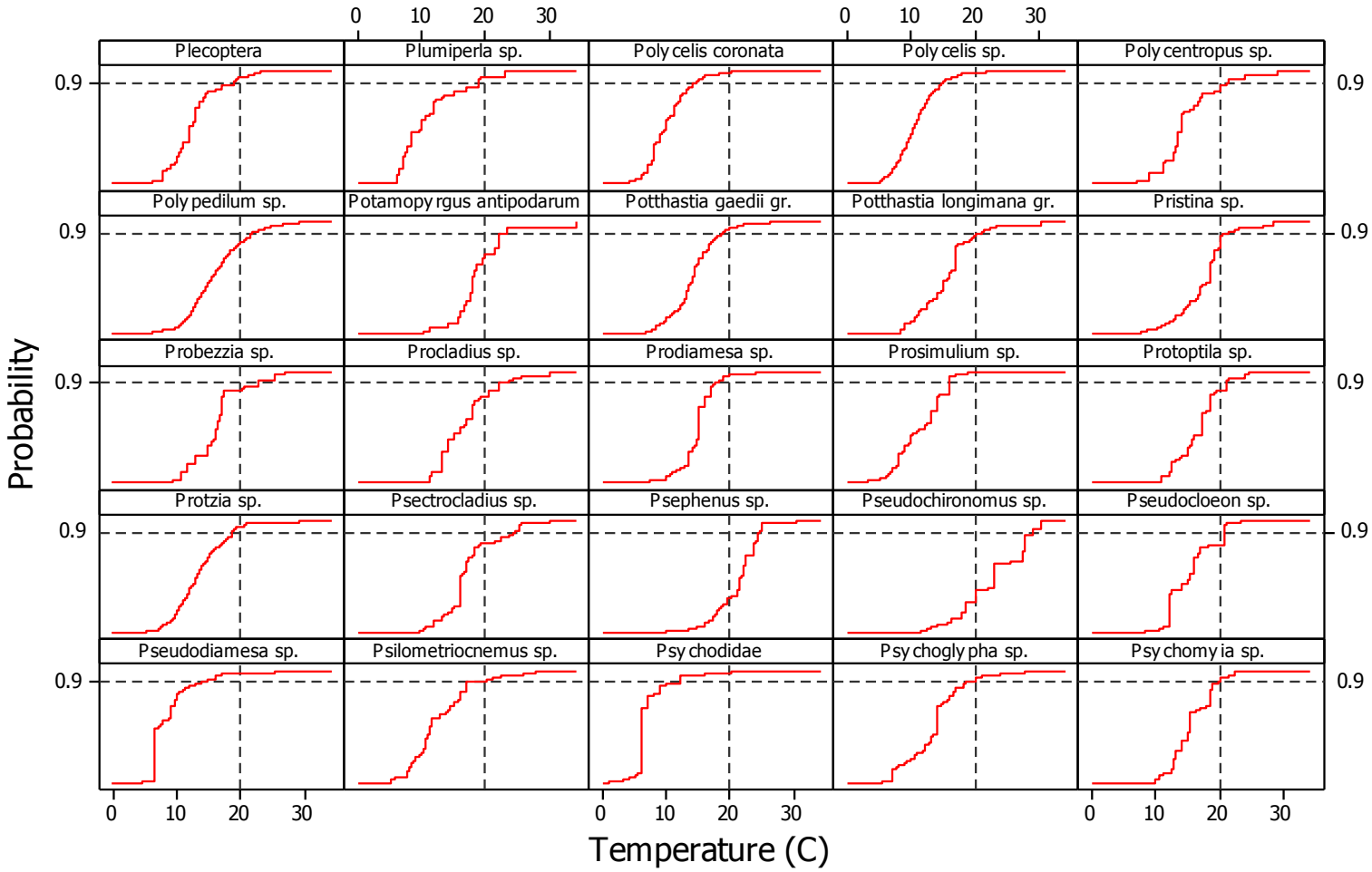


Figure 14. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for Plecoptera to *Psychomyia* sp. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

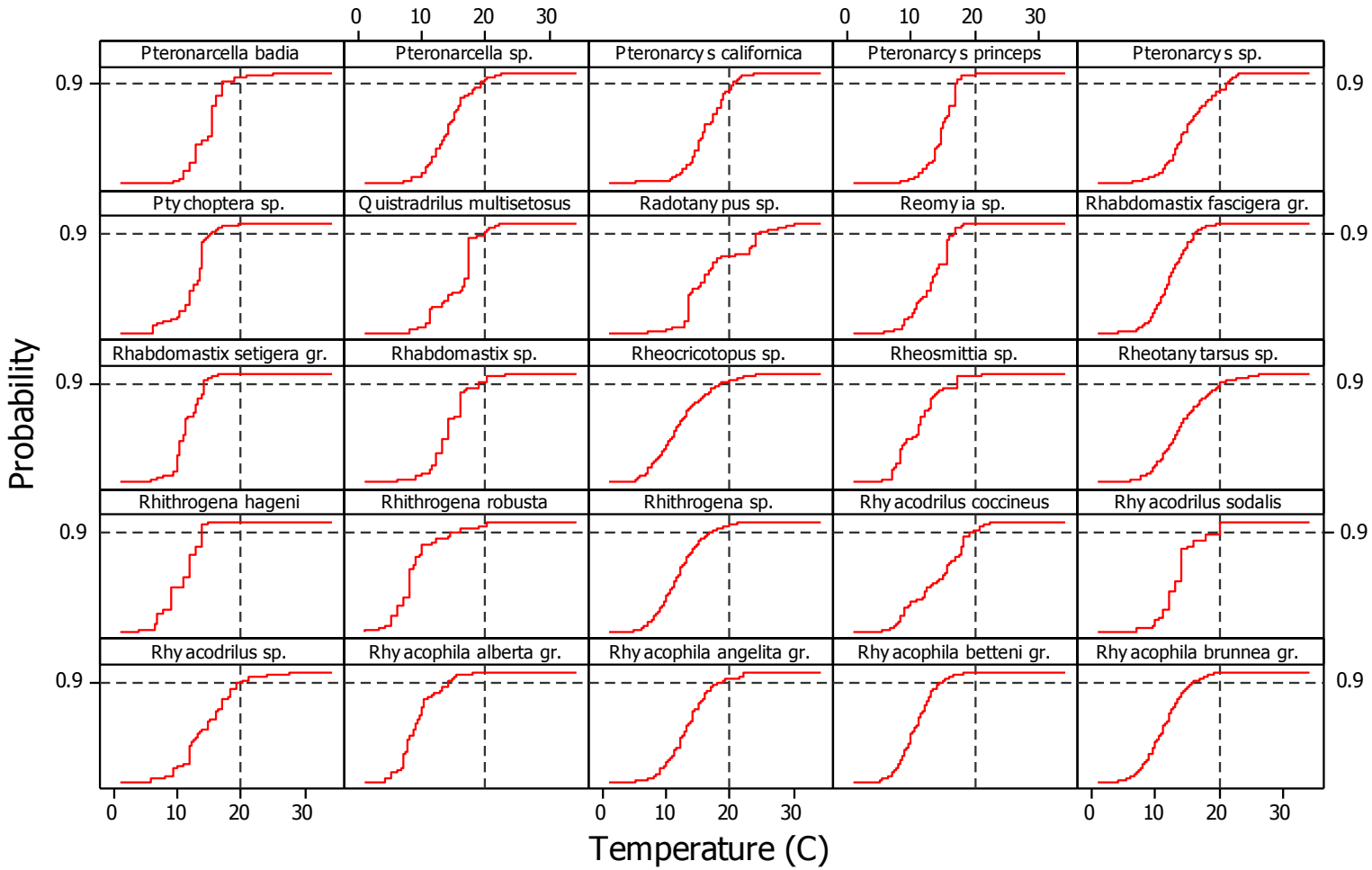


Figure 15. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Pteronarcella badia* to *Rhyacophila brunnea* gr. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

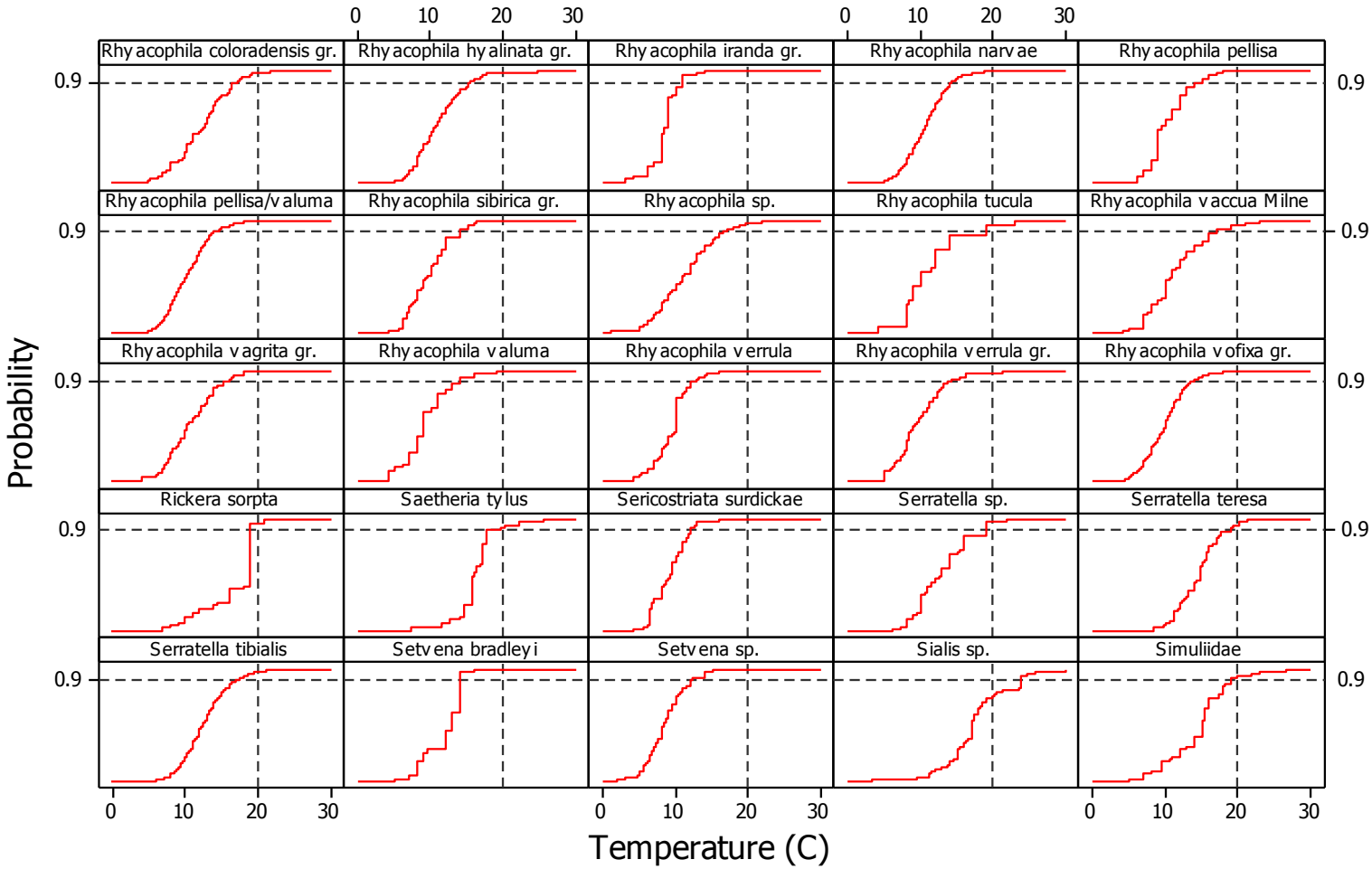


Figure 16. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Rhyacophila coloradensis* gr. to Simuliidae. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

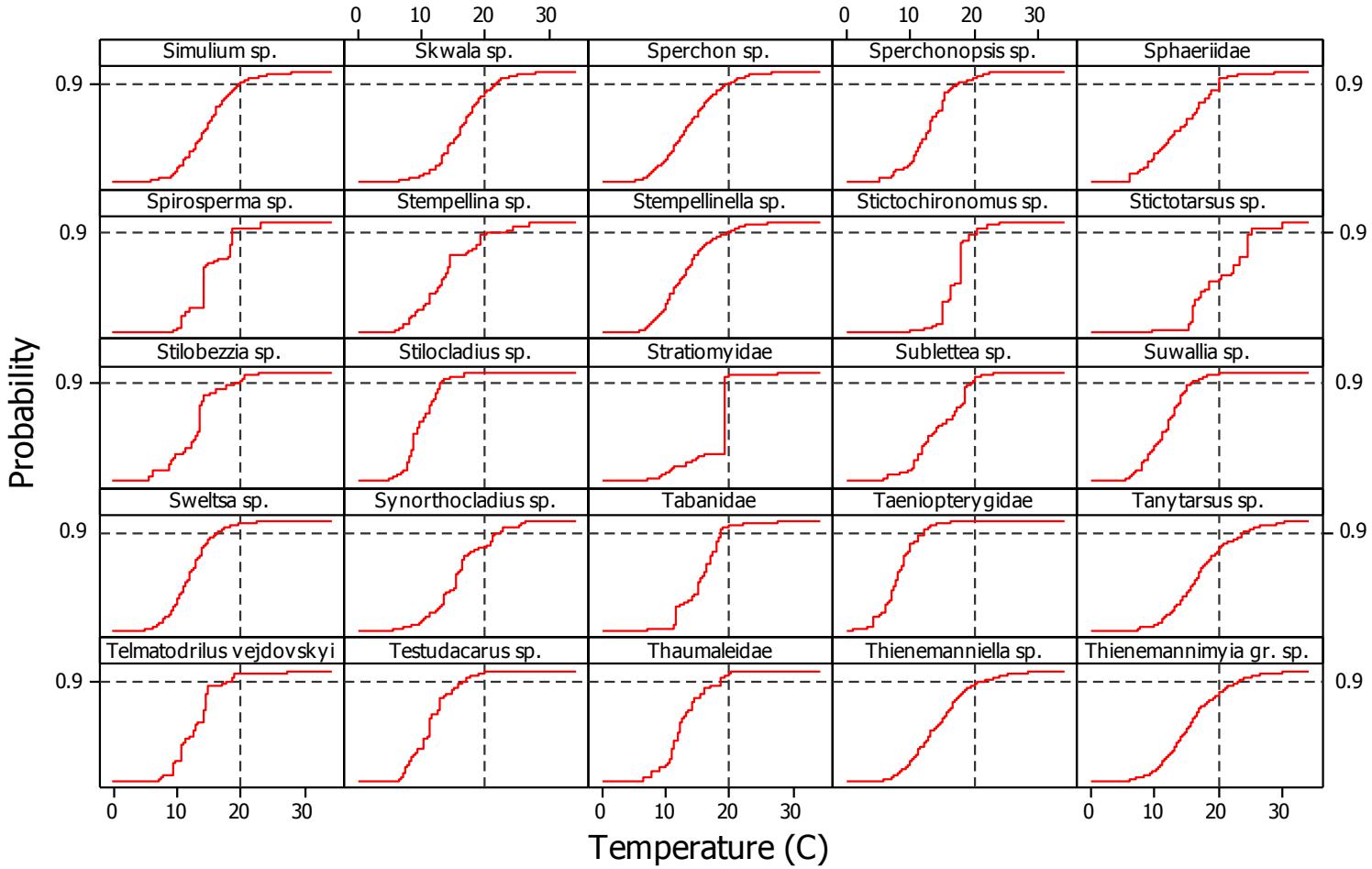


Figure 17. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Simulium* sp. to *Thienemannimyia* gr. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

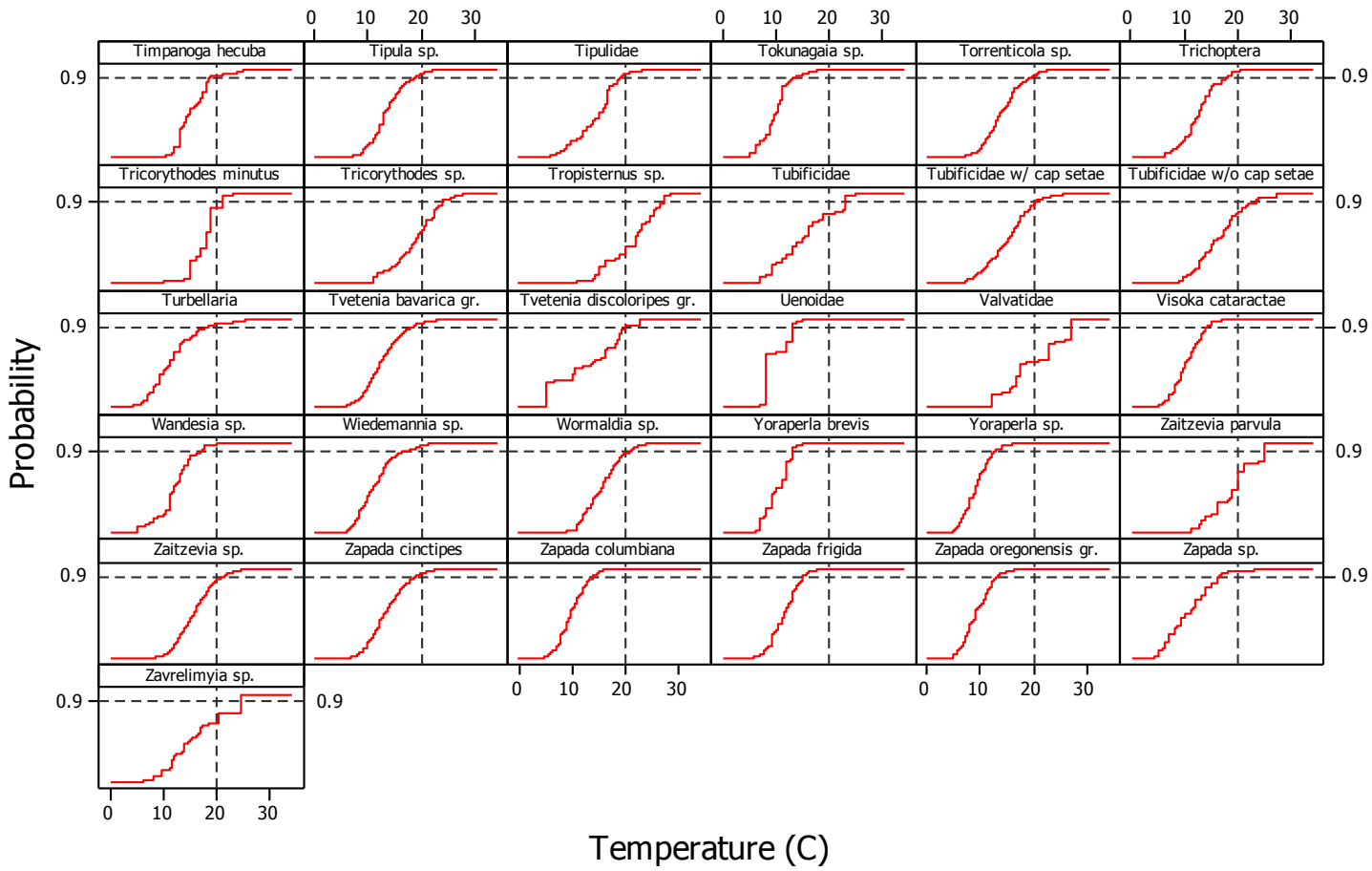


Figure 18. Empirical cumulative distribution functions (ECDFs) of temperature occurrences for *Timpanogo hecuba* to *Zavrelimyia* sp. ECDFs of temperature occurrences were weighted to their abundances from each sample. Dashed horizontal lines are 0.90 probabilities and dashed vertical lines are 20^0 C. If the red ECDF line occurs in the upper left quadrant of each taxon's graph, then it meets cold-water indicator criteria: 0.90 probability of < 20^0 C.

Cold- water taxa based on ECDFs

There were 258 taxa whose ECDFs occurred in the upper left quadrant of each taxon's graph (Figures 1-18) and thus met cold-water indicator criteria: a 0.90 probability of occurence at < 20^0 C (Table 1). This group of taxa represented 57% of the taxa examined; however, the list was biased because most (94%) of the temperature records had values < 20^0 C (see section: Effect of Sampling Bias on Taxa Temperature Occurrence Ranges). Although this list certainly includes cold-water indicator taxa; it also includes taxa that most likely aren't strong cold-water indicators.

Table 1. List of taxa whose 90th percentile ECDFs occurred at < 20 C^0 (N = 258 taxa).

Acari	*Acentrella insignificans*	*Acentrella turbida*
Ameletus similior	*Ameletus* sp.	*Ametor* sp.
Amiocentrus aspilus	*Amiocentrus* sp.	*Amphinemura* sp.
Anagapetus sp.	Annelida	*Antocha* sp.
Apatania sp.	*Arctopsyche grandis*	*Arctopsyche* sp.
Arctopsychinae	*Atrichopogon* sp.	*Baetis bicaudatus*
Baetis tricaudatus	*Bezzia/Palpomyia* sp.	*Blephariceridae*
Brachycentrus americanus	*Brillia* sp.	*Brundiniella* sp.
Bryelmis idahoensis	Capniidae	*Caudatella edmundsi*
Caudatella heterocaudata	*Caudatella hystrix*	*Caudatella* sp.
Ceratopogonidae	*Chaetocladius* sp.	*Chelifera* sp.
Chironomini	*Chloroperlidae*	*Cinygma* sp.
Cinygmula sp.	*Cleptelmis addenda*	*Clinocera* sp.
Cricotopus - Nostoc. Type II	*Cricotopus (Nostoc.) nostocicola*	*Cryptochia* sp.
Cultus sp.	*Despaxia augusta*	*Deuterophlebia* sp.
Diamesa sp.	*Dicosmoecus* sp.	*Dicranota* sp.
Diptera	*Dixa* sp.	*Dolichopodidae*
Dolophilodes sp.	*Doroneuria* sp.	*Drunella coloradensis*
Drunella coloradensis/flavilinea	*Drunella doddsi*	*Drunella grandis*
Drunella sp.	*Drunella spinifera*	*Drunella spinifera/grandis*
Ecclisomyia sp.	Elmidae	Empididae
Enchytraeidae	*Epeorus deceptivus*	*Epeorus grandis*
Epeorus iron	*Epeorus longimanus*	*Epeorus* sp.
Ephemerella aurivillii	*Ephemerella dorothea*	*Ephemerella dorothea/excrucians*
Ephemerella sp.	Ephemerellidae	*Eukiefferiella brevicalcar* gr.
Eukiefferiella claripennis gr.	*Eukiefferiella coerulescens* gr.	*Eukiefferiella devonica* gr.
Eukiefferiella gracei gr.	*Eukiefferiella pseudomontana* gr.	*Eukiefferiella* sp.
Eukiefferiella tirolensis	*Euryhapsis* sp.	*Forcipomyia* sp.
Gammarus lacustris Sars	*Glossosoma* sp.	Glossosomatidae

Glutops sp.	Haplotaxidae	*Haplotaxis* sp.
Heleniella sp.	*Helopelopia* sp.	Heptageniidae
Hesperoconopa sp.	*Hesperoperla pacifica*	*Hesperoperla* sp.
Heterlimnius corpulentus	*Heterotrissocladius marcidus* gr.	*Heterotrissocladius* sp.
Hydra sp.	*Hydraena* sp.	*Hydrobaenus* sp.
Hydropsychinae	Hydryphantidae	*Ironodes* sp.
Isoperla sp.	*Kathroperla* sp.	*Kogotus* sp.
Krenopelopia sp.	*Krenosmittia* sp.	*Lara avara*
Lara sp.	*Lepidostoma* sp.	Leuctridae
Limnephilidae	*Limnophila* sp.	*Lumbricina*
Macropelopiini	*Malenka* sp.	*Megarcys* sp.
Meringodixa sp.	*Micrasema* sp.	*Micropsectra* sp.
Microtendipes rydalensis gr.	*Mideopsis* sp.	*Monodiamesa* sp.
Narpus sp.	Nematoda	Nemouridae
Neophylax sp.	*Neophylax splendens*	*Neothremma alicia*
Neothremma sp.	*Ochrotrichia* sp.	*Odontomesa* sp.
Oligochaeta	*Oligophlebodes* sp.	*Onocosmoecus* sp.
Optioservus quadrimaculatus	*Ordobrevia* sp.	*Oreogeton* sp.
Oribatei	*Ormosia* sp.	*Orthocladiinae*
Orthocladius (Eudactylo.) sp.	*Orthocladius (Euortho.) rivulorum*	*Orthocladius (Euorthocladius)* sp.
Orthocladius (Euorthos.) rivicola gr.	*Orthocladius(Euorthos.)rivulorum* gr.	*Orthocladius (Symp.) lignicola*
Orthocladius Complex	*Orthocladius* sp.	Ostracoda
Pagastia sp.	*Paracricotopus* sp.	*Paraleptophlebia* sp.
Paraleuctra sp.	*Paraperla* sp.	*Paraphaenocladius "n.* sp."
Paraphaenocladius sp.	*Parapsyche almota*	*Parapsyche elsis*
Parapsyche sp.	*Parorthocladius* sp.	*Pedicia* sp.
Pentaneurini	*Pericoma/Telmatoscopus* sp.	Perlidae
Perlinodes sp.	Perlodidae	Philopotamidae
Plecoptera	*Plumiperla* sp.	*Polycelis coronata*
Polycelis sp.	*Potthastia gaedii* gr.	*Prodiamesa* sp.
Prosimulium sp.	*Protzia* sp.	*Pseudodiamesa* sp.
Psilometriocnemus sp.	Psychodidae	*Psychoglypha* sp.
Psychomyia sp.	*Pteronarcella badia*	*Pteronarcella* sp.
Pteronarcys princeps	*Ptychoptera* sp.	*Quistradrilus multisetosus*
Reomyia sp.	*Rhabdomastix fascigera* gr.	*Rhabdomastix setigera* gr.
Rhabdomastix sp.	*Rheocricotopus* sp.	*Rheosmittia* sp.
Rhithrogena hageni	*Rhithrogena robusta*	*Rhithrogena* sp.
Rhyacodrilus coccineus	*Rhyacophila alberta* gr.	*Rhyacophila angelita* gr.
Rhyacophila betteni gr.	*Rhyacophila brunnea* gr.	*Rhyacophila coloradensis* gr.
Rhyacophila hyalinata gr.	*Rhyacophila iranda* gr.	*Rhyacophila narvae*
Rhyacophila pellisa	*Rhyacophila pellisa/valuma*	*Rhyacophila sibirica* gr.
Rhyacophila sp.	*Rhyacophila vaccua Milne*	*Rhyacophila vagrita* gr.
Rhyacophila valuma	*Rhyacophila verrula*	*Rhyacophila verrula* gr.
Rhyacophila vofixa gr.	*Saetheria tylus*	*Sericostriata surdickae*

Serratella sp.	*Serratella teresa*	*Serratella tibialis*
Setvena bradleyi	*Setvena* sp.	Simuliidae
Sperchon sp.	*Sperchonopsis* sp.	*Stempellinella* sp.
Stilobezzia sp.	*Stilocladius* sp.	Stratiomyidae
Sublettea sp.	*Suwallia* sp.	*Sweltsa* sp.
Tabanidae	*Taeniopterygidae*	*Telmatodrilus vejdovskyi*
Testudacarus sp.	Thaumaleidae	*Timpanoga hecuba*
Tipula sp.	Tipulidae	*Tokunagaia* sp.
Torrenticola sp.	Trichoptera	Turbellaria
Tvetenia bavarica gr.	Uenoidae	*Visoka cataractae*
Wandesia sp.	*Wiedemannia* sp.	*Yoraperla brevis*
Yoraperla sp.	*Zapada columbiana*	*Zapada frigida*
Zapada oregonensis gr.	*Zapada* sp.	

Comparison of Temperature Occurrence CDFs for all Taxa

Individual ECDFs (Figures 1-18) were useful to determine which taxa had 90th percentiles at < 20^{0} C and to more closely examine their temperature probabilities (see previous section); however direct comparison of ranges of temperature occurrences for all the taxa required combining their CDFs onto one graph (Figure 19). Comparison of all taxa CDFs (normal distribution fitted) showed that most taxa had similar temperature occurrences (Figure 19). Some taxa had CDFs with discernibly lower or higher temperature distributions (Figure 19). Taxa that had clearly discernible CDFs to the left of the norm can be considered cold- water obligate taxa and taxa that had discernible CDFs to the right of the norm considered warm-water taxa (Figure 19, Table 2).

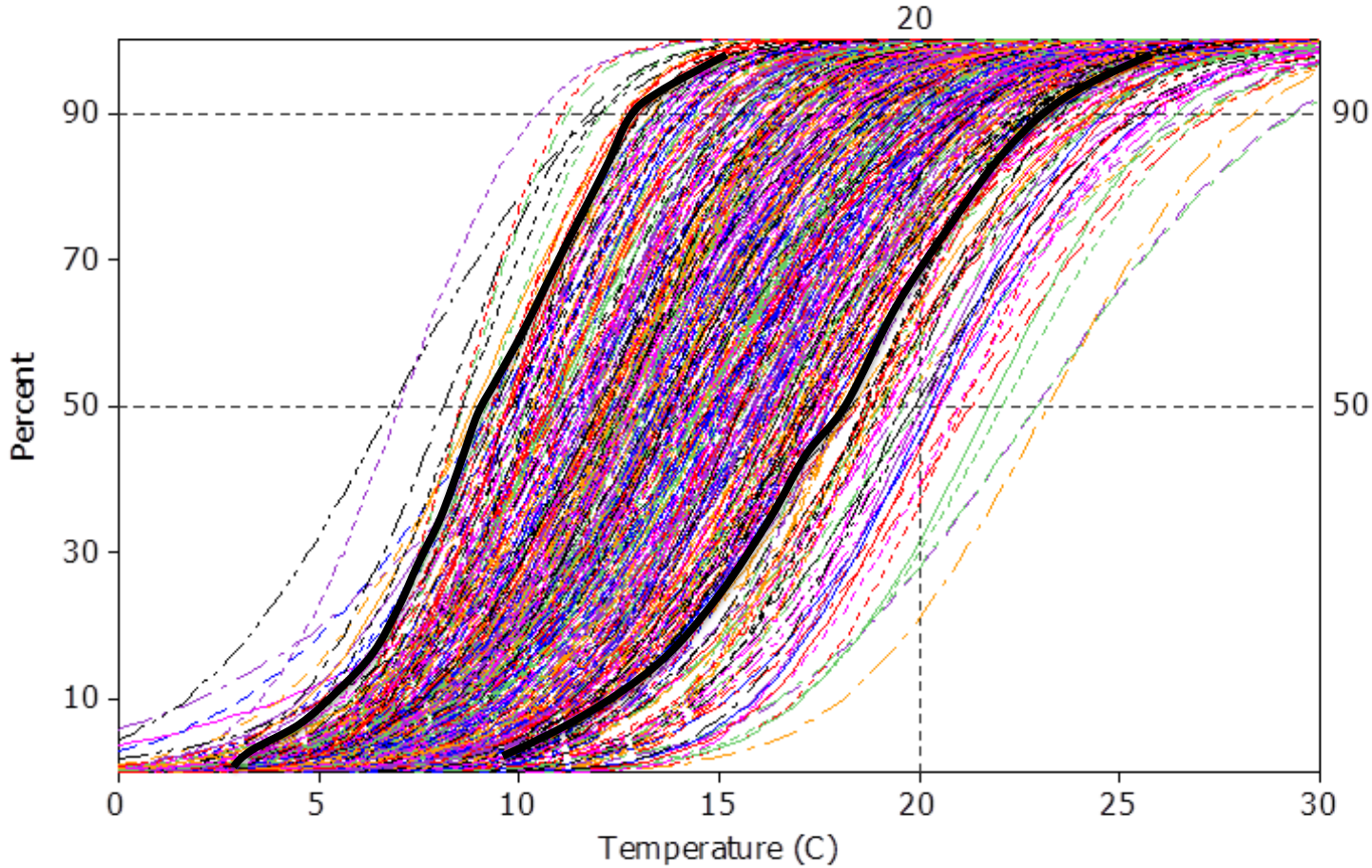


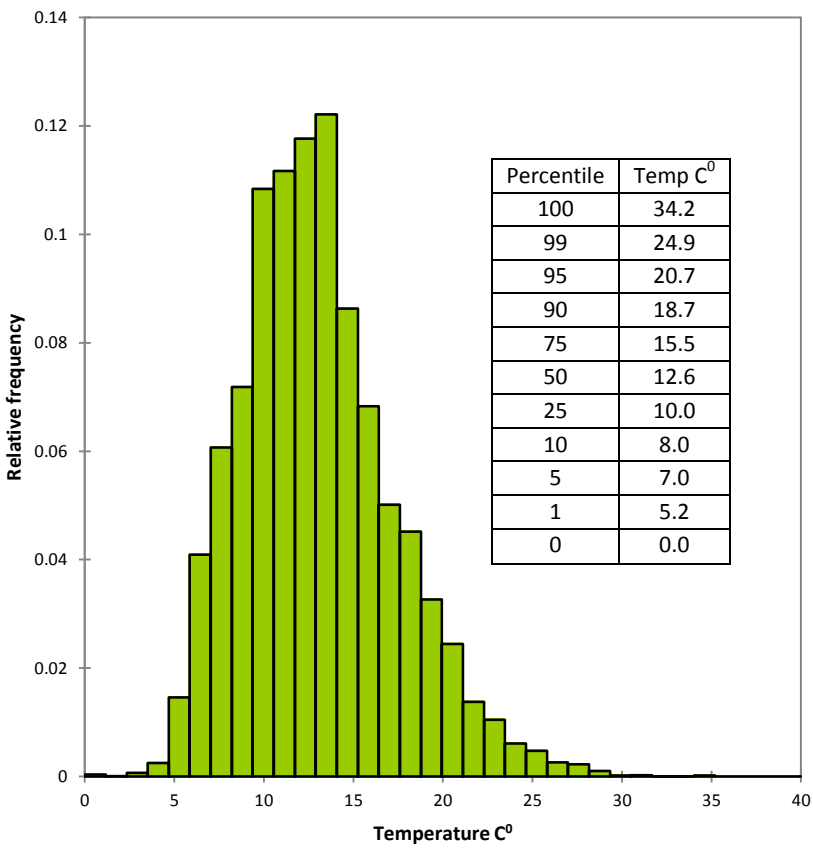
Figure 19. CDFs for all 453 taxa combined. Normal distribution curves were fitted to empirical data. Thick black curves indicate estimated cut offs for obligate cold -water and taxa that mostly occur in warmer water. See Table 2 for list of taxa at extremes of temperature ranges.

Table 2. Obligate cold-water taxa and taxa that occur primarily in warmer water, based on normal CDF curves (Figure 19).

Obligate Cold- Water Taxa	Warmer- Water Taxa	
Annelida	*Ablabesmyia* sp.	*Leucotrichia* sp.
Baetis bicaudatus	*Apedilum* sp.	Lymnaidae
Cryptochia sp.	*Caenis* sp.	*Microcylleopus* sp.
Despaxia augusta	*Callibaetis* sp.	*Nais variabilis*
Drunella coloradensis	*Chimarra* sp.	*Nilotanypus* sp.
Epeorus sp.	*Chironomus* sp.	*Oecetis avara*
Paraphaenocladius "n. sp."	*Cricotopus (Isocladius) Type I*	*Ophiogomphus* sp.
Pseudodiamesa sp.	Coenagrionidae	*Paratanytarsus* sp.
Psychodidae	*Cryptochironomus* sp.	*Pentaneura* sp.
Rhyacophila iranda gr.	*Dicrotendipes* sp.	*Petrophila* sp.
Rhyacophila verrula	*Eukiefferiella brevicalcar* gr.	*Physa* sp.
Sercostriata surdickae	*Fallceon quilleri*	Physidae
Setvena sp.	*Ferrissia* sp.	*Potamopyrgus antipodarum*
Taeniopterygidae	*Fossaria* sp.	*Pseudochironomus* sp.
Yoraperla sp.	*Glossiphonia complanata*	*Psephenus* sp.
	Gomphidae	*Stictotarsus* sp.
	Gyraulus sp.	*Tricorythodes* sp.
	Haliplus sp.	*Tropisternus* sp.
	Hydrophilidae	*Valvatidae*
	Leptoceridae	

Effect of Sampling Bias on Taxa Temperature Occurrence Ranges

It is well known that sampling effort has a direct effect on taxa occurrence (e.g. the number of taxa collected, α diversity). Increased sampling effort will result in an increased number of taxa collected (up to an asymptote); whereas fewer samples collected will result in fewer taxa collected (Species Area Curve Rule). As discussed earlier, data used in these analyses were not randomly or uniformly sampled from a full range of temperatures, but were collected from streams with instantaneous temperatures that mostly occurred between 8.0 and 18.7^0 C (10th to 90th percentiles)(Figure 20). 95% of the samples were collected at temperatures < 21.0^0 C (Figure 20).



Percentile	Temp C^0
100	34.2
99	24.9
95	20.7
90	18.7
75	15.5
50	12.6
25	10.0
10	8.0
5	7.0
1	5.2
0	0.0

Figure 20. Relative frequency and percentiles of temperatures sampled. Most samples were collected between 8.0 and 18.7 C^0 (10th to 90th percentiles).

Therefore, sites with temperatures > 18.7^0 C and < 8.0^0 C were sampled substantially fewer times and were underrepresented. This resulted in temperature ECDFs that may have not been

entirely representative of their temperature occurrences. In particular, the upper ECDF bounds and percentiles may have been underestimated because taxa may have been missing from higher temperature records simply because of less sampling effort and not from temperature intolerances. The effects of fewer samples recorded at temperatures > 18.7 C^0 on ECDFs is unknown but suggested that the following supportive analyses be conducted.

Taxa Temperature Occurrence Ranges in Relation to Mean Temperature

The mean temperature recorded was 13^0 C (N = 175,557; median = 12.6^0 C). The following figures are temperature occurrence ranges for all taxa in relation to the mean temperature of 13^0 C (Figures 21-38).

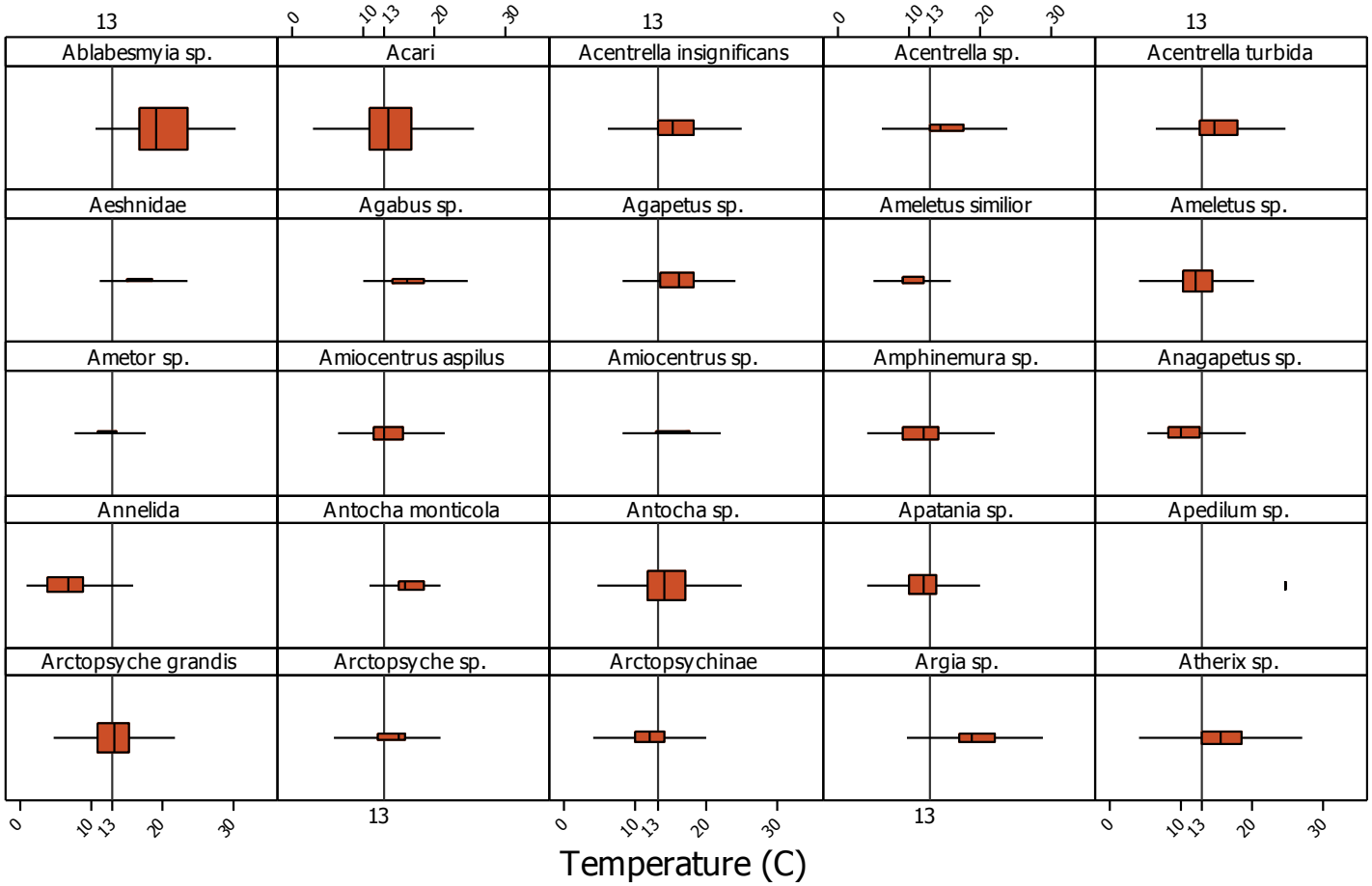


Figure 21. Vertical box and whisker interval plots of temperatures values for *Ablabesmyia* sp. to *Atherix* sp. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^0 C; the mean of the temperature records.

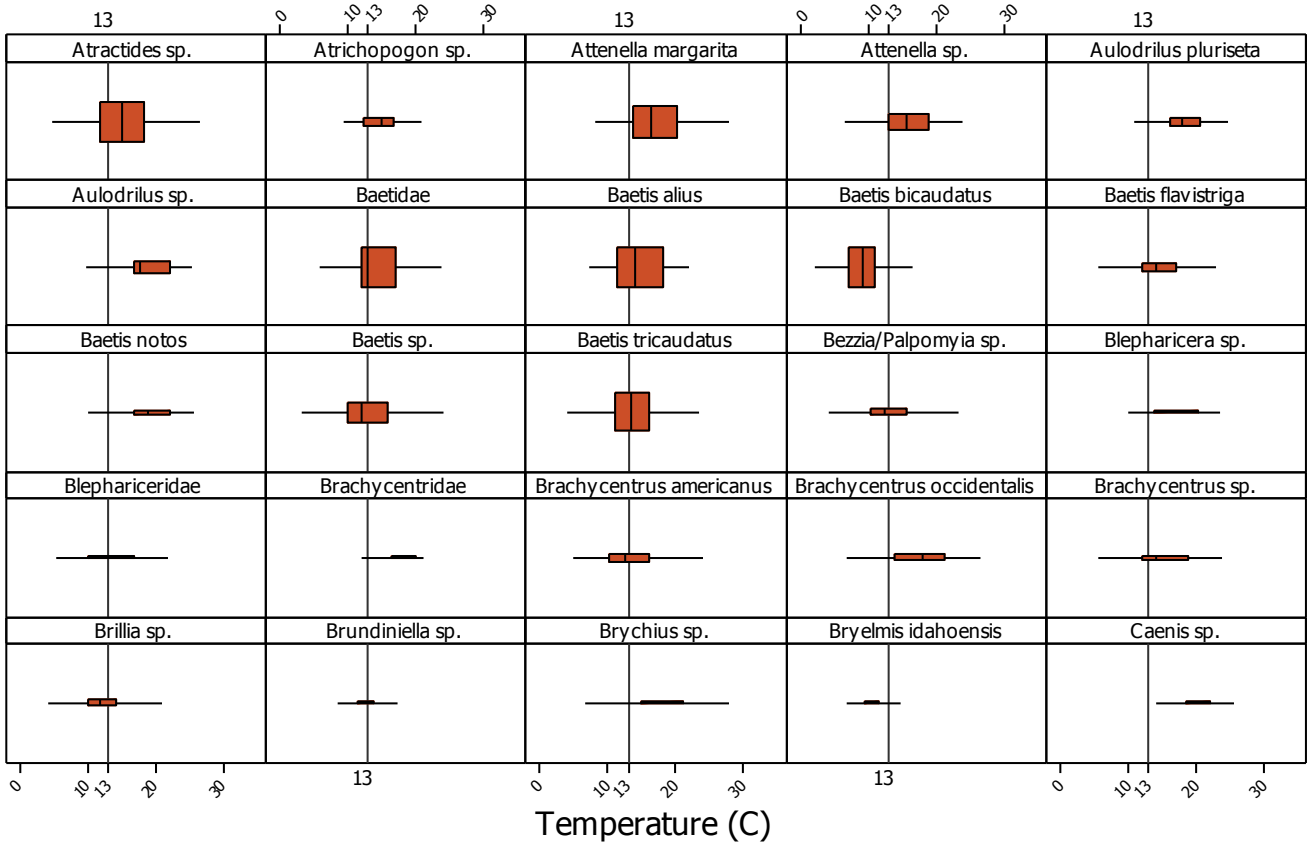


Figure 22. Vertical box and whisker interval plots of temperatures values for *Atractides* sp. to *Caenis* sp. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^0 C; the mean of the temperature records.

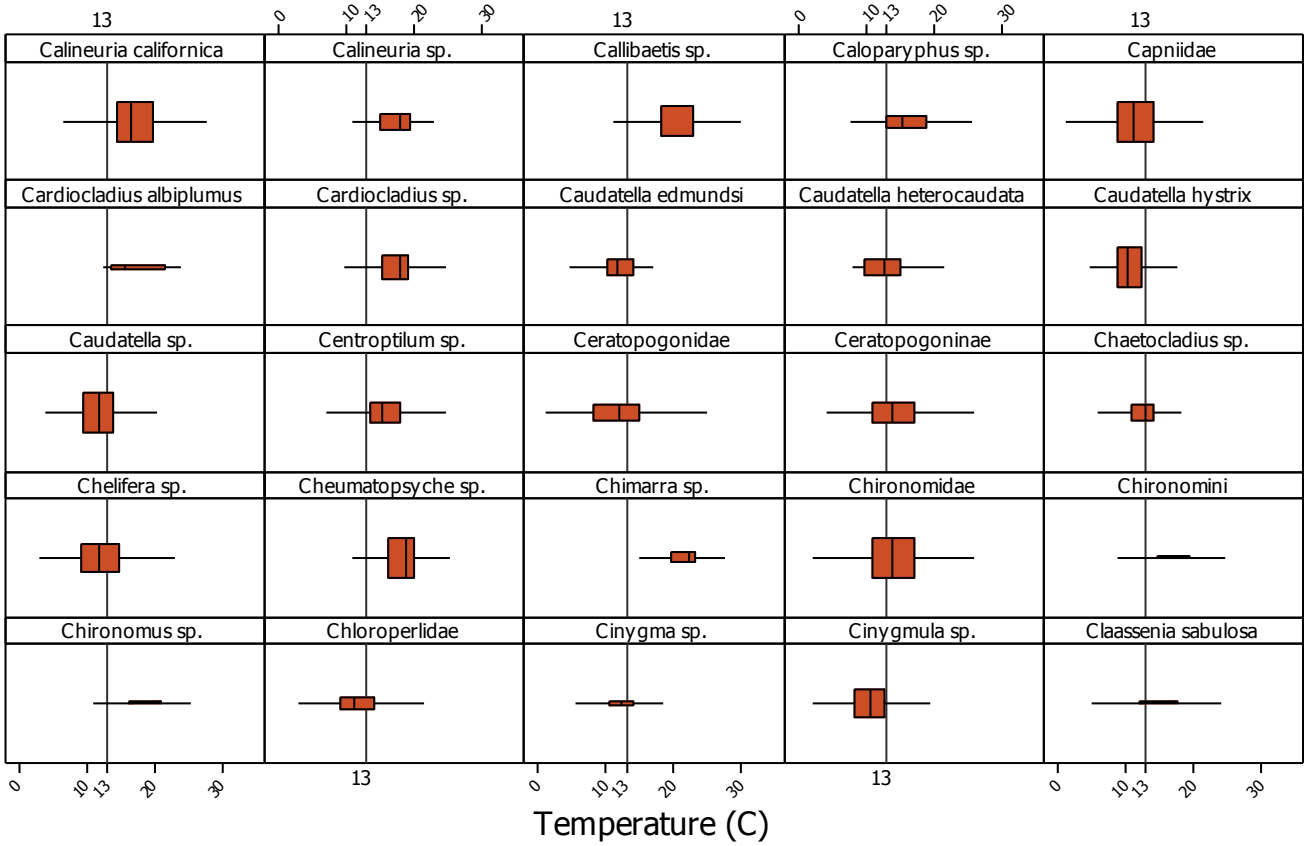


Figure 23. Vertical box and whisker interval plots of temperatures values for *Calineuria californica* to *Claassenia sabulosa*. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C; the mean of the temperature records.

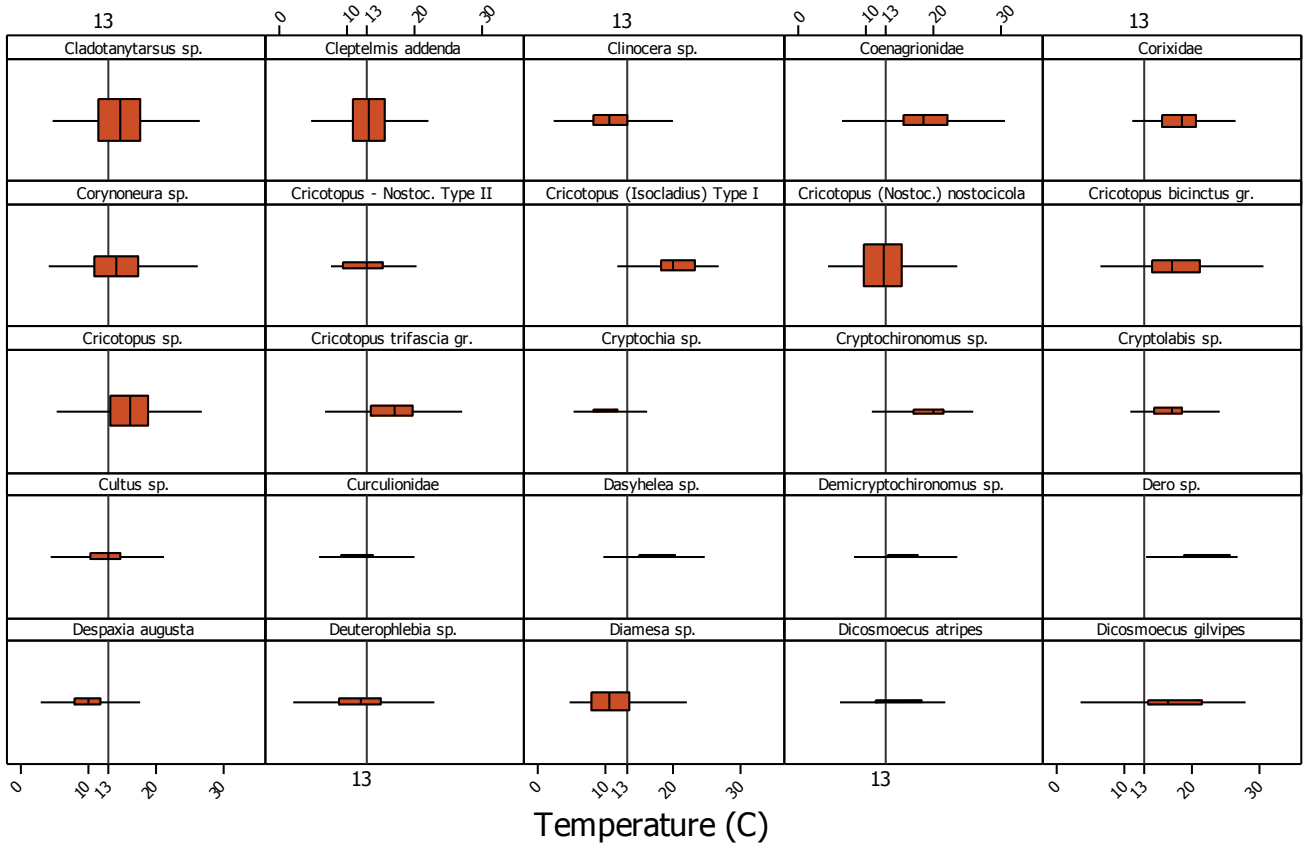


Figure 24. Vertical box and whisker interval plots of temperatures values for *Cladotanytarsus* sp. *Dicosmoecus gilvipes*. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C; the mean of the temperature records.

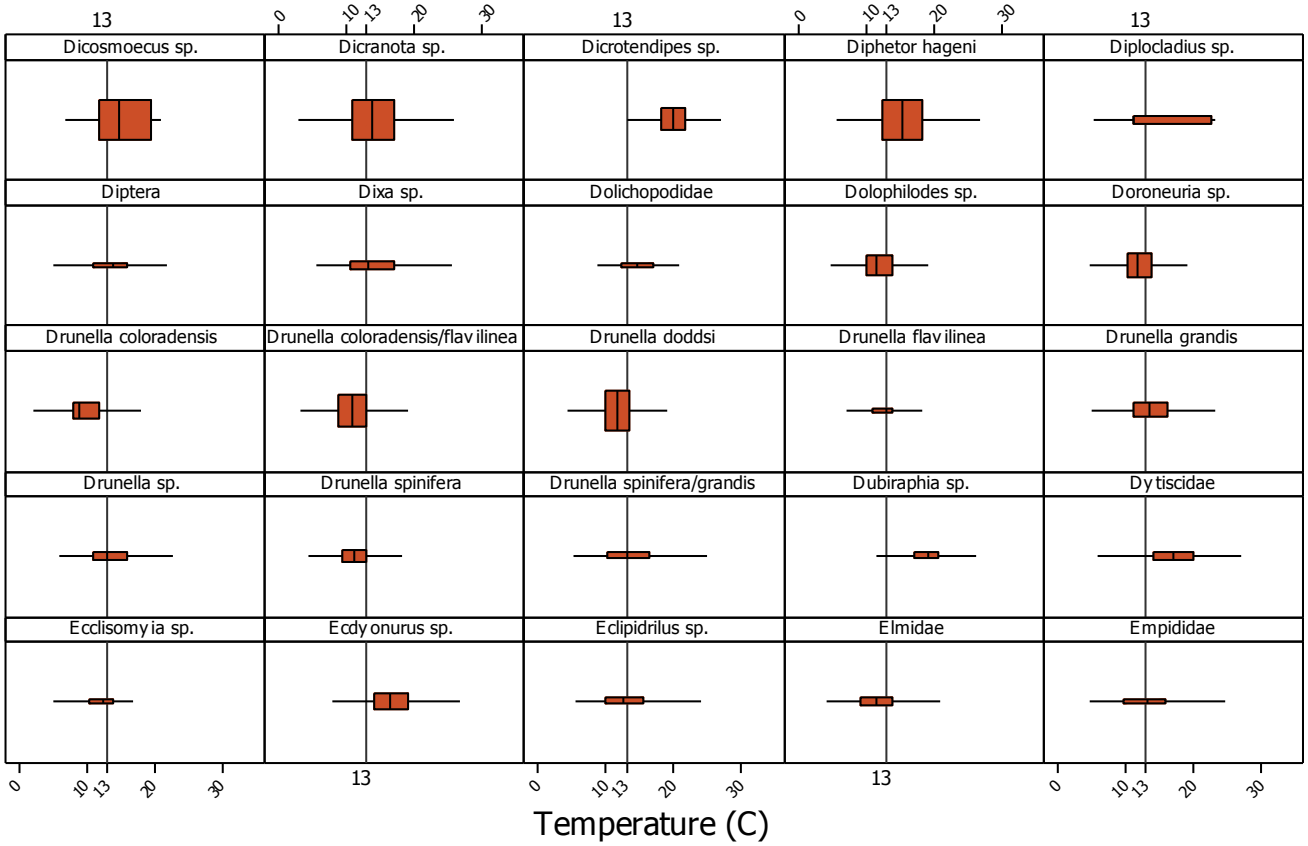


Figure 25. Vertical box and whisker interval plots of temperatures values for *Dicosmoecus* sp. to Empididae. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C; the mean of the temperature records.

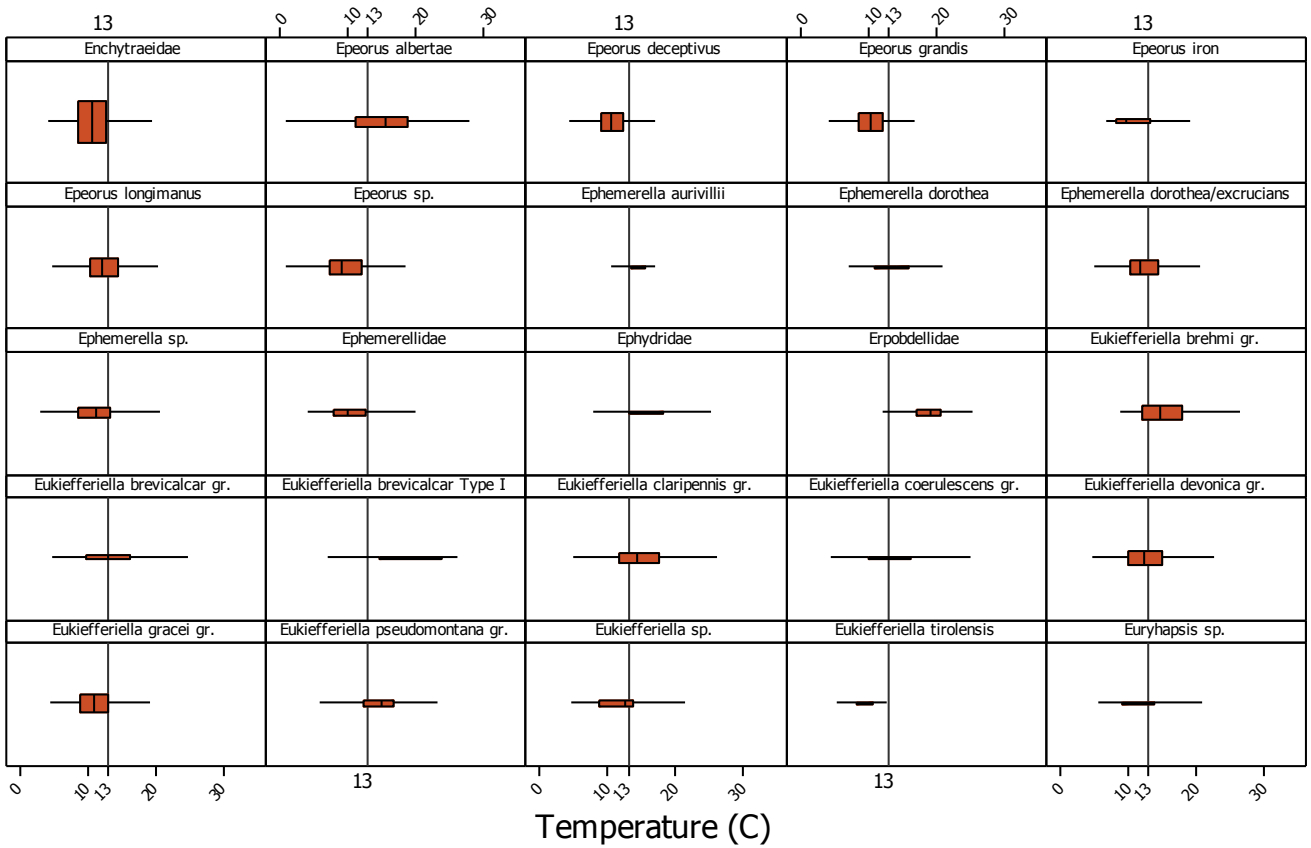


Figure 26. Vertical box and whisker interval plots of temperatures values for Enchytraeidae to *Euryhapsis* sp. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C; the mean of the temperature records.

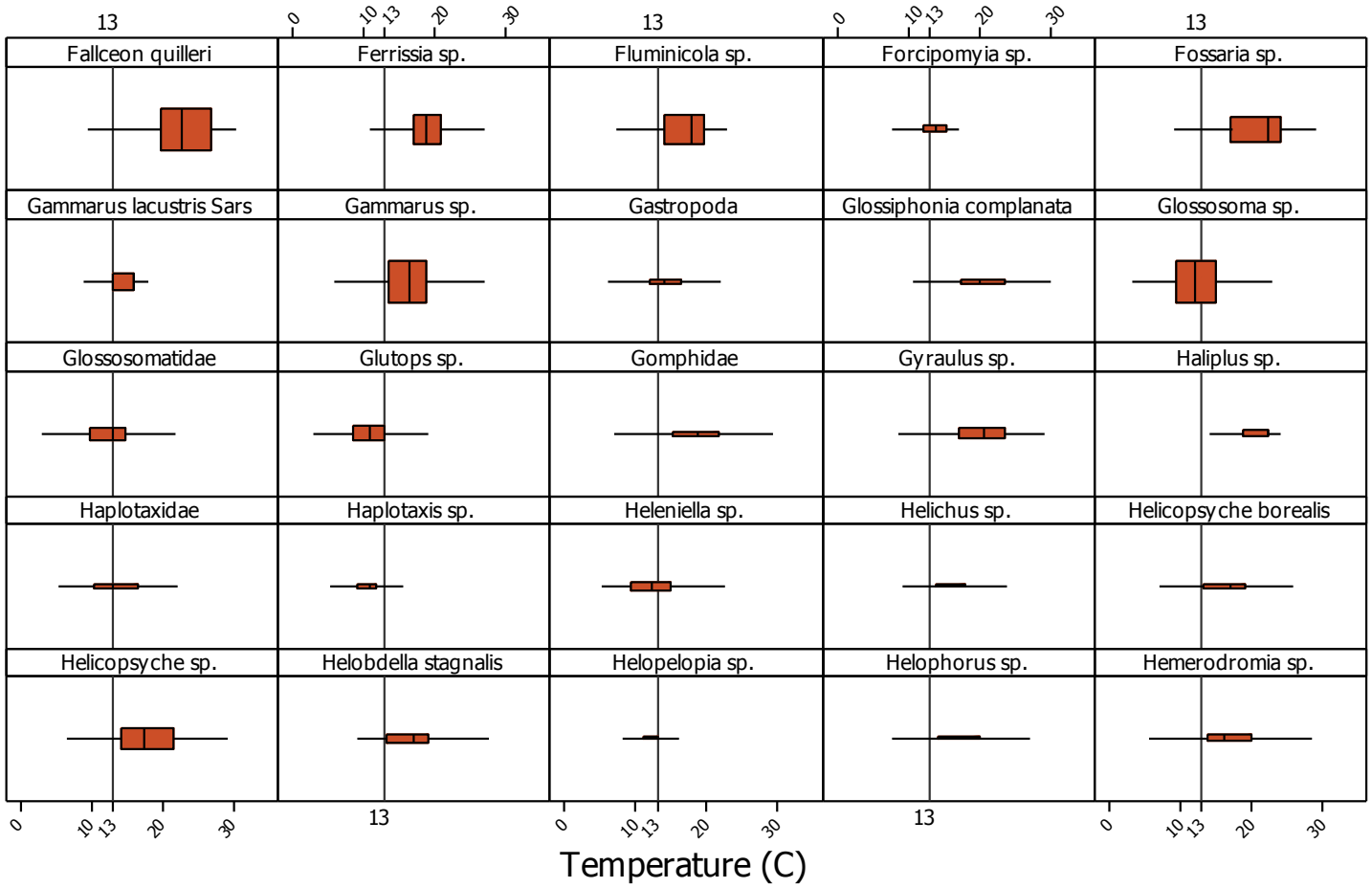


Figure 27. Vertical box and whisker interval plots of temperatures values for *Fallceon quilleri* to *Hemerodromia* sp. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C, which is the mean of the temperature records.

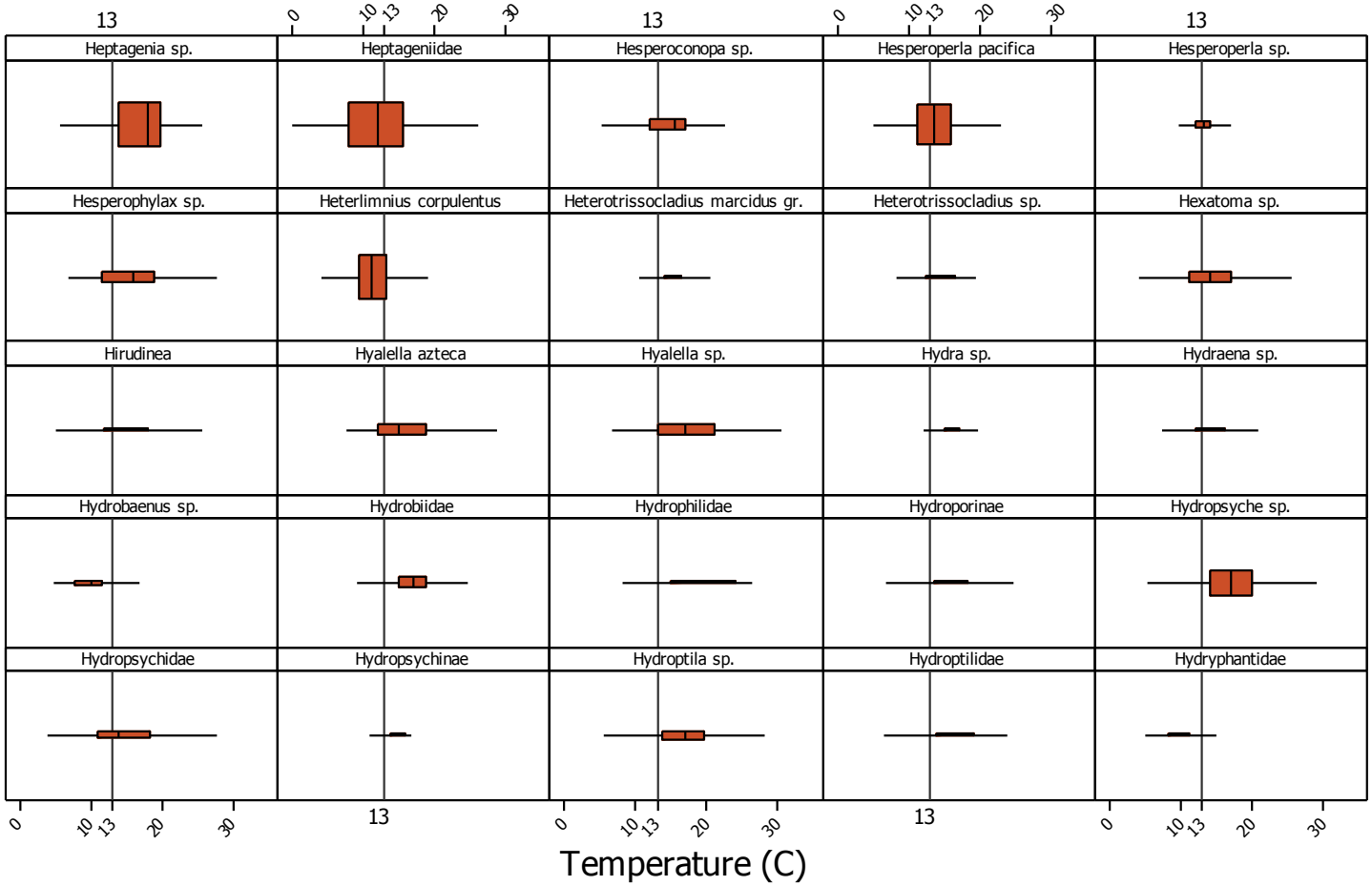


Figure 28. Vertical box and whisker interval plots of temperatures values for *Heptagenia* sp. to Hydryphantidae. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C, which is the mean of the temperature records.

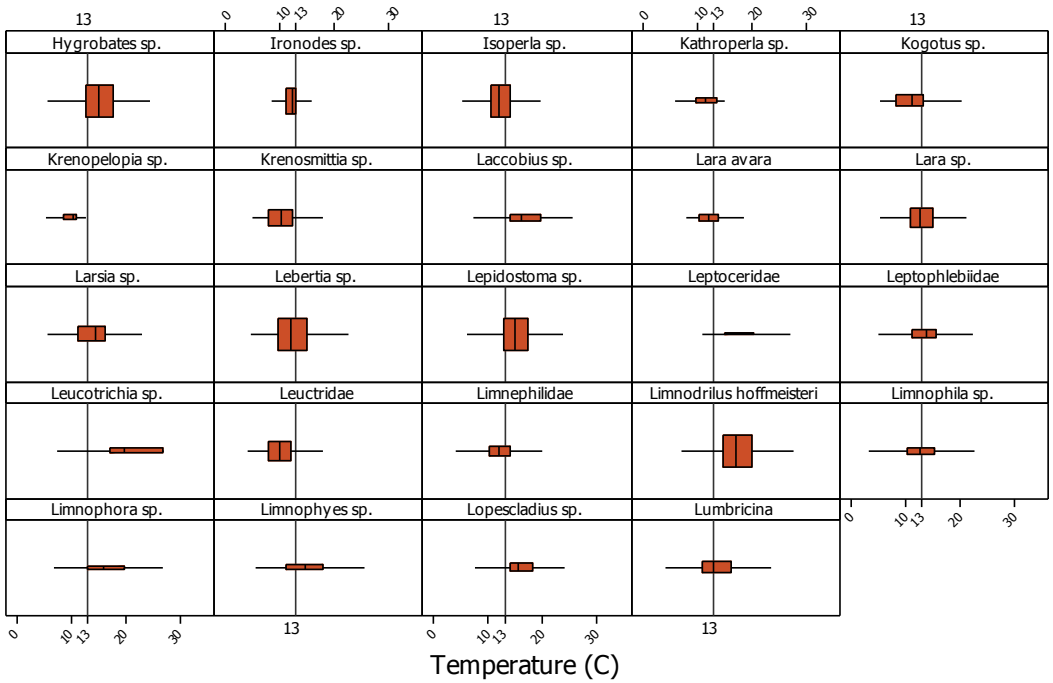


Figure 29. Vertical box and whisker interval plots of temperatures values for *Hygrobates* sp. to Lumbricina. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^0 C, which is the mean of the temperature records.

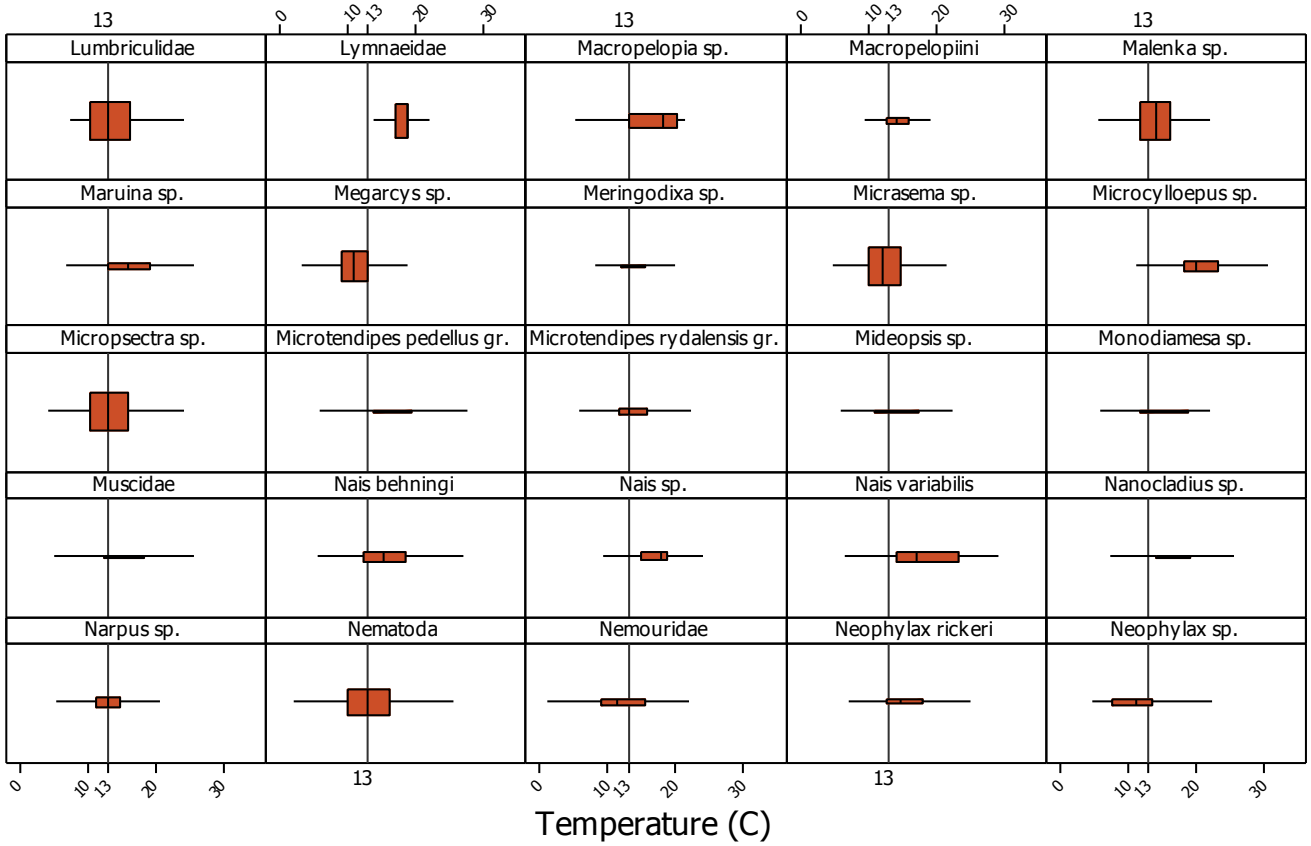


Figure 30. Vertical box and whisker interval plots of temperatures values for Lumbriculidae to *Neophylax* sp. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C, which is the mean of the temperature records.

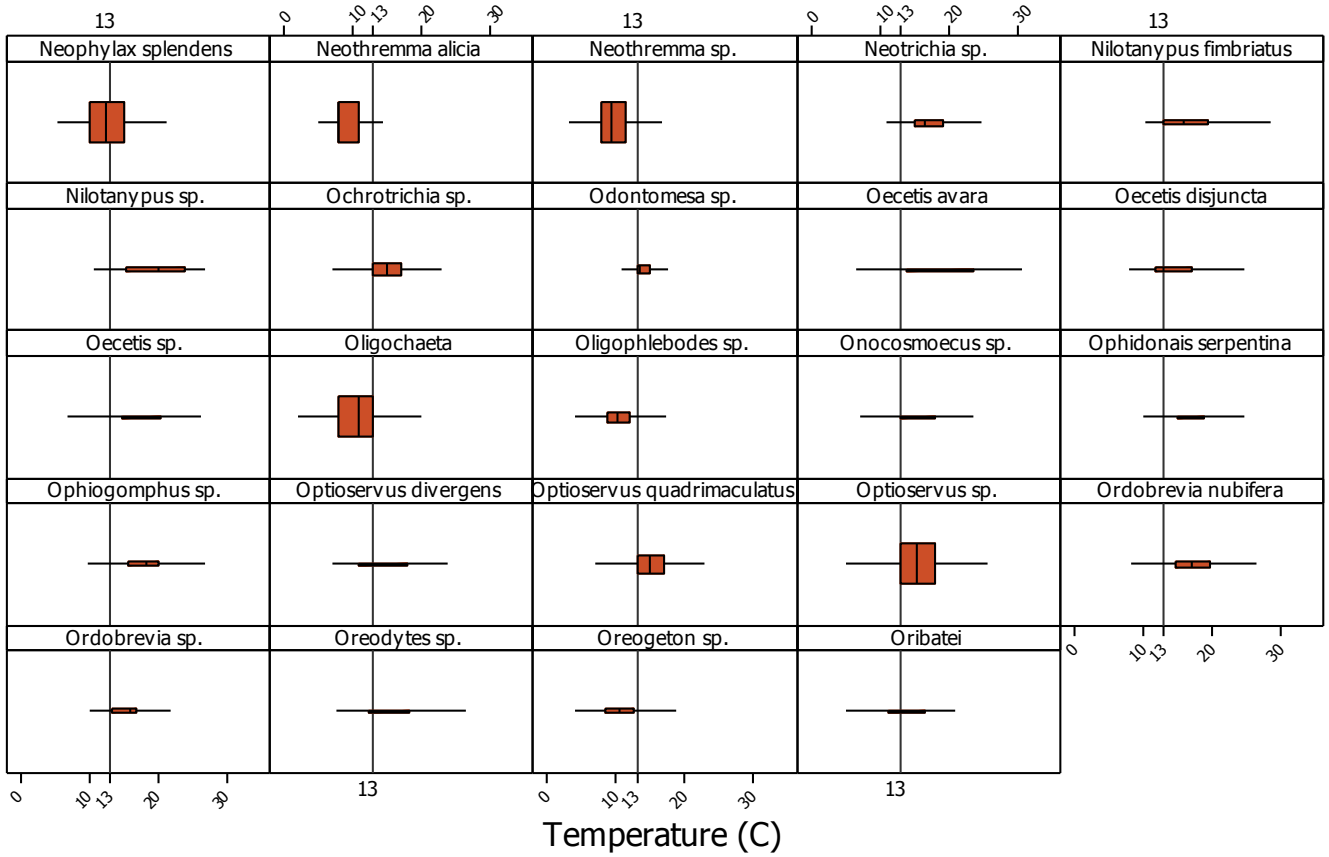


Figure 31. Vertical box and whisker interval plots of temperatures values for *Neophylax splendens* to *Oribatei* sp. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^0 C, which is the mean of the temperature records.

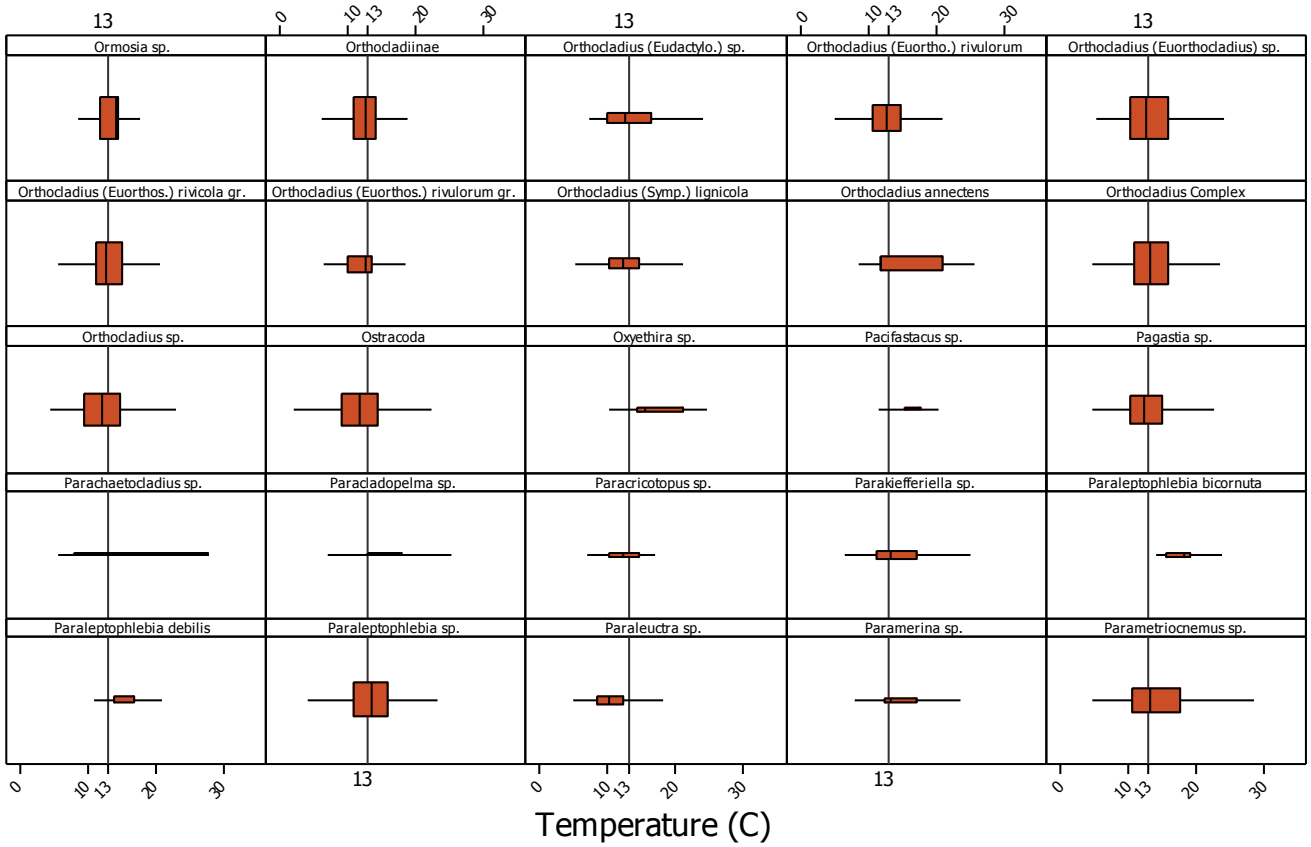


Figure 32. Vertical box and whisker interval plots of temperatures values for *Ormosia* sp. to *Paramtriocnemus* sp. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C, which is the mean of the temperature records.

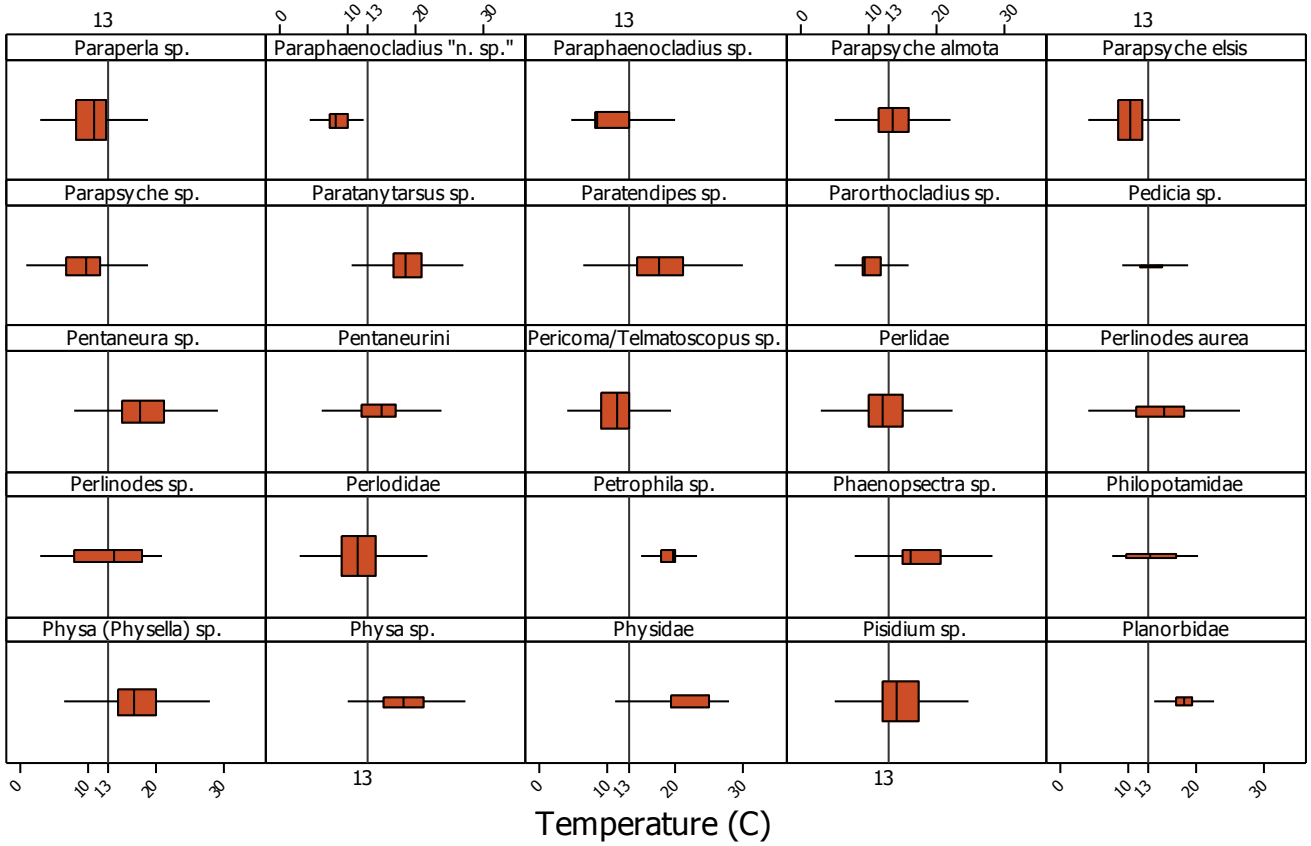


Figure 33. Vertical box and whisker interval plots of temperatures values for *Paraperla* sp. to Planorbidae. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^0 C, which is the mean of the temperature records.

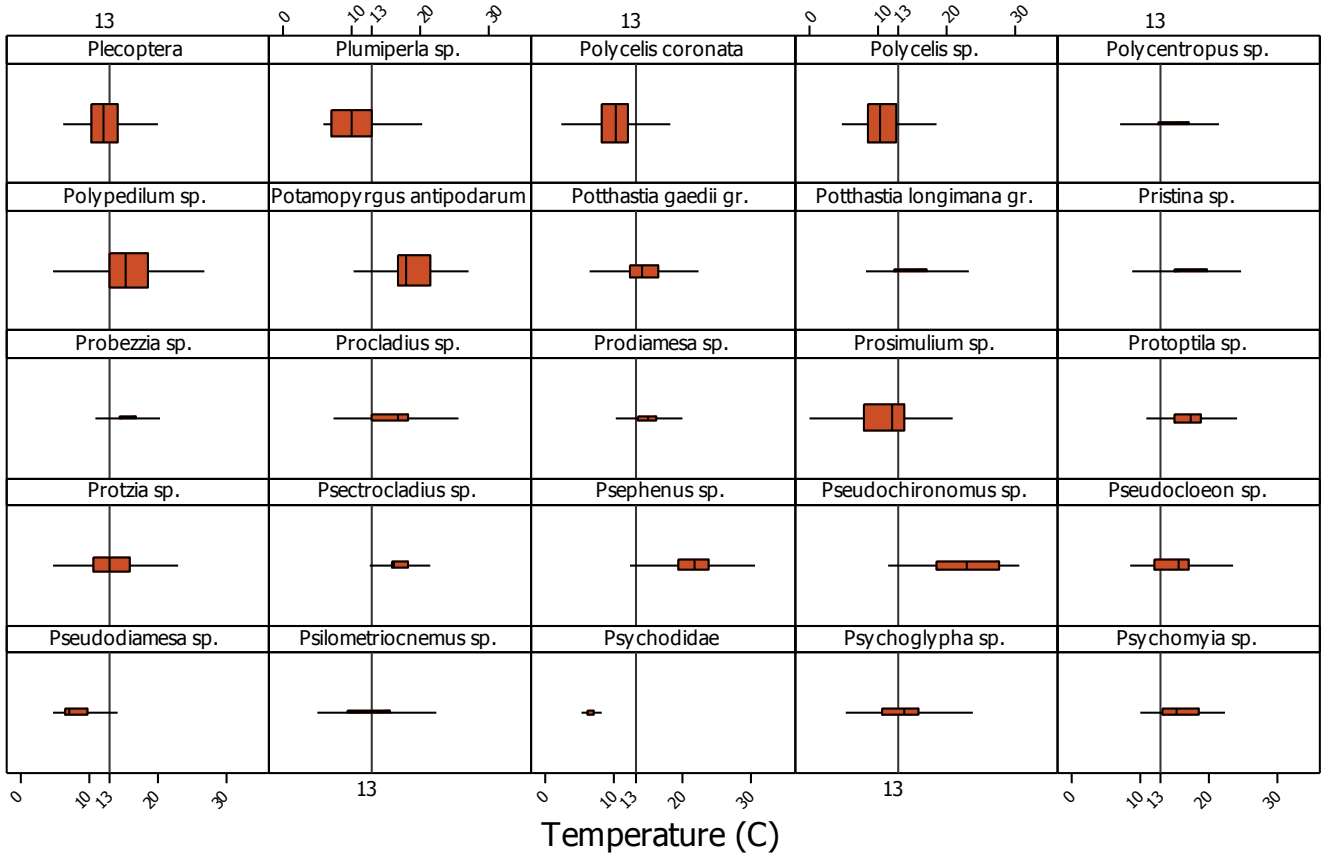


Figure 34. Vertical box and whisker interval plots of temperatures values for Plecoptera to *Psychomyia* sp. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C, which is the mean of the temperature records.

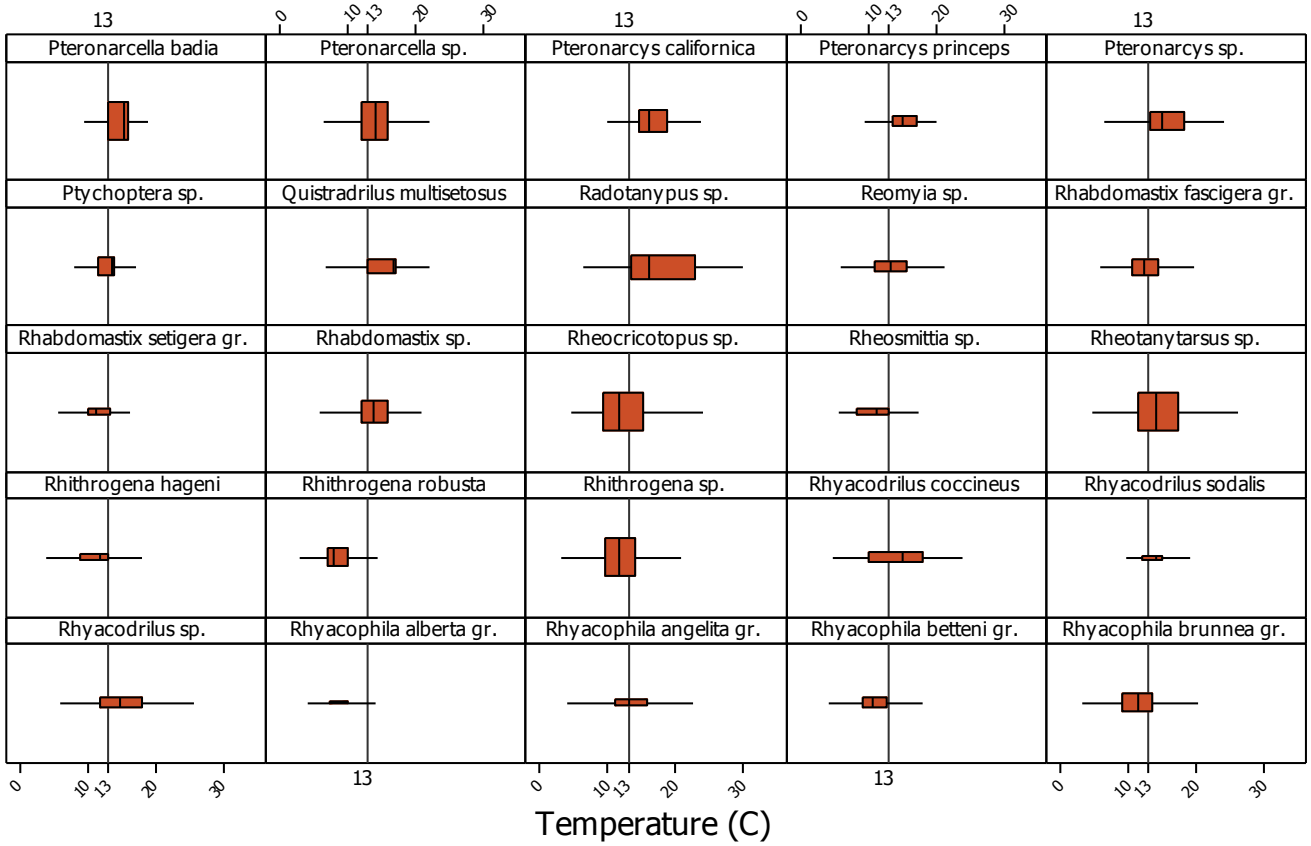


Figure 35. Vertical box and whisker interval plots of temperatures values for *Pteronarcella badia* to *Rhyacophila brunnea* gr. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C, which is the mean of the temperature records.

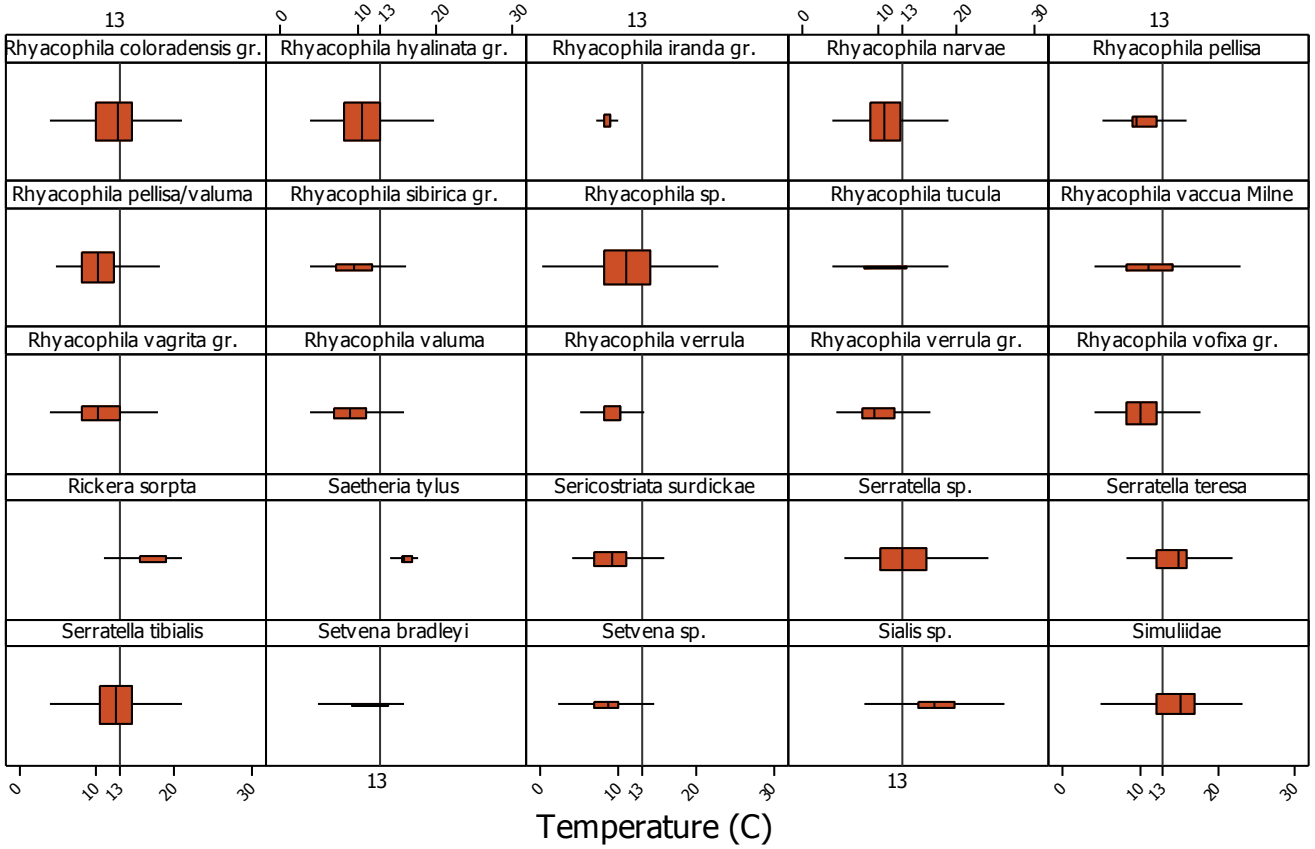


Figure 36. Vertical box and whisker interval plots of temperatures values for *Rhyacophila coloradensis* gr. to Simulidae. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^0 C, which is the mean of the temperature records.

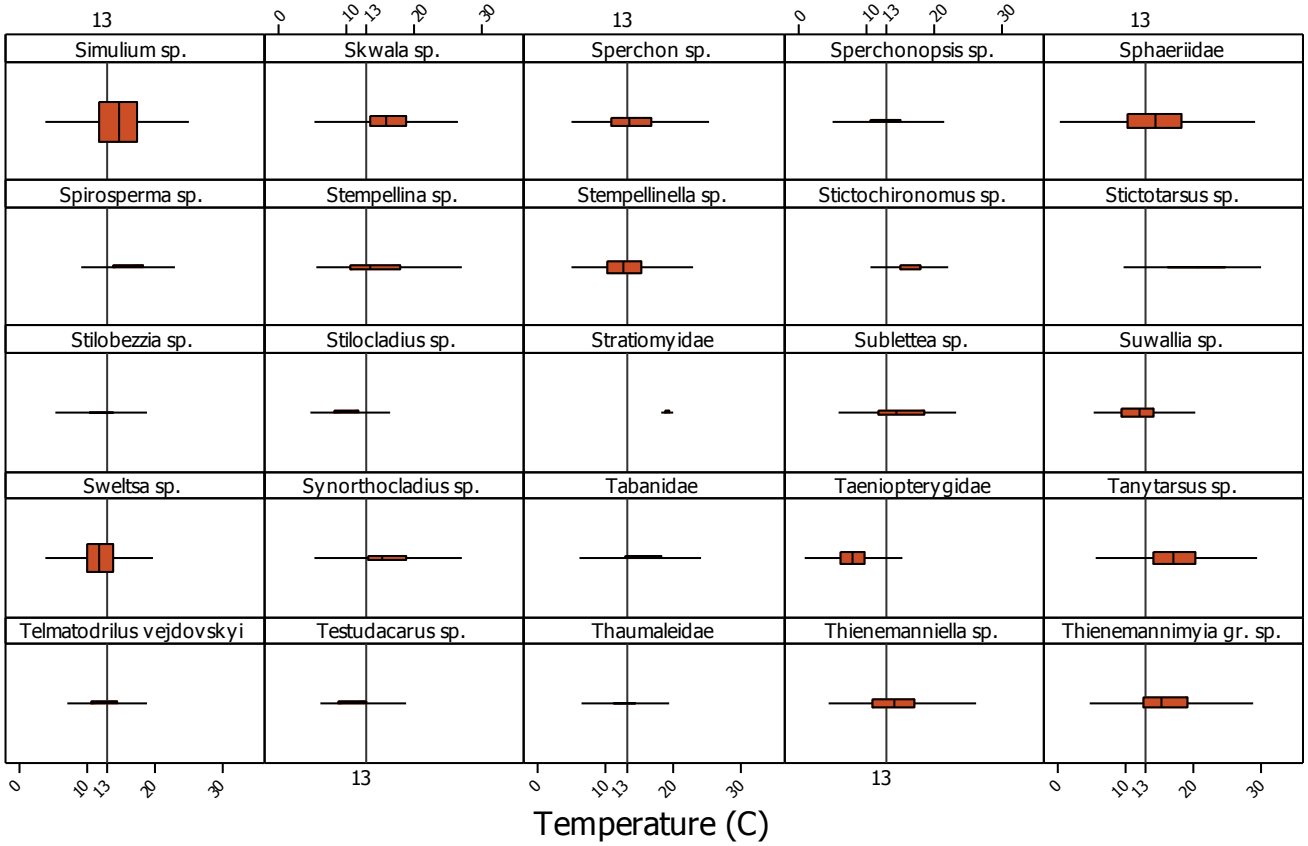


Figure 37. Vertical box and whisker interval plots of temperatures values for *Simulium* sp. to *Thienemannimyia* gr. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C, which is the mean of the temperature records.

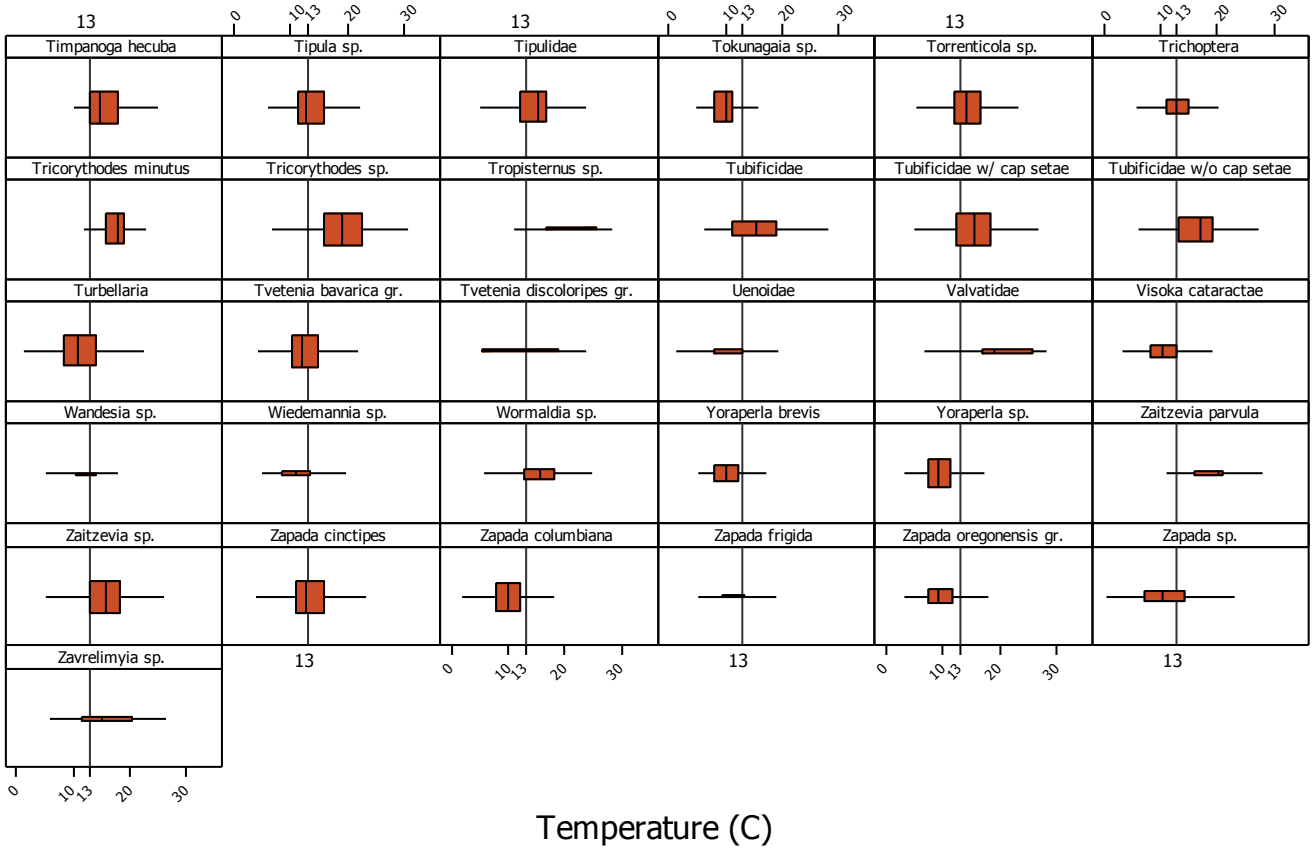


Figure 38. Vertical box and whisker interval plots of temperatures values for *Timpanoga hecuba* to *Zavrelimyia* sp. Vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where Lower Limit = Q1 – 1.5 (Q3 – Q1); Upper Limit = Q3 + 1.5 (Q3 – Q1). Length of boxes (left to right) illustrates the spread of temperature values that a taxon was found. Width of boxes (up to down) is the relative sample size. Vertical solid line is 13^{0} C; the mean of the temperature records.

Temperature occurrence ranges for all taxa were grouped into three categories: 1) taxa whose 1st through 3rd quartiles were left of the 13^0 C ; 2) taxa whose 1st through 3rd quartiles were to the right of 13^0 C and 3) taxa whose 1st through 3rd quartile ranges spanned 13^0 C (Figures 21-38). Taxa with 1st through 3rd quartiles < 13^0 C (Case 1) are considered first round selections for cold-water taxa (Table 2). All of these first round cold- water taxa also had 95th quartiles < 20^0 C. Taxa with 1st through 3rd quartiles $\geq$ 13^0 C (Case 2) are considered first round selections for warm-water taxa (Table 2). Taxa with 1st to 3rd quartiles that spanned 13^0 C may have had true temperature occurrence ranges near 13^0 C, but their ranges could also have been clouded by sampling bias and these taxa are considered poor indicators of cold or warm-water habitats, pending further analyses.

Table 3. Taxa with 1st to 3rd quartiles < 13^0 C (first round cold-water taxa)and taxa with 1st to 3rd quartiles $\geq$ 13^0 C (first round warm-water taxa).

1st to 3rd quartiles < 13^0 C	**1st to 3rd quartiles > 13^0 C**	
Ameletus similior	*Ablabesmyia* sp.	Aeshnidae
Anagapetus sp.	*Agabus* sp.	*Agapetus* sp.
Annelida	*Antocha monticola*	*Apedilum* sp.
Baetis bicaudatus	*Argia* sp.	*Attenella margarita*
Bryelmis idahoensis	*Attenella* sp.	*Aulodrilus pluriseta*
Caudatella hystrix	*Aulodrilus* sp.	*Baetis notos*
Cinygmula sp.	*Blepharicera* sp.	*Brachycentridae*
Cryptochia sp.	*Brachycentrus occidentalis*	*Brychius* sp.
Despaxia augusta	*Caenis* sp.	*Calineuria californica*
Drunella coloradensis	*Calineuria* sp.	*Callibaetis* sp.
Enchytraeidae	*Cardiocladius albiplumus*	*Cardiocladius* sp.
Epeorus deceptivus	*Centroptilum* sp.	*Cheumatopsyche* sp.
Epeorus grandis	*Chimarra* sp.	*Chironomini*
Epeorus sp.	*Chironomus* sp.	*Coenagrionidae*
Ephemerellidae	Corixidae	*Cricotopus (Isocladius)* Type I
Eukiefferiella tirolensis	*Cricotopus bicinctus* gr.	*Cricotopus* sp.
Haplotaxis sp.	*Cricotopus trifascia* gr.	*Cryptochironomus* sp.
Hydrobaenus sp.	*Cryptolabis* sp.	*Demicryptochironomus* sp.
Hydryphantidae	*Dero* sp.	*Dicosmoecus gilvipes*
Krenopelopia sp.	*Dicrotendipes* sp.	*Dubiraphia* sp.
Krenosmittia sp.	Dytiscidae	*Ecdyonurus* sp.
Leuctridae	*Ephemerella aurivillii*	*Erpobdellidae*
Neothremma alicia	*Erpobdellidae*	*Eukiefferiella brevicalcar Type I*
Neothremma sp.	*Fallceon quilleri*	*Ferrissia* sp.

1st to 3rd quartiles < 13^0 C	1st to 3rd quartiles > 13^0 C	
Oligophlebodes sp.	*Fluminicola* sp.	*Fossaria* sp.
Oreogeton sp.	*Gammarus* sp.	*Glossiphonia complanata*
Paraleuctra sp.	Gomphidae	*Gyraulus* sp.
Paraperla sp.	*Haliplus* sp.	*Helichus* sp.
Paraphaenocladius "n. sp."	*Helicopsyche* sp.	*Helobdella stagnalis*
Parapsyche elsis	*Helophorus* sp.	*Hemerodromia* sp.
Parapsyche sp.	*Heptagenia* sp.	*Heterotrissocladius marcidus gr.*
Parorthocladius sp.	*Hyalella* sp.	*Hydra* sp.
Polycelis coronata	Hydrobiidae	Hydrophilidae
Polycelis sp.	*Hydroporinae*	*Hydropsyche* sp.
Pseudodiamesa sp.	*Hydropsychinae*	*Hydroptila* sp.
Psychodidae	Hydroptilidae	*Laccobius* sp.
Rhithrogena robusta	Leptoceridae	*Leucotrichia* sp.
Rhyacophila alberta gr.	*Limnodrilus hoffmeisteri*	*Lopescladius* sp.
Rhyacophila betteni gr.	Lymnaeidae	*Microcylloepus* sp.
Rhyacophila iranda gr.	*Microtendipes pedellus gr.*	*Nais* sp.
Rhyacophila narvae	*Nais variabilis*	*Nanocladius* sp.
Rhyacophila pellisa	*Neotrichia* sp.	*Nilotanypus* sp.
Rhyacophila pellisa/valuma	*Oecetis avara*	*Oecetis* sp.
Rhyacophila sibirica gr.	*Ophidonais serpentina*	*Ophiogomphus* sp.
Rhyacophila valuma	*Ordobrevia nubifera*	*Ordobrevia* sp.
Rhyacophila verrula	*Oxyethira* sp.	*Pacifastacus* sp.
Rhyacophila verrula gr.	*Paraleptophlebia bicornuta*	*Paraleptophlebia debilis*
Rhyacophila vofixa gr.	*Paratanytarsus* sp.	*Paratendipes* sp.
Sericostriata surdickae	*Pentaneura* sp.	*Petrophila* sp.
Setvena sp.	*Phaenopsectra* sp.	*Physa (Physella)* sp.
Stilocladius sp.	*Physa* sp.	Physidae
Taeniopterygidae	Planorbidae	*Potamopyrgus antipodarum*
Testudacarus sp.	*Pristina* sp.	*Probezzia* sp.
Tokunagaia sp.	*Prodiamesa* sp.	*Protoptila* sp.
Visoka cataractae	*Psectrocladius* sp.	*Psephenus* sp.
Yoraperla brevis	*Pseudochironomus* sp.	*Pteronarcys californica*
Yoraperla sp.	*Pteronarcys princeps*	*Radotanypus* sp.
Zapada columbiana	*Saetheria tylus*	*Sialis* sp.
Zapada oregonensis gr.	*Skwala* sp.	*Spirosperma* sp.
	Stictochironomus sp.	*Stictotarsus* sp.
	Stratiomyidae	*Synorthocladius* sp.
	Tanytarsus sp.	*Tricorythodes minutus*
	Tricorythodes sp.	Valvatidae
	Zaitzevia parvula	

Discussion

Many taxa listed in this report are useful obligate cold- water indicators and results of this analysis are consistent with known temperature tolerance ranges for these taxa. Many warm-water taxa also were identified. However, it is less clear which taxa can be used as seasonal cold- water indicators and further analysis and refinement of seasonal cold-water indicator criteria is needed.

Instantaneous vs. Continuous Temperature Readings

An important concern regarding the results from this analysis is that temperatures were recorded as instantaneous and not continuous. Analyses based on instantaneous values have inherent problems, first and foremost of which is that water temperatures frequently vary hourly, daily and weekly; particularly in non-spring fed systems. Instantaneous temperatures can vary by several degrees, depending on time of day and therefore, are dependent on when the temperature was recorded. Temperatures that exceed criteria values obviously can be missed using instantaneous readings if they weren't collected at peak hours (usually mid to late afternoon). Also, unseasonable local weather conditions can cause daily or weekly changes in temperatures. Taxa distributions and abundances typically do not respond rapidly to these short- duration, unseasonable temperature conditions. However, given enough samples (i.e. this data set) the effects of using instantaneous temperature readings instead of continuous readings in this analysis were somewhat dampened. Although instantaneous temperature readings have value and provided useful information; continuous recordings are preferred and are highly recommended.

Other Environmental Variables and Macroinvertebrate Distribution and Abundance

It is well known that in addition to water temperature, other environmental and biotic variables affect macroinvertebrate taxa abundances and distribution including: pH, nutrients, food resources, interspecific competition, flow, substrate, canopy, stream size (order), region, etc. Many of these variables change in a predictable manner from headwaters to valleys, as do the macroinvertebrate assemblages associated with these changes (i.e. River Continuum Concept).

Environmental and biotic variables can also have interactive effects on macroinvertebrate abundances and distributions. For example, all of the snail taxa analyzed in this report were associated with warmer water. However, water chemistry, velocity, and food types could have contributed more to their distribution and abundance than temperature alone. To further illustrate, New Zealand Mudsnails (*Potamopyrgus antipodarum*) mostly occurred in warmer waters in this analysis (mean temperature occurrence = 19.0^0 C). These snails are highly abundant in the Colorado River downstream of Glen Canyon Dam, where temperatures are consistently a cold, 9.0^0 C year round. Other environmental variables can clearly affect New Zealand mudsnail distribution and abundance, including food resources, water chemistry, and flow conditions. No environmental co-variables were included in this analysis, therefore some taxa may have been absent for reasons other than temperature and if they happen to be found in future surveys in cold water habitats it won't necessarily indicate that temperatures are warm or cold- water impaired.

A more intensive analysis that examines potential co-variables needs to be conducted to more accurately assess the effects of temperature on macroinvertebrates. These co-variables can then be accounted for and a much improved, ecologically valid, list of obligate cold-water or seasonal cold-water taxa can be generated.

Sampling bias

The database used in this analysis is a highly valuable resource, mostly because of its very large number of records collected over a long time period, stream types, conditions, and locations. Additional statistical analyses of this database to mitigate the sample bias problem of truncated mid-range temperature data are encouraged. New ECDFs can be generated from a fixed sampling strategy using temperature categories (bins). In this scenario, the maximum number of samples randomly selected from each temperature will be based on the temperature group with the fewest number of samples. The alternative to this statistical analysis is to physically collect more samples at higher temperatures. However, both methods need to be used; the latter to verify the former.

Monthly Temperature Effects

Temperature values from samples collected in September could have skewed results to more cold water occurrence estimates. September temperatures were the lowest of the four summer months, including June, and September temperatures were significantly lower than July temperatures (Figure 39).

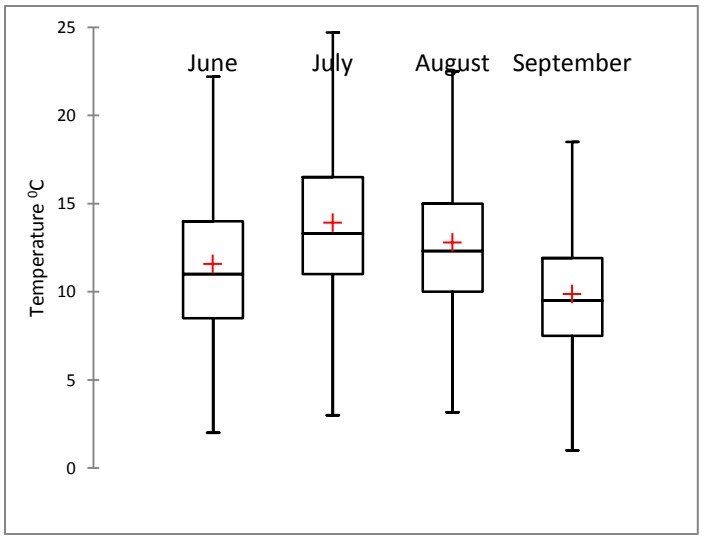


Figure 39. Temperature records by month. Cross in box = mean; vertical line in box = median; boxes = 25th and 75th quartiles (Q1 and Q3); and whiskers = general extent of the data (where lower limit = Q1 – 1.5 (Q3 – Q1); upper limit = Q3 + 1.5 (Q3 – Q1). September temperatures were significantly lower than July temperatures (ANOVA: F = 5758.07, p-value < 0.01, Tukey's HSD: p-value < 0.01).

Follow- up analyses should be conducted with September samples removed and then compared with results from this analysis that included September samples. If sample size is a concern using July and August samples only, then June samples could be included because June temperatures were more similar to, and not significantly different than, July or August temperatures.

Additional Discussion

Taxonomic resolution

Species within a genus or family often had different temperature occurrences, but not always. Many genera in Idaho only have one or two species and a genus (or family) level taxonomic

identification may be suitable. The lists presented here need to be more closely examined and discussed with expert macroinvertebrate taxonomist and ecologists to determine which level of taxonomic identification is adequate and representative of temperature occurrence values.

Plasticity and adaptation

In general, macroinvertebrate taxa are more plastic and adaptable to slight, gradual changes in environmental conditions compared with larger, longer- lived, taxa. Their shorter generation times and large numbers may allow for genetic modification and adaptability to changes in temperature due to global climate change, if temperatures do not change faster than they are able to adapt. Further analysis of this important and valuable IDEQ database may find increasing temperature occurrence trends for some taxa or losses and decreased abundance of some taxa that were unable to adapt in direct relation to increasing temperatures.

References

Arismendi, I., S. L. Johnson, J. B. Dunham, and R. Haggerty. 2013. Descriptors of natural thermal regimes in streams and their responsiveness to change in the Pacific Northwest of North America. Freshwater Biology. Vol.58 (5): 880-894.

Brandt, D.H. 2001. *Temperature Preferences and Tolerances for 137 Common Idaho Macroinvertebrate Taxa*. Idaho Department of Environmental Quality, Coeur d'Alene, ID. 56 pp.

DEQ, 2002. *Idaho Water Body Assessment Guidance (2nd Edition).* Idaho Department of Environmental Quality. Boise, Idaho. 232 pp.

DEQ, 2013. *Beneficial Use Reconnaissance Program Field Manual*. Idaho Department of Environmental Quality. Boise, Idaho. 161 pp.

Lester, G., and C. Robinson. 2000. Literature review of life histories for Idaho macroinvertebrate taxa. Electronic database. Prepared by EcoAnalysts, Inc. Moscow, Idaho for the Idaho Department of Environmental Quality, Boise, ID.

Maret, T.R., D.E. MacCoy, K.D.Skinner, S.E. Moore, and I. O'Dell. 2001. *Evaluation of macroinvertebrate assemblages in Idaho rivers using multimetric and multivariate*

techniques, 1996-1998. U. S. Geological Survey, Water Resources Investigations Report 01-4145, Boise Idaho.

O'Dell, I., T. R. Maret, S.E. Moore. 1998. *Changes to Idaho's statewide surface-water quality monitoring program since 1995*. Boise Idaho, Water Resources Division, U.S. Geological Survey. 4 pp.

Vannote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell, C.E. Cushing. 1980. Canadian Journal of Fisheries and Aquatic Sciences. Vol. 37 (1): 130-137.

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Appendices

Appendix 1. Descriptive statistics of 453 taxa in relation to water temperature. All statistics, other than N, are temperatures in ^{0}C. Taxa highlighted in yellow are the first round cold water taxa from Table 3.

											95% CIs		Percentiles		
Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Ablabesmyia sp.	49	10.59	30.60	20.01	16.90	19.20	23.80	19.87	4.39	0.63	18.60	21.14	13	24.3	25.4
Acari	2372	1.00	30.60	29.60	11.00	13.50	16.80	13.92	4.19	0.09	13.75	14.09	7.5	19.2	21
Acentrella insignificans	198	6.00	28.00	22.00	13.00	15.10	18.00	15.25	3.64	0.26	14.74	15.76	9.1	19.1	21
Acentrella sp.	110	5.40	27.00	21.60	13.00	14.50	17.20	15.21	3.51	0.34	14.55	15.88	11	20	21
Acentrella turbida	289	6.20	26.00	19.80	12.40	14.70	17.70	15.02	3.80	0.22	14.58	15.46	8.91	19.7	21.8
Aeshnidae	21	11.44	29.00	17.56	15.19	17.10	18.80	17.39	3.76	0.84	15.63	19.14	11.7	22	23.8
Agabus sp.	107	7.00	27.00	20.00	14.20	16.20	18.60	16.38	3.32	0.32	15.75	17.02	11	21	22.4
Agapetus sp.	310	0.00	26.70	26.70	13.50	16.00	18.00	16.12	3.59	0.20	15.72	16.52	11	21.4	22
Ameletus similior	60	5.00	19.00	14.00	9.00	9.00	12.00	10.45	2.89	0.38	9.70	11.21	6	14	17
Ameletus sp.	1207	2.00	24.00	22.00	10.00	12.00	14.20	12.16	3.33	0.10	11.97	12.35	7	16	18
Ametor sp.	41	6.70	21.00	14.30	10.90	11.55	13.60	12.52	3.01	0.48	11.56	13.48	9.1	16.6	21
Amiocentrus aspilus	307	4.70	25.30	20.60	11.50	13.10	15.50	13.87	3.48	0.20	13.48	14.26	8.6	19.3	22
Amiocentrus sp.	28	8.00	22.00	14.00	13.20	15.80	17.40	14.91	3.50	0.67	13.53	16.29	9	18.95	19
Amphinemura sp.	193	4.00	26.00	22.00	9.00	12.00	14.20	12.15	3.34	0.24	11.68	12.63	7	17	18
Anagapetus sp.	183	5.00	26.00	21.00	8.10	9.90	12.60	10.17	2.77	0.21	9.77	10.58	6.6	13.2	15
Annelida	76	1.00	26.50	25.50	4.00	7.00	9.00	6.85	4.01	0.46	5.93	7.77	1	13	15
Antocha monticola	28	8.50	28.00	19.50	15.00	16.00	18.50	17.08	3.42	0.66	15.73	18.43	11.5	24	24
Antocha sp.	1374	0.00	34.20	34.20	11.70	14.00	17.00	14.34	4.03	0.11	14.12	14.55	8	19.6	21.6
Apatania sp.	489	3.15	23.70	20.55	10.00	12.00	14.00	12.13	3.16	0.14	11.85	12.41	7.7	16.7	18.1
Apedilum sp.	48	7.70	30.60	22.90	24.60	24.70	24.70	23.20	3.98	0.58	22.03	24.37	14.6	24.7	27.8
Arctopsyche grandis	836	4.70	25.60	20.90	11.00	13.30	15.60	13.46	3.54	0.12	13.22	13.70	7.5	18	19.6
Arctopsyche sp.	37	5.50	21.00	15.50	12.00	15.00	16.00	13.69	3.24	0.54	12.60	14.78	7	16	16
Arctopsychinae	282	4.00	24.00	20.00	9.80	12.00	14.00	12.01	3.41	0.20	11.61	12.41	6	16.3	17

											95% CIs		Percentiles		
Taxon	**N**	**Min**	**Max**	**Rng**	**1st Q**	**Med**	**3rd Q**	**Mean**	**St.Dev**	**S.E.**	**Lower**	**Upper**	**5th**	**90th**	**95th**
Argia sp.	113	7.00	29.00	22.00	17.00	19.00	22.00	19.18	4.07	0.38	18.41	19.94	12.4	24.8	25.3
Atherix sp.	343	4.00	28.00	24.00	12.70	15.60	18.50	15.55	4.18	0.23	15.11	16.00	8.9	21	22.3
Atractides sp.	471	4.70	34.20	29.50	12.00	15.10	18.30	15.29	4.40	0.20	14.89	15.69	8.5	22.27	22.4
Atrichopogon sp.	37	9.30	24.70	15.40	12.50	14.90	16.70	14.73	3.44	0.57	13.56	15.89	10.3	17.9	20.9
Attenella margarita	156	0.00	28.00	28.00	13.60	16.40	20.05	17.10	5.10	0.41	16.29	17.91	11.3	24	26.5
Attenella sp.	57	6.50	24.00	17.50	13.20	15.50	19.00	15.84	4.92	0.66	14.52	17.16	6.5	24	24
Aulodrilus pluriseta	23	9.78	24.70	14.92	16.20	17.85	20.35	18.12	3.73	0.79	16.48	19.77	10.9	24.6	24.7
Aulodrilus sp.	25	4.94	25.70	20.76	17.00	17.70	22.30	18.22	4.94	1.01	16.14	20.30	9.78	25.7	25.7
Baetidae	98	6.00	26.38	20.38	12.00	13.00	17.00	14.45	4.17	0.42	13.61	15.29	8	22	22
Baetis alius	146	7.10	21.90	14.80	11.40	13.90	18.00	14.80	4.01	0.33	14.14	15.46	9.3	21.2	21.9
Baetis bicaudatus	1009	0.00	24.00	24.00	7.10	9.00	11.00	9.13	2.82	0.09	8.96	9.31	5	13	14
Baetis flavistriga	152	5.50	23.00	17.50	12.00	14.05	16.87	14.60	3.66	0.30	14.01	15.19	10	20.5	21.53
Baetis notos	50	10.00	26.00	16.00	17.00	19.00	22.40	19.25	3.76	0.54	18.17	20.33	12	24.8	26
Baetis sp.	461	0.00	28.40	28.40	10.00	12.00	16.00	13.02	4.69	0.22	12.59	13.45	7	20.7	23
Baetis tricaudatus	3678	1.00	34.20	33.20	11.00	13.50	16.00	13.80	3.74	0.06	13.68	13.92	8.1	18.7	20.1
Bezzia/Palpomyia sp.	1233	4.00	30.60	26.60	10.20	12.50	15.50	13.18	4.35	0.12	12.94	13.43	7	19.1	22
Blepharicera sp.	54	9.80	23.40	13.60	13.80	15.80	20.20	16.51	3.44	0.47	15.56	17.46	12.3	22.7	22.7
Blephariceridae	77	5.36	21.90	16.54	10.00	14.00	17.00	13.62	3.68	0.42	12.78	14.46	7.5	17.8	18.6
Brachycentridae	50	4.00	21.10	17.10	16.50	20.00	20.00	17.90	2.98	0.43	17.04	18.75	12	20	20
Brachycentrus americanus	861	4.70	26.70	22.00	10.00	12.50	16.00	13.11	3.95	0.13	12.84	13.37	7	18.5	19.3
Brachycentrus occidentalis	215	6.90	34.20	27.30	14.00	18.00	21.00	17.81	4.47	0.31	17.21	18.41	11	23	24.7
Brachycentrus sp.	151	5.30	29.00	23.70	11.80	14.00	18.50	14.81	4.88	0.40	14.03	15.60	6.9	23	23
Brillia sp.	987	4.30	24.00	19.70	10.00	12.00	14.40	12.24	3.23	0.10	12.03	12.44	7.3	16.5	17.8
Brundiniella sp.	38	8.70	21.40	12.70	11.60	13.00	14.00	13.09	2.25	0.37	12.34	13.84	10.3	15.45	17.3
Brychius sp.	135	0.00	28.00	28.00	15.00	17.30	21.10	18.23	4.47	0.39	17.47	19.00	11.5	25	25.5
Bryelmis idahoensis	55	5.30	18.90	13.60	9.40	10.20	11.50	10.39	1.91	0.26	9.87	10.91	7	13	14
Caenis sp.	46	11.80	30.60	18.80	18.50	21.40	22.00	20.85	3.57	0.53	19.78	21.92	17	24	30.6

											95% CIs		Percentiles		
Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Calineuria californica	249	5.50	28.00	22.50	14.50	16.70	19.90	17.04	3.90	0.25	16.55	17.53	11	22.1	23.1
Calineuria sp.	47	7.00	23.00	16.00	15.00	18.00	19.50	17.02	3.35	0.49	16.03	18.02	11	20.5	22
Callibaetis sp.	47	11.00	30.00	19.00	18.00	23.00	23.00	20.50	3.36	0.50	19.50	21.49	14	23	24.6
Caloparyphus sp.	57	7.70	25.60	17.90	13.00	15.40	19.00	16.10	4.69	0.63	14.84	17.35	10	25.6	25.6
Capniidae	655	1.00	28.40	27.40	8.70	11.10	14.00	11.48	4.04	0.16	11.17	11.79	5.3	17	19.1
Cardiocladius albiplumus	22	12.60	24.00	11.40	13.80	15.80	21.70	17.36	3.86	0.84	15.61	19.11	12.6	22.9	24
Cardiocladius sp.	213	5.00	27.60	22.60	15.42	18.00	19.20	17.45	3.48	0.24	16.98	17.92	11	22	23.1
Caudatella edmundsi	77	4.60	20.40	15.80	10.00	11.50	14.00	11.78	2.55	0.29	11.20	12.37	8.2	15.6	15.6
Caudatella heterocaudata	63	8.00	21.40	13.40	9.78	12.70	15.00	12.60	3.27	0.41	11.77	13.43	8	17	18
Caudatella hystrix	363	4.60	21.70	17.10	8.60	10.20	12.20	10.54	2.86	0.15	10.25	10.84	6.4	14.6	16
Caudatella sp.	693	4.00	28.00	24.00	9.50	12.00	13.90	11.78	3.12	0.12	11.54	12.01	6.8	16	16.8
Centroptilum sp.	193	7.00	31.00	24.00	13.60	15.20	18.10	16.20	4.04	0.29	15.63	16.78	10.4	23.075	24.3
Ceratopogonidae	238	1.00	29.00	28.00	8.00	12.00	15.00	12.09	4.69	0.30	11.49	12.69	5.5	18	20
Ceratopogoninae	489	4.00	29.30	25.30	11.00	14.00	17.20	14.52	5.05	0.23	14.07	14.97	8	20.3	24.7
Chaetocladius sp.	149	4.94	25.60	20.66	10.60	12.70	13.90	12.50	2.83	0.23	12.04	12.96	7.7	16.9	17.3
Chelifera sp.	940	0.00	34.20	34.20	9.30	12.00	15.00	12.33	3.93	0.13	12.08	12.58	6.9	17.6	19
Cheumatopsyche sp.	308	5.50	29.00	23.50	16.30	19.00	20.00	18.67	3.62	0.21	18.26	19.07	12.1	23	26
Chimarra sp.	44	11.90	29.30	17.40	19.60	22.30	23.30	21.75	3.64	0.55	20.63	22.87	15.9	24.9	29.3
Chironomidae	1395	0.00	29.00	29.00	11.00	14.00	17.00	13.83	4.58	0.12	13.59	14.07	7	20	22
Chironomini	78	6.70	29.30	22.60	14.70	19.20	19.20	17.00	3.84	0.44	16.13	17.87	8.8	19.2	21
Chironomus sp.	39	11.00	25.70	14.70	16.50	20.00	21.00	19.22	2.50	0.41	18.40	20.04	15.19	21	21
Chloroperlidae	933	3.00	28.00	25.00	9.00	11.30	14.10	11.88	3.99	0.13	11.63	12.14	6	17	19
Cinygma sp.	184	5.00	21.30	16.30	10.50	12.10	14.00	12.21	2.67	0.20	11.83	12.60	8	16	16
Cinygmula sp.	2807	0.00	29.00	29.00	8.30	10.50	12.80	10.72	3.17	0.06	10.60	10.83	6	14.8	16
Claassenia sabulosa	105	4.90	24.00	19.10	12.00	13.80	17.60	14.76	3.80	0.37	14.03	15.50	10.9	20.8	21.6
Cladotanytarsus sp.	432	4.70	26.70	22.00	11.70	14.90	17.70	14.96	4.55	0.22	14.53	15.39	7.6	21.4	24
Cleptelmis addenda	1077	4.60	34.20	29.60	11.00	13.30	15.50	13.41	3.50	0.11	13.20	13.62	8.3	18	19.5
Clinocera sp.	367	2.00	30.00	28.00	8.00	10.55	13.00	11.18	3.91	0.20	10.78	11.59	6.3	16.5	17.7

Coenagrionidae	74	6.60	30.60	24.00	15.60	18.60	22.00	19.39	5.47	0.64	18.11	20.66	11.6	29	30
											95% CIs		Percentiles		
Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Corixidae	119	10.87	30.00	19.13	15.60	18.40	20.40	18.63	3.27	0.30	18.03	19.22	14	24	24.3
Corynoneura sp.	861	4.30	30.00	25.70	11.10	14.30	17.40	14.75	4.69	0.16	14.43	15.06	8	21	23
Cricotopus (Isocladius) Type I	64	9.80	26.70	16.90	18.00	20.00	23.20	20.26	3.41	0.43	19.40	21.12	12.6	24	24.7
Cricotopus (Nostoc.) nostocicola	825	4.40	29.00	24.60	9.70	12.60	15.30	12.90	4.29	0.15	12.60	13.19	6.5	18.6	21.2
Cricotopus bicinctus gr.	371	6.40	30.60	24.20	14.00	17.00	21.10	17.55	4.78	0.25	17.06	18.04	9.4	24	25.5
Cricotopus sp.	1151	4.70	34.20	29.50	13.40	16.30	19.00	16.32	4.32	0.13	16.07	16.57	9.5	22.9	24
Cricotopus trifascia gr.	197	6.70	30.60	23.90	13.50	17.10	19.70	17.38	3.87	0.28	16.83	17.92	12.5	23.1	24
Cryptochia sp.	36	5.00	16.00	11.00	8.00	9.90	11.45	9.73	2.33	0.39	8.93	10.52	5.4	13	13.5
Cryptochironomus sp.	90	7.70	30.00	22.30	17.00	20.00	21.60	19.62	3.88	0.41	18.81	20.44	13	25.4	25.4
Cryptolabis sp.	59	5.00	26.38	21.38	14.30	16.90	18.50	16.30	3.13	0.41	15.47	17.12	11.7	21.1	21.2
Cultus sp.	157	4.60	21.40	16.80	10.40	13.00	14.80	12.50	3.39	0.27	11.96	13.04	6.6	16.5	17.7
Curculionidae	37	6.00	25.00	19.00	9.00	12.00	14.00	12.45	4.57	0.76	10.90	13.99	7	20	21.6
Demicryptochironomus sp.	22	8.20	23.70	15.50	13.30	16.20	17.30	16.01	3.72	0.81	14.33	17.70	8.2	21.1	23.1
Dero sp.	21	5.50	26.80	21.30	18.60	19.10	25.70	20.74	4.15	0.93	18.81	22.68	13.2	25.7	25.7
Despaxia augusta	159	3.00	17.70	14.70	8.00	10.00	12.00	9.83	2.94	0.23	9.37	10.29	5	14	15
Deuterophlebia sp.	79	2.00	23.00	21.00	8.91	12.10	15.00	12.43	3.56	0.40	11.63	13.24	8.91	17.6	18.6
Diamesa sp.	608	4.60	34.20	29.60	7.60	10.30	13.50	10.91	3.63	0.15	10.62	11.20	6	16	17.2
Dicosmoecus atripes	72	6.10	21.80	15.70	11.50	14.00	18.00	15.05	4.15	0.49	14.07	16.03	9	21.8	21.8
Dicosmoecus gilvipes	94	3.15	28.00	24.85	13.30	16.30	21.20	17.04	4.77	0.49	16.05	18.02	9.5	24.2	24.2
Dicosmoecus sp.	48	7.00	21.10	14.10	12.00	15.00	19.50	15.28	4.31	0.63	14.01	16.54	8	19.5	20
Dicranota sp.	1292	0.00	34.20	34.20	10.90	14.00	17.00	13.79	4.35	0.12	13.55	14.03	6.9	19.5	22
Dicrotendipes sp.	64	7.70	30.00	22.30	18.00	19.94	21.60	19.55	3.11	0.39	18.76	20.33	13	23.2	23.2
Diphetor hageni	1572	5.60	31.00	25.40	12.50	15.30	18.30	15.51	4.07	0.10	15.31	15.71	9.5	20.8	22.9
Diplocladius sp.	35	5.00	23.30	18.30	11.00	11.00	22.50	14.32	5.43	0.93	12.43	16.22	8.8	22.5	22.5
Diptera	96	5.00	27.80	22.80	11.00	14.00	16.00	14.00	3.63	0.37	13.26	14.74	8	18	19
Dixa sp.	212	5.60	25.60	20.00	10.60	13.40	17.00	13.97	4.09	0.28	13.42	14.53	8	19.7	20
Dolichopodidae	24	8.70	26.00	17.30	12.30	14.55	16.60	15.19	3.14	0.65	13.84	16.55	12.3	19	19.7
Dolophilodes sp.	771	0.00	27.80	27.80	10.10	11.60	13.90	11.91	2.95	0.11	11.71	12.12	7.1	16	17.1

Doroneuria sp.	1069	3.00	23.40	20.40	10.00	11.60	13.70	11.82	3.08	0.09	11.63	12.00	7	16	17.8
											95% CIs		Percentiles		
Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Drunella coloradensis	292	2.00	22.00	20.00	8.00	9.00	12.00	9.96	2.74	0.16	9.64	10.27	6	13	15
Drunella coloradensis/flavilinea	1401	0.00	24.00	24.00	8.90	11.00	13.00	11.10	3.06	0.08	10.94	11.26	6.5	15.3	16.6
Drunella doddsi	2472	1.00	28.00	27.00	9.70	11.50	13.40	11.65	3.05	0.06	11.53	11.77	7	15.4	17.2
Drunella flavilinea	25	7.00	21.00	14.00	11.00	13.00	14.00	13.20	3.34	0.68	11.79	14.61	9	20	21
Drunella grandis	799	4.90	28.00	23.10	11.00	13.30	16.00	13.71	3.61	0.13	13.46	13.96	8.5	18.8	20.8
Drunella sp.	134	6.00	29.00	23.00	11.00	13.10	16.00	13.48	3.63	0.31	12.86	14.10	7.5	17.7	19
Drunella spinifera	895	1.00	23.00	22.00	9.50	11.30	13.10	11.36	2.87	0.10	11.17	11.55	7	14.7	16
Drunella spinifera/grandis	113	5.00	25.00	20.00	10.00	13.00	16.50	12.73	3.35	0.32	12.10	13.35	7	16.5	16.5
Dubiraphia sp.	98	7.20	30.60	23.40	17.00	19.10	20.70	18.76	3.55	0.36	18.05	19.48	13.2	23	24
Dytiscidae	256	0.00	27.00	27.00	14.00	17.00	20.00	17.18	4.68	0.29	16.60	17.75	10.5	24	25.5
Ecclisomyia sp.	63	5.00	21.00	16.00	10.30	12.50	14.00	11.89	2.67	0.34	11.21	12.57	8.3	14.5	15.3
Ecdyonurus sp.	465	5.00	28.00	23.00	14.10	16.50	19.20	16.88	3.92	0.18	16.52	17.23	11	22.4	24
Eclipidrilus sp.	232	5.40	25.60	20.20	9.80	12.40	15.60	13.03	4.54	0.30	12.44	13.62	7.4	20	22.5
Elmidae	185	4.00	26.50	22.50	9.00	11.40	14.00	11.90	3.58	0.26	11.38	12.42	7	16	20
Empididae	365	4.60	29.30	24.70	9.60	13.00	15.80	13.11	4.15	0.22	12.68	13.53	7	19	19.9
Enchytraeidae	2267	4.30	29.30	25.00	8.50	10.60	12.90	10.96	3.37	0.07	10.82	11.10	6	15.2	17
Epeorus albertae	536	1.00	28.00	27.00	11.30	15.50	19.00	15.07	5.04	0.22	14.64	15.50	6	21	23
Epeorus deceptivus	1017	3.00	22.40	19.40	9.00	10.50	12.20	10.62	2.65	0.08	10.45	10.78	6.4	14	15
Epeorus grandis	1125	4.00	24.00	20.00	8.70	10.30	12.00	10.52	2.61	0.08	10.37	10.67	6.5	14	15
Epeorus iron	38	6.50	21.00	14.50	8.00	9.50	13.00	10.85	3.38	0.56	9.72	11.97	8	16	18
Epeorus longimanus	1395	4.00	29.00	25.00	10.50	12.28	14.50	12.61	2.97	0.08	12.45	12.77	8	17	17.6
Epeorus sp.	604	1.00	29.30	28.30	7.50	9.10	12.00	9.73	3.39	0.14	9.46	10.00	5	14	15.1
Ephemerella aurivillii	30	6.50	16.90	10.40	13.50	14.00	15.50	14.04	1.83	0.34	13.34	14.73	10.5	15.5	16
Ephemerella dorothea	38	7.00	26.00	19.00	11.00	15.00	16.00	13.65	3.27	0.54	12.56	14.74	9	16	18
Ephemerella dorothea/excrucians	588	4.70	34.20	29.50	10.00	11.70	14.20	12.24	3.78	0.16	11.93	12.55	6.4	17.7	19.6
Ephemerella sp.	657	3.00	24.60	21.60	8.60	11.20	13.50	11.32	3.61	0.14	11.05	11.60	5.7	16	17.8
Ephemerellidae	421	4.00	26.00	22.00	8.00	10.00	12.80	10.57	3.42	0.17	10.24	10.89	5.5	15	17
Ephydridae	64	4.70	27.40	22.70	13.00	16.50	18.00	16.21	4.37	0.55	15.11	17.31	8.5	21	24

											95% CIs		Percentiles		
Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Erpobdellidae	111	7.00	28.70	21.70	17.00	19.20	20.50	18.78	3.00	0.29	18.22	19.35	13.4	22	23.6
Eukiefferiella brehmi gr.	1310	8.70	34.20	25.50	11.90	14.60	17.80	14.97	3.82	0.11	14.76	15.18	9.9	20.4	22
Eukiefferiella brevicalcar gr.	238	4.70	28.10	23.40	9.90	13.00	16.50	13.34	4.42	0.29	12.78	13.91	7.1	19.5	20.9
Eukiefferiella brevicalcar Type I	31	7.00	26.38	19.38	14.70	24.00	24.00	19.45	5.95	1.09	17.23	21.67	8.7	24	24
Eukiefferiella claripennis gr.	977	4.70	34.20	29.50	11.70	14.30	17.60	14.59	4.10	0.13	14.34	14.85	9	19.9	21.3
Eukiefferiella coerulescens gr.	274	4.30	25.20	20.90	10.00	13.00	16.10	13.27	4.05	0.25	12.78	13.75	7.1	18.4	20.9
Eukiefferiella devonica gr.	1136	4.40	34.20	29.80	9.80	12.30	15.00	12.56	3.73	0.11	12.34	12.77	7.3	17.6	19.2
Eukiefferiella gracei gr.	1295	4.40	29.00	24.60	9.00	11.10	13.20	11.33	3.34	0.09	11.15	11.52	6.7	15.9	17.4
Eukiefferiella pseudomontana gr.	519	4.70	24.00	19.30	12.40	14.90	16.90	14.69	3.28	0.14	14.40	14.97	9.5	19	20.1
Eukiefferiella sp.	339	4.60	28.40	23.80	8.50	12.40	13.70	11.69	3.79	0.21	11.29	12.10	4.7	15.8	18
Eukiefferiella tirolensis	44	4.70	21.90	17.20	8.40	9.60	10.40	9.73	2.78	0.42	8.87	10.59	5.4	12.3	15.1
Euryhapsis sp.	51	5.50	22.30	16.80	8.90	11.40	13.70	11.66	3.22	0.45	10.74	12.57	7.3	15.9	17
Fallceon quilleri	52	9.50	30.60	21.10	20.00	23.00	27.00	22.93	4.97	0.70	21.53	24.33	13.9	29	29
Ferrissia sp.	101	7.00	28.10	21.10	17.00	18.80	21.00	18.68	3.28	0.33	18.03	19.33	13	23	23
Fluminicola sp.	60	7.20	34.20	27.00	14.00	17.70	19.50	16.81	4.14	0.54	15.74	17.89	10	20.3	20.5
Forcipomyia sp.	24	7.60	17.00	9.40	12.00	13.90	15.20	13.20	2.59	0.54	12.08	14.32	7.6	16.1	16.4
Fossaria sp.	49	9.00	29.00	20.00	17.10	22.40	24.00	20.49	4.13	0.60	19.30	21.69	12	24	25.6
Gammarus lacustris	23	9.00	18.00	9.00	13.00	16.00	16.00	14.78	2.05	0.44	13.87	15.69	9	16	16.6
Gammarus sp.	209	5.80	28.70	22.90	13.44	16.40	19.00	16.81	4.38	0.30	16.21	17.40	10	22.3	25.34
Gastropoda	31	6.00	25.00	19.00	12.00	14.00	16.00	13.99	4.23	0.77	12.42	15.57	8	20.4	21.1
Glossiphonia complanata	32	10.70	30.00	19.30	17.30	20.15	23.38	20.06	4.11	0.74	18.55	21.56	13.4	24.52	27.4
Glossosoma sp.	1651	0.00	28.00	28.00	9.30	12.00	14.80	12.38	4.07	0.10	12.18	12.58	6.6	18.1	19.2
Glossosomatidae	355	1.00	24.20	23.20	9.90	13.00	15.00	12.38	3.60	0.19	12.00	12.75	7	17	18
Glutops sp.	833	3.00	26.38	23.38	8.50	10.90	13.00	10.82	3.15	0.11	10.60	11.03	6	14.8	16
Gomphidae	101	7.00	29.30	22.30	15.30	18.60	21.80	18.96	4.24	0.42	18.12	19.80	12.4	25.5	26
Gyraulus sp.	135	6.60	29.30	22.70	17.00	20.50	23.60	20.31	4.44	0.38	19.55	21.07	12.5	25.7	25.7
Haliplus sp.	48	0.00	24.00	24.00	18.80	22.30	22.30	20.06	3.29	0.48	19.10	21.03	13.4	22.3	22.3
Haplotaxidae	55	5.30	22.30	17.00	10.30	13.00	16.60	13.48	4.19	0.57	12.34	14.62	7.4	18.6	22.3
											95% CIs		Percentiles		

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Haplotaxis sp.	90	5.20	19.70	14.50	9.00	11.00	11.80	10.90	2.99	0.32	10.27	11.53	6.8	14.4	16.6
Heleniella sp.	301	5.00	28.00	23.00	9.20	12.20	15.00	12.16	4.09	0.24	11.69	12.62	6	18.1	19
Helichus sp.	37	9.00	24.00	15.00	14.00	17.00	18.00	16.48	3.22	0.54	15.39	17.57	10.5	20.7	20.9
Helicopsyche borealis	41	7.00	26.00	19.00	13.00	17.00	19.00	15.62	4.45	0.70	14.19	17.04	7	21	21
Helicopsyche sp.	262	6.60	29.30	22.70	14.40	17.60	21.80	17.79	4.60	0.28	17.23	18.35	11	23.2	26.5
Helobdella stagnalis	108	9.00	27.80	18.80	13.20	17.20	19.20	17.39	4.00	0.39	16.62	18.15	13.2	23	27
Helopelopia sp.	21	8.00	19.00	11.00	10.87	12.00	13.20	12.24	2.25	0.50	11.19	13.29	10	15	18.1
Helophorus sp.	30	7.70	27.00	19.30	14.10	18.30	20.00	17.44	5.08	0.94	15.51	19.37	9.1	25.15	26.1
Hemerodromia sp.	179	5.50	30.60	25.10	13.70	16.00	20.00	16.49	4.87	0.36	15.77	17.21	7	23.2	23.3
Heptagenia sp.	55	5.80	26.00	20.20	14.00	18.00	20.00	17.36	3.72	0.51	16.35	18.38	12	22	22
Heptageniidae	385	0.00	29.30	29.30	8.00	12.00	15.50	11.96	4.30	0.22	11.52	12.39	5	17	18
Hesperoconopa sp.	99	5.00	22.50	17.50	12.00	15.50	17.00	14.27	3.58	0.36	13.55	14.99	7.1	17	18
Hesperoperla pacifica	984	0.00	29.00	29.00	11.30	13.50	16.00	13.92	3.67	0.12	13.69	14.15	8.8	18.7	20.8
Hesperoperla sp.	22	4.00	18.00	14.00	12.00	13.00	14.00	12.05	3.58	0.78	10.42	13.67	4	16	17
Hesperophylax sp.	47	7.00	27.80	20.80	11.50	16.10	19.00	15.59	4.84	0.71	14.15	17.03	9	20.7	22.1
Heterlimnius corpulentus	2741	1.00	29.00	28.00	9.40	11.30	13.30	11.50	2.95	0.06	11.39	11.61	6.9	15.1	16.4
Heterotrissocladius marcidus gr.	67	5.70	25.40	19.70	13.90	14.50	16.50	15.07	3.23	0.40	14.28	15.87	10.45	17.75	21.29
Heterotrissocladius sp.	24	8.30	19.50	11.20	12.40	16.40	16.40	14.33	2.92	0.61	13.07	15.59	9.1	17	18
Hexatoma sp.	1336	0.00	31.00	31.00	11.00	13.90	16.90	14.14	4.47	0.12	13.89	14.38	7.4	20.3	23
Hirudinea	79	5.00	29.00	24.00	11.90	14.80	18.10	14.62	5.25	0.59	13.44	15.81	5	21	24
Hyalella azteca	135	7.70	29.00	21.30	12.00	15.00	19.00	16.46	4.77	0.41	15.64	17.27	12	23	26
Hyalella sp.	192	6.70	34.20	27.50	13.20	17.00	21.00	17.64	4.98	0.36	16.93	18.36	11.6	25.34	27.8
Hydra sp.	50	8.10	25.34	17.24	15.00	15.00	17.00	16.22	2.66	0.38	15.45	16.98	12	18.4	23.1
Hydraena sp.	47	7.10	24.00	16.90	11.80	13.90	16.00	14.22	3.76	0.55	13.10	15.33	8.6	19.3	20.9
Hydrobaenus sp.	147	4.70	23.10	18.40	7.60	10.00	11.60	10.31	3.45	0.29	9.75	10.87	6.1	16.3	17
Hydrobiidae	152	4.00	27.80	23.80	15.00	17.00	19.00	16.37	3.89	0.32	15.74	16.99	8.6	20	21
Hydrophilidae	62	8.00	26.60	18.60	15.00	17.00	24.00	18.48	5.28	0.68	17.12	19.83	10	25.7	25.7
Hydroporinae	57	5.80	28.40	22.60	13.60	15.45	18.05	16.41	4.87	0.65	15.10	17.71	10.2	24.7	27
Hydropsyche sp.	1360	4.70	31.00	26.30	14.00	17.00	20.00	17.11	4.43	0.12	16.88	17.35	10.1	23	24.7
											95% CIs		Percentiles		

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Hydropsychidae	364	4.00	28.00	24.00	10.90	13.90	18.30	14.37	4.97	0.26	13.85	14.88	7	22.6	22.6
Hydropsychinae	21	9.40	26.00	16.60	14.00	16.00	16.00	15.94	3.49	0.78	14.31	17.56	10	19.3	20.4
Hydroptila sp.	410	5.50	34.20	28.70	13.80	17.00	19.60	17.19	4.53	0.22	16.75	17.63	10.3	24	26.2
Hydroptilidae	111	6.60	30.60	24.00	14.00	15.90	19.30	15.97	3.99	0.38	15.22	16.73	8.4	20.3	22.2
Hydryphantidae	32	4.70	26.20	21.50	8.00	9.30	11.10	10.15	3.91	0.70	8.71	11.58	6.4	12.8	16.1
Hygrobates sp.	135	5.66	29.30	23.64	12.70	15.10	17.70	15.59	3.98	0.34	14.91	16.27	10.6	21.5	23.8
Ironodes sp.	77	7.30	22.50	15.20	11.20	12.50	13.10	12.55	2.08	0.24	12.07	13.02	9.4	15.2	15.9
Isoperla sp.	308	3.15	34.20	31.05	10.50	12.00	14.10	12.28	3.51	0.20	11.88	12.67	5.9	16	18.3
Kathroperla sp.	24	6.00	14.90	8.90	9.70	11.50	13.50	11.21	2.43	0.51	10.16	12.26	6.4	14	14
Kogotus sp.	155	4.94	21.30	16.36	8.00	11.00	13.00	10.84	3.16	0.25	10.33	11.34	6	15	16
Krenopelopia sp.	37	4.30	17.90	13.60	8.50	10.30	11.00	10.00	2.84	0.47	9.03	10.96	5.3	12.9	15.4
Krenosmittia sp.	283	4.94	23.80	18.86	8.00	10.20	12.30	10.59	3.39	0.20	10.19	10.99	6	15.1	17.5
Laccobius sp.	36	7.20	25.60	18.40	14.10	16.20	19.70	17.12	4.17	0.71	15.69	18.55	11	24.7	24.7
Lara avara	51	8.00	20.00	12.00	10.50	12.00	14.00	12.65	2.87	0.41	11.84	13.47	8	16	18
Lara sp.	399	5.10	25.60	20.50	10.70	12.50	14.80	12.74	3.03	0.15	12.44	13.04	7.9	16.4	17.8
Larsia sp.	148	5.70	30.60	24.90	11.44	14.50	16.20	14.24	4.50	0.37	13.50	14.97	5.7	20.3	24
Lebertia sp.	764	4.70	28.00	23.30	9.60	12.00	14.90	12.51	3.98	0.14	12.22	12.79	5.7	20.3	24
Lepidostoma sp.	1108	3.00	28.00	25.00	12.70	14.80	17.10	15.08	3.54	0.11	14.87	15.29	10	19.7	22
Leptoceridae	24	11.00	27.00	16.00	15.00	18.05	20.40	18.22	3.84	0.80	16.57	19.88	11.9	24.7	25.3
Leptophlebiidae	261	4.00	27.00	23.00	11.00	13.60	15.60	13.78	4.35	0.27	13.25	14.31	7	20	22.1
Leucotrichia sp.	39	7.50	27.00	19.50	17.30	20.00	27.00	21.00	4.68	0.76	19.46	22.53	16	27	27
Leuctridae	947	4.00	23.00	19.00	8.00	10.00	12.00	10.12	2.82	0.09	9.94	10.30	5.7	13.7	14.9
Limnephilidae	458	3.15	27.80	24.65	10.00	12.00	14.00	12.38	3.44	0.16	12.06	12.69	7	17	19
Limnodrilus hoffmeisteri	448	5.50	30.00	24.50	14.70	17.20	20.00	17.40	4.43	0.21	16.99	17.81	10.7	23.2	25.7
Limnophila sp.	370	1.00	29.00	28.00	10.00	12.50	15.20	12.72	3.92	0.20	12.32	13.12	6.9	18	19.5
Limnophora sp.	86	7.00	27.00	20.00	13.00	16.00	20.00	16.26	5.26	0.57	15.13	17.40	8	24	25.5
Limnophyes sp.	138	5.60	28.40	22.80	11.30	14.80	17.90	14.94	4.54	0.39	14.17	15.71	8	21	22.27
Lopescladius sp.	168	4.70	27.00	22.30	13.90	15.50	18.20	15.95	3.54	0.27	15.41	16.49	10.7	20.3	21.1
Lumbricina	499	4.00	34.20	30.20	11.00	13.10	16.10	13.76	3.88	0.17	13.42	14.10	8	19	21
											95% CIs		Percentiles		

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Lumbriculidae	349	5.20	24.30	19.10	10.30	12.80	16.00	13.21	4.37	0.23	12.74	13.67	6.9	20.3	21.4
Lymnaeidae	110	6.00	34.20	28.20	17.00	19.00	19.00	18.14	3.01	0.29	17.57	18.72	12.5	20.2	23.2
Macropelopia sp.	44	5.00	21.50	16.50	13.00	18.10	20.29	16.49	4.18	0.64	15.21	17.78	7.6	20.29	20.29
Macropelopiini	22	7.60	24.80	17.20	12.70	14.10	15.90	14.67	3.78	0.82	12.96	16.38	9.4	19.05	24
Malenka sp.	849	0.00	34.20	34.20	11.70	14.00	16.00	14.22	3.76	0.13	13.97	14.47	9	18.5	21.4
Maruina sp.	68	7.00	26.00	19.00	13.00	16.20	19.20	16.13	4.01	0.49	15.16	17.11	10.6	22	23.4
Megarcys sp.	1259	3.15	23.00	19.85	9.00	11.00	13.00	11.14	2.88	0.08	10.98	11.30	6.8	15	16
Meringodixa sp.	38	8.00	20.90	12.90	12.00	14.00	15.50	14.31	3.13	0.51	13.27	15.35	10.6	19.9	20.9
Micrasema sp.	1823	3.00	29.00	26.00	10.00	12.00	14.60	12.44	3.32	0.08	12.29	12.59	7.4	16.8	18.3
Microcylloepus sp.	129	6.50	30.60	24.10	18.00	20.00	23.20	20.10	4.52	0.40	19.31	20.89	11	26.7	27.6
Micropsectra sp.	2304	4.30	34.20	29.90	10.50	13.00	16.10	13.55	4.23	0.09	13.37	13.72	7.5	18.9	21.1
Microtendipes pedellus gr.	74	5.50	27.80	22.30	14.00	17.80	19.60	17.19	4.11	0.48	16.23	18.14	9.8	22.3	22.3
Microtendipes rydalensis gr.	299	4.70	26.38	21.68	11.50	13.20	15.80	13.89	4.21	0.24	13.41	14.37	7.7	19.7	21.4
Mideopsis sp.	38	5.90	22.30	16.40	11.20	13.25	17.30	13.62	3.98	0.65	12.30	14.95	7	18.6	18.7
Monodiamesa sp.	29	5.60	22.10	16.50	11.55	14.10	18.60	14.31	4.04	0.76	12.74	15.87	8	18.6	18.6
Muscidae	63	5.00	28.40	23.40	12.50	16.50	18.40	15.88	4.56	0.58	14.72	17.04	6.7	22.27	22.5
Nais behningi	344	5.50	29.30	23.80	12.50	15.42	18.50	15.36	4.28	0.23	14.90	15.81	8.4	21	22.9
Nais sp.	117	6.10	26.80	20.70	14.80	17.97	18.80	17.25	3.46	0.32	16.62	17.89	11.7	21	25.2
Nais variabilis	265	6.60	29.30	22.70	14.10	17.00	23.30	18.32	5.76	0.35	17.62	19.01	10	26	28.4
Nanocladius sp.	200	6.40	30.60	24.20	14.10	17.00	19.00	16.77	4.24	0.30	16.17	17.36	10.4	22.4	24.7
Narpus sp.	820	4.00	26.38	22.38	11.20	13.10	15.00	13.33	3.15	0.11	13.11	13.54	8.7	17.7	18.8
Nematoda	2330	2.00	30.00	28.00	10.00	12.90	16.30	13.18	4.32	0.09	13.01	13.36	7	19	20.5
Nemouridae	143	1.00	22.00	21.00	9.00	11.45	15.40	11.88	4.13	0.35	11.20	12.56	4	17	18
Neophylax rickeri	162	7.10	25.20	18.10	12.60	14.80	18.00	15.40	3.75	0.30	14.81	15.98	10.1	21.3	23.8
Neophylax sp.	321	4.60	26.60	22.00	7.50	11.00	13.50	11.04	4.05	0.23	10.59	11.48	6	16	19.5
Neophylax splendens	160	5.50	21.40	15.90	10.00	12.60	15.10	13.01	3.44	0.27	12.47	13.54	8.1	18	19.7
Neothremma alicia	110	5.00	21.00	16.00	8.00	8.00	11.00	9.37	2.55	0.24	8.88	9.85	6	13	14.4
Neothremma sp.	878	2.00	29.00	27.00	7.70	9.20	11.40	9.62	2.98	0.10	9.42	9.82	5.7	13.3	14.9
Neotrichia sp.	114	11.00	26.00	15.00	15.10	16.60	19.20	17.27	3.18	0.30	16.68	17.86	12.4	21.8	23.7
											95% CIs		Percentiles		

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Nilotanypus fimbriatus	66	10.10	28.40	18.30	12.80	15.90	19.20	16.34	3.72	0.46	15.42	17.26	11.25	20.55	23.8
Nilotanypus sp.	51	10.80	27.00	16.20	15.60	20.20	24.00	19.37	4.68	0.66	18.04	20.70	11.2	24.8	24.8
Ochrotrichia sp.	264	0.00	28.10	28.10	13.00	15.00	17.00	15.19	3.67	0.23	14.75	15.64	9.4	19.3	21.7
Odontomesa sp.	68	6.10	26.00	19.90	13.00	13.40	14.80	13.72	2.14	0.26	13.20	14.24	10.7	16	16.6
Oecetis avara	24	6.60	30.60	24.00	14.00	17.30	23.60	18.47	5.58	1.16	16.07	20.88	11.3	27	27
Oecetis disjuncta	36	7.60	25.60	18.00	11.60	12.70	16.90	14.53	3.96	0.67	13.17	15.89	11.2	20.1	23
Oecetis sp.	52	7.00	29.30	22.30	14.90	17.00	20.50	17.61	4.05	0.57	16.47	18.75	11	23	23
Oligochaeta	1092	0.00	29.00	29.00	8.00	11.00	13.00	11.08	3.98	0.12	10.84	11.31	6	16	19
Oligophlebodes sp.	363	4.00	24.00	20.00	8.60	10.00	12.00	10.46	2.71	0.14	10.18	10.74	6.8	14.2	15.3
Onocosmoecus sp.	121	7.00	23.70	16.70	13.00	15.00	18.00	15.43	3.38	0.31	14.82	16.04	10.2	19.9	22
Ophidonais serpentina	58	9.78	26.80	17.02	14.90	16.35	18.80	16.73	3.32	0.44	15.85	17.61	12.3	20.9	23
Ophiogomphus sp.	91	7.00	30.60	23.60	15.80	18.50	20.30	18.80	4.29	0.45	17.90	19.70	12.5	24	27
Optioservus divergens	32	7.00	24.00	17.00	11.00	17.00	18.00	15.69	3.92	0.70	14.25	17.13	10	21	21
Optioservus quadrimaculatus	326	0.00	28.00	28.00	13.00	15.00	17.00	15.12	3.93	0.22	14.69	15.55	10	19	24
Optioservus quadrimaculatus DUPLICATE	22	9.00	21.50	12.50	16.00	16.00	18.00	15.84	2.29	0.50	14.80	16.88	11	18	18
Optioservus sp.	2146	4.00	34.20	30.20	12.90	15.30	18.10	15.58	3.95	0.09	15.41	15.75	9.6	20.8	22.3
Ordobrevia nubifera	165	5.50	27.80	22.30	14.50	16.90	19.60	17.35	3.51	0.27	16.81	17.89	12	22.3	23.1
Ordobrevia sp.	57	8.00	26.50	18.50	13.50	16.00	17.00	15.55	2.78	0.37	14.80	16.29	11	19.5	21
Oreodytes sp.	133	7.60	26.50	18.90	12.50	15.20	18.30	15.48	3.74	0.33	14.83	16.12	10.4	20	21.25
Oreogeton sp.	262	4.00	19.10	15.10	8.40	10.50	12.60	10.71	2.89	0.18	10.35	11.06	6.1	14.8	16
Oribatei	105	4.94	29.30	24.36	11.10	12.50	16.60	13.11	4.32	0.42	12.27	13.95	6.6	19.1	20.2
Ormosia sp.	39	7.00	19.90	12.90	12.00	14.20	14.60	13.44	2.21	0.36	12.71	14.16	9	14.6	17
Orthocladiinae	248	4.70	30.00	25.30	11.00	12.80	14.20	12.86	3.36	0.21	12.44	13.28	7	17.1	18.4
Orthocladius (Eudactylo.) sp.	22	7.10	24.00	16.90	9.85	12.40	16.50	13.33	3.53	0.77	11.73	14.94	7.1	16.5	18.5
Orthocladius (Euortho.) rivulorum	82	4.90	21.00	16.10	10.50	12.60	14.70	12.46	3.11	0.35	11.77	13.14	8.4	17.5	17.6
Orthocladius (Euorthocladius) sp.	265	5.00	34.20	29.20	10.00	12.50	15.90	12.96	4.27	0.26	12.44	13.48	6.4	19	20.2
Orthocladius (Euorthos.) rivicola gr.	331	5.00	26.60	21.60	11.24	12.90	15.10	13.54	3.83	0.21	13.13	13.96	7.5	18.4	20.8
Orthocladius (Euorthos.) rivulorum gr.	66	4.70	21.30	16.60	10.00	12.70	13.50	12.31	2.93	0.36	11.59	13.04	7.6	16	16.9
Orthocladius (Symp.) lignicola	138	5.20	21.00	15.80	10.25	12.20	14.60	12.39	3.19	0.27	11.85	12.93	8	16.4	17.2
											95% CIs		Percentiles		

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Orthocladius annectens	29	8.70	25.50	16.80	11.68	11.68	21.00	16.04	5.61	1.06	13.87	18.21	11.68	25.4	25.4
Orthocladius Complex	1960	4.40	30.00	25.60	10.80	13.20	15.90	13.61	4.14	0.09	13.43	13.80	7.7	18.9	21.3
Orthocladius sp.	1391	4.60	34.20	29.60	9.50	12.10	15.00	12.46	3.86	0.10	12.26	12.66	6.9	17.7	19.4
Ostracoda	1567	2.00	30.00	28.00	9.00	11.90	14.40	12.16	4.08	0.10	11.96	12.37	6.6	17.8	20.1
Oxyethira sp.	24	10.20	24.80	14.60	14.30	15.50	21.20	16.85	3.76	0.78	15.23	18.47	12.6	22	23.6
Pacifastacus sp.	60	10.50	25.10	14.60	15.20	17.00	17.60	16.86	3.07	0.40	16.06	17.66	11.5	20.2	23.8
Pagastia sp.	1704	4.40	29.00	24.60	10.00	12.30	15.00	12.70	3.66	0.09	12.52	12.87	7.4	17.7	19
Parachaetocladius sp.	35	5.70	27.80	22.10	8.10	11.30	27.80	14.57	8.10	1.39	11.75	17.39	7	27.8	27.8
Paracladopelma sp.	49	7.10	25.40	18.30	13.00	16.00	18.00	15.91	3.94	0.57	14.77	17.06	9.5	22.1	24.3
Paracricotopus sp.	36	7.00	17.00	10.00	10.00	12.15	14.60	12.53	2.55	0.43	11.65	13.40	10	17	17
Parakiefferiella sp.	209	6.40	30.60	24.20	11.10	13.40	17.00	14.47	4.88	0.34	13.80	15.14	7.1	20.3	23.8
Paraleptophlebia bicornuta	27	14.00	24.30	10.30	15.50	18.00	19.00	17.65	2.83	0.56	16.51	18.80	14	23	23.8
Paraleptophlebia debilis	42	3.15	25.00	21.85	14.00	17.00	17.00	16.05	3.79	0.59	14.85	17.24	11	21	24
Paraleptophlebia sp.	1837	3.00	29.00	26.00	11.00	13.50	16.00	13.69	4.02	0.09	13.51	13.87	7.5	19.1	20.8
Paraleuctra sp.	249	4.90	20.20	15.30	8.30	10.20	12.30	10.59	3.13	0.20	10.20	10.98	6.2	14.8	17.2
Paramerina sp.	50	8.00	29.30	21.30	12.30	13.30	17.00	14.48	3.43	0.49	13.50	15.46	9.2	20	20
Parametriocnemus sp.	1426	4.40	29.30	24.90	10.40	13.00	17.60	14.05	4.81	0.13	13.80	14.30	7.3	20.8	23.2
Paraperla sp.	714	0.00	23.00	23.00	8.40	10.90	12.70	10.71	3.17	0.12	10.47	10.94	5.36	15	16
Paraphaenocladius "n. sp."	79	4.40	17.60	13.20	7.50	8.30	9.95	8.60	2.06	0.23	8.14	9.07	5.3	11.3	12.1
Paraphaenocladius sp.	79	4.40	24.70	20.30	8.00	8.20	13.00	9.81	3.87	0.44	8.94	10.68	4.7	14	17
Parapsyche almota	183	5.00	22.00	17.00	11.50	13.50	16.00	13.70	3.06	0.23	13.25	14.15	9.5	17.5	18.7
Parapsyche elsis	815	4.00	20.40	16.40	8.20	10.00	12.00	10.14	2.67	0.09	9.96	10.33	6	13.5	14.9
Parapsyche sp.	187	1.00	24.70	23.70	7.00	9.80	11.90	9.54	3.87	0.28	8.98	10.10	3	13.8	17
Paratanytarsus sp.	125	7.60	30.00	22.40	16.70	18.60	20.90	19.08	3.70	0.33	18.42	19.73	14.2	25.4	25.4
Paratendipes sp.	142	6.40	30.00	23.60	14.40	17.40	21.00	17.85	4.54	0.38	17.10	18.61	11.1	24	24.9
Parorthocladius sp.	242	5.00	29.00	24.00	9.10	9.50	11.90	10.21	2.58	0.17	9.88	10.54	6.3	13	14.3
Pedicia sp.	22	9.00	21.00	12.00	11.60	12.75	15.00	13.46	2.82	0.62	12.18	14.74	9.4	18	18.7
Pentaneura sp.	296	8.10	30.60	22.50	15.30	17.90	21.30	18.36	4.62	0.27	17.83	18.89	11	24.7	26.6
Pentaneurini	104	6.30	29.30	23.00	12.00	15.10	17.00	14.84	4.12	0.41	14.03	15.64	8.3	18.1	20
											95% CIs		Percentiles		

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Pericoma/Telmatoscopus sp.	577	4.00	27.80	23.80	9.00	11.20	13.20	11.37	3.29	0.14	11.10	11.64	6.6	15.9	16.8
Perlidae	654	3.00	28.00	25.00	10.00	12.00	15.00	12.58	3.73	0.15	12.30	12.87	6.9	18	20
Perlinodes aurea	54	4.00	26.38	22.38	11.00	15.10	18.00	14.23	5.21	0.72	12.80	15.67	7	20	21.4
Perlinodes sp.	51	3.00	21.00	18.00	8.00	14.00	18.00	12.68	5.16	0.73	11.22	14.15	5	19.5	19.5
Perlodidae	1648	1.00	27.80	26.80	9.00	11.60	14.15	11.96	4.00	0.10	11.77	12.16	6.2	17	19
Petrophila sp.	95	7.00	27.60	20.60	17.90	19.60	20.00	18.95	3.18	0.33	18.30	19.60	13.5	22.2	23.8
Phaenopsectra sp.	142	5.50	28.40	22.90	14.90	16.30	20.50	17.45	4.36	0.37	16.72	18.17	10.8	24	24.7
Philopotamidae	35	7.50	20.20	12.70	9.70	12.95	17.00	13.25	3.84	0.66	11.91	14.59	8	19	19.6
Physa (Physella) sp.	311	5.60	30.60	25.00	14.60	16.90	20.30	17.30	4.27	0.24	16.82	17.78	11	23.2	26.2
Physa sp.	82	5.50	34.20	28.70	15.40	18.30	21.15	17.90	4.20	0.47	16.97	18.83	11.6	22.4	23.6
Physidae	59	0.00	28.00	28.00	19.20	25.00	25.00	22.09	3.97	0.52	21.04	23.13	14	25	25
Pisidium sp.	538	4.94	34.20	29.26	12.00	14.25	17.30	14.93	4.78	0.21	14.52	15.33	7.8	20.5	23.7
Planorbidae	60	6.00	30.60	24.60	16.90	18.00	19.20	18.12	3.08	0.40	17.32	18.92	13.1	22	23.6
Plecoptera	106	6.30	24.20	17.90	10.30	12.10	14.30	12.80	3.65	0.36	12.09	13.51	8	19	20.3
Plumiperla sp.	36	6.00	23.10	17.10	7.20	9.90	13.00	11.01	4.68	0.79	9.41	12.62	6	18.9	19.3
Polycelis coronata	620	2.00	29.00	27.00	8.00	10.00	12.00	10.17	3.11	0.12	9.93	10.42	6	14.5	16
Polycelis sp.	1120	4.70	34.20	29.50	8.50	10.40	12.60	10.78	3.20	0.10	10.59	10.96	6.1	14.9	16.9
Polycentropus sp.	29	7.00	29.30	22.30	12.60	13.90	17.00	15.02	4.32	0.82	13.34	16.69	9	21.5	24
Polypedilum sp.	1062	4.90	30.60	25.70	13.00	15.60	18.60	16.09	4.30	0.13	15.83	16.34	9.8	21.9	23.8
Potamopyrgus antipodarum	45	7.60	34.20	26.60	16.70	18.00	21.40	19.00	4.30	0.65	17.69	20.31	11.1	22.1	25.6
Potthastia gaedii gr.	289	5.40	26.38	20.98	12.20	14.10	16.30	14.17	3.44	0.20	13.77	14.57	8.4	18.8	20.4
Potthastia longimana gr.	38	8.30	30.60	22.30	12.40	16.00	17.00	15.64	4.51	0.74	14.14	17.15	8.9	21	23.3
Pristina sp.	54	7.70	28.40	20.70	15.00	18.50	19.60	17.61	4.06	0.56	16.50	18.73	10.7	21.6	24.7
Probezzia sp.	31	9.50	27.00	17.50	15.00	16.50	17.00	16.40	3.86	0.71	14.96	17.84	10.6	23	25.34
Procladius sp.	48	7.48	30.00	22.52	13.00	16.70	18.25	16.87	4.41	0.64	15.58	18.17	11.1	22	24.75
Prodiamesa sp.	43	7.30	24.00	16.70	13.40	15.00	16.00	14.88	2.58	0.40	14.08	15.69	10	17.6	19
Prosimulium sp.	633	0.00	25.50	25.50	8.00	12.00	14.00	11.47	3.53	0.14	11.19	11.74	6	16	16
Protoptila sp.	52	10.70	27.00	16.30	15.00	17.30	18.60	16.80	3.33	0.47	15.87	17.74	12	21.1	24
Protzia sp.	511	4.70	34.20	29.50	10.80	13.20	16.00	13.60	3.83	0.17	13.27	13.93	7.8	18.8	20.2
											95% CIs		Percentiles		

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Psectrocladius sp.	62	9.40	30.00	20.60	16.00	16.10	18.33	17.33	4.17	0.53	16.26	18.40	11.1	24.7	25.2
Psephenus sp.	89	9.80	30.60	20.80	19.20	21.80	23.80	21.10	3.26	0.35	20.41	21.79	15.5	24.2	24.9
Pseudochironomus sp.	48	11.60	30.60	19.00	18.60	23.00	27.80	22.93	5.05	0.74	21.45	24.42	13.21	29.3	30.6
Pseudocloeon sp.	35	8.30	23.40	15.10	12.00	15.40	17.00	15.33	3.49	0.60	14.11	16.54	11.2	20.7	20.7
Pseudodiamesa sp.	49	4.70	25.50	20.80	6.70	7.30	9.90	8.88	3.25	0.47	7.94	9.82	6.7	13.3	16.1
Psilometriocnemus sp.	59	4.94	27.80	22.86	9.40	11.30	15.70	12.57	4.51	0.59	11.38	13.75	6.8	17	21
Psychodidae	25	1.00	20.10	19.10	6.00	6.00	7.00	7.02	2.69	0.55	5.89	8.16	4	10	12
Psychoglypha sp.	93	5.30	27.80	22.50	10.50	14.00	16.00	13.49	4.28	0.45	12.60	14.38	7	18.5	21
Psychomyia sp.	34	9.80	22.30	12.50	13.00	15.20	18.50	15.59	3.06	0.53	14.50	16.67	10.5	19.7	21.4
Pteronarcella badia	43	7.00	25.00	18.00	13.00	15.50	16.00	14.97	2.84	0.44	14.09	15.85	11	17	21
Pteronarcella sp.	312	6.50	28.00	21.50	12.00	14.10	16.00	14.42	3.54	0.20	14.02	14.81	8.4	19.1	20.5
Pteronarcys californica	127	5.00	25.00	20.00	14.50	16.00	18.60	16.39	3.23	0.29	15.82	16.96	11	20.4	21.3
Pteronarcys princeps	38	8.40	24.00	15.60	13.60	15.00	17.00	14.92	2.38	0.39	14.12	15.71	11	17	18
Pteronarcys sp.	158	4.70	26.50	21.80	13.00	15.00	18.10	15.55	3.93	0.31	14.93	16.17	9.9	21.5	22.4
Ptychoptera sp.	76	4.00	21.40	17.40	11.50	13.60	14.00	12.67	2.84	0.33	12.02	13.32	6.2	15.1	16.4
Quistradrilus multisetosus	42	6.90	22.20	15.30	13.00	16.90	17.10	15.49	3.35	0.52	14.43	16.55	10.5	19.8	20.5
Radotanypus sp.	85	6.30	30.00	23.70	13.40	16.10	23.00	17.58	5.20	0.57	16.45	18.71	11.8	24	27.4
Reomyia sp.	47	5.80	21.20	15.40	10.80	13.40	15.70	13.29	2.91	0.43	12.43	14.16	8.5	16.6	17
Rhabdomastix fascigera gr.	217	4.00	21.40	17.40	10.30	12.20	14.40	12.42	2.98	0.20	12.02	12.82	7.4	16	17.2
Rhabdomastix setigera gr.	30	5.80	16.40	10.60	10.30	11.40	13.30	11.73	2.13	0.40	10.92	12.54	8	14.2	15
Rhabdomastix sp.	100	4.00	23.00	19.00	12.00	14.00	16.00	14.50	3.14	0.32	13.87	15.12	9	19	20
Rheocricotopus sp.	1143	4.40	29.30	24.90	9.10	11.60	15.10	12.39	4.61	0.14	12.12	12.66	6.2	18.4	21
Rheosmittia sp.	53	5.50	21.20	15.70	8.30	11.30	13.10	11.32	3.45	0.48	10.36	12.28	6.9	17.2	17.2
Rheotanytarsus sp.	1203	4.60	34.20	29.60	11.20	13.90	17.20	14.54	4.45	0.13	14.29	14.79	7.9	20.1	23.1
Rhithrogena hageni	34	4.00	18.00	14.00	9.00	12.00	13.00	10.84	2.68	0.47	9.88	11.79	6.5	14	14
*Rhithrogena robusta**	85	1.00	21.00	20.00	7.00	8.00	10.00	9.08	3.93	0.43	8.22	9.93	5	14.5	20
Rhithrogena sp.	2224	3.00	30.60	27.60	9.50	11.70	14.00	12.02	3.71	0.08	11.87	12.18	6.8	17	19
Rhyacodrilus coccineus	248	4.60	24.00	19.40	10.00	15.00	18.00	14.19	4.42	0.28	13.64	14.74	7.5	19.2	20.7
Rhyacodrilus sodalis	48	6.00	23.00	17.00	12.00	14.00	15.00	13.81	3.19	0.47	12.88	14.75	9.5	20	20
											95% CIs		Percentiles		

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Rhyacodrilus sp.	163	6.00	30.00	24.00	12.00	15.00	18.00	14.89	4.32	0.34	14.22	15.56	8.6	20.4	21.2
Rhyacophila alberta gr.	86	4.00	19.20	15.20	7.30	9.00	10.10	9.39	3.12	0.34	8.72	10.07	5	14	15.1
Rhyacophila angelita gr.	432	4.00	25.50	21.50	11.00	13.00	15.70	13.49	3.61	0.17	13.15	13.83	8	18.3	21.4
Rhyacophila betteni gr.	1179	4.00	23.80	19.80	9.00	10.70	12.60	10.87	2.87	0.08	10.70	11.03	6.5	14.8	16
Rhyacophila brunnea gr.	2227	1.00	29.00	28.00	9.02	11.24	13.50	11.49	3.31	0.07	11.36	11.63	6.2	16	17.6
Rhyacophila coloradensis gr.	104	4.00	22.20	18.20	10.00	12.70	14.60	12.37	3.67	0.36	11.66	13.09	6.4	17.1	17.8
Rhyacophila hyalinata gr.	665	4.00	25.60	21.60	8.30	10.70	13.00	11.08	3.41	0.13	10.82	11.34	6.5	15.4	17.1
Rhyacophila iranda gr.	49	3.00	14.00	11.00	8.00	9.00	9.00	8.54	1.96	0.28	7.97	9.11	4	11	11
Rhyacophila narvae	1211	4.00	23.00	19.00	8.70	10.70	12.80	10.78	2.88	0.08	10.61	10.94	6.4	14.3	15.8
Rhyacophila pellisa	111	5.00	18.00	13.00	9.00	9.50	12.00	10.54	2.78	0.27	10.01	11.06	6	15	16
Rhyacophila pellisa/valuma	694	4.60	20.80	16.20	8.20	10.20	12.20	10.39	2.84	0.11	10.18	10.60	6.3	14	15.3
Rhyacophila sibirica gr.	66	4.00	16.40	12.40	7.50	9.50	12.00	9.76	2.83	0.35	9.06	10.46	6	14	15
Rhyacophila sp.	1116	0.00	27.80	27.80	8.00	11.00	14.00	11.32	4.03	0.12	11.09	11.56	5	16.5	18.5
Rhyacophila vaccua Milne	62	4.00	23.00	19.00	8.00	11.00	14.00	11.52	3.96	0.51	10.51	12.54	7	17	19
Rhyacophila vagrita gr.	174	4.00	23.00	19.00	8.10	10.30	13.10	10.87	3.35	0.25	10.37	11.38	6.2	15.3	16.6
Rhyacophila valuma	64	4.00	19.00	15.00	7.00	9.00	11.00	9.32	3.20	0.40	8.52	10.13	4	14	15
Rhyacophila verrula	164	2.00	17.40	15.40	8.00	10.10	10.10	9.49	2.42	0.19	9.12	9.87	5	12.1	14
Rhyacophila verrula gr.	104	4.40	26.00	21.60	7.70	9.20	11.80	9.79	3.32	0.33	9.15	10.44	5.1	13.7	16.4
Rhyacophila vofixa gr.	314	4.00	29.00	25.00	8.00	10.00	11.90	9.98	2.90	0.16	9.66	10.31	5.5	13.5	15
Saetheria tylus	21	7.10	25.50	18.40	15.80	16.00	17.00	16.19	2.91	0.65	14.83	17.55	11.44	17.8	22.3
Sericostriata surdickae	78	4.00	16.00	12.00	6.80	9.20	10.90	9.18	2.29	0.26	8.66	9.70	6.5	12	13
Serratella sp.	120	5.40	24.00	18.60	10.00	13.00	16.00	12.95	3.59	0.33	12.30	13.60	8	19	19
Serratella teresa	140	8.00	24.00	16.00	12.00	14.80	16.00	14.56	2.93	0.25	14.07	15.05	9.8	19	20.3
Serratella tibialis	1962	4.00	27.00	23.00	10.40	12.50	14.70	12.69	3.12	0.07	12.56	12.83	8	17	18.2
Setvena bradleyi	26	5.00	16.00	11.00	9.50	13.00	14.00	11.87	2.50	0.50	10.84	12.90	7.5	14	14
Setvena sp.	128	2.00	16.10	14.10	6.80	8.50	10.00	8.59	2.69	0.24	8.11	9.06	4.7	12	14
Sialis sp.	184	3.15	30.00	26.85	15.00	17.00	19.70	17.63	4.40	0.32	16.99	18.28	11.3	23.8	24.3
Simuliidae	306	1.00	26.60	25.60	12.00	15.00	17.00	14.57	4.03	0.23	14.11	15.02	7	19	22
Simulium sp.	2847	0.00	34.20	34.20	12.00	14.90	17.40	14.89	4.00	0.07	14.75	15.04	9	20	22
											95% CIs		Percentiles		

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Skwala sp.	696	5.30	28.00	22.70	13.50	16.00	19.00	16.38	4.06	0.15	16.08	16.68	9.9	21.53	23
Sperchon sp.	773	4.70	34.20	29.50	10.70	13.30	16.60	13.74	4.44	0.16	13.43	14.05	7.3	19.9	21.6
Sperchonopsis sp.	96	4.90	22.40	17.50	10.70	13.00	15.10	13.05	3.71	0.38	12.30	13.81	6.9	17.74	20.3
Sphaeriidae	929	0.00	30.60	30.60	10.10	14.40	18.00	14.17	4.77	0.16	13.86	14.48	6	20	21
Spirosperma sp.	28	9.30	23.20	13.90	14.10	14.10	18.30	15.16	3.28	0.63	13.87	16.46	6	20	21
Stempellina sp.	86	5.60	27.00	21.40	10.50	13.70	18.00	14.04	4.98	0.54	12.97	15.11	7.1	20.1	24.3
Stempellinella sp.	1123	4.70	30.60	25.90	10.00	12.60	15.20	13.02	4.22	0.13	12.77	13.27	7.1	19.2	21.4
Stictochironomus sp.	56	9.00	25.40	16.40	15.00	17.90	17.90	17.10	2.29	0.31	16.48	17.72	13.3	20.4	22.1
Stictotarsus sp.	25	9.40	30.00	20.60	16.20	20.50	24.70	20.55	4.41	0.90	18.69	22.40	13.3	20.4	22.1
Stilobezzia sp.	39	5.50	22.70	17.20	10.40	13.50	14.10	12.98	3.84	0.62	11.72	14.24	6.1	19	20.7
Stilocladius sp.	72	4.70	16.50	11.80	8.20	9.40	11.90	9.93	2.44	0.29	9.35	10.51	6.1	12.7	14.2
Stratiomyidae	49	6.10	27.60	21.50	18.70	19.30	19.30	17.57	3.58	0.52	16.54	18.61	9.1	19.3	19.3
Sublettea sp.	124	5.80	23.20	17.40	11.80	14.50	18.50	14.60	4.08	0.37	13.88	15.33	6.2	19.4	20
Suwallia sp.	597	0.00	24.00	24.00	9.20	12.00	14.00	11.75	3.18	0.13	11.50	12.01	6.5	15.7	17
Sweltsa sp.	2871	1.00	29.00	28.00	10.00	12.00	14.00	12.17	3.30	0.06	12.05	12.29	7	16.2	18
Synorthocladius sp.	181	5.30	27.00	21.70	13.30	15.20	18.80	15.89	4.45	0.33	15.23	16.54	8.9	22.3	23.7
Tabanidae	114	6.00	29.00	23.00	12.90	15.75	18.00	15.46	3.16	0.30	14.87	16.05	11.44	18.5	19.1
Taeniopterygidae	466	1.00	20.00	19.00	6.20	8.00	9.80	8.12	2.83	0.13	7.86	8.38	4	12	13
Tanytarsus sp.	684	5.50	30.60	25.10	13.90	16.90	20.20	17.29	4.98	0.19	16.92	17.67	10.1	24	25.5
Telmatodrilus vejdovskyi	43	7.30	27.40	20.10	10.60	13.00	14.60	12.98	3.13	0.48	12.01	13.96	7.7	17.8	18.7
Testudacarus sp.	72	6.20	19.70	13.50	8.90	11.00	12.90	11.44	3.15	0.37	10.69	12.18	7.1	16.2	16.9
Thaumaleidae	41	6.40	20.00	13.60	10.90	12.00	14.40	12.79	3.33	0.53	11.72	13.85	7.5	18.7	19.3
Thienemanniella sp.	1264	4.30	29.30	25.00	11.00	14.10	17.10	14.45	4.61	0.13	14.20	14.71	7.5	20.3	23.2
Thienemannimyia gr. sp.	1276	4.40	30.60	26.20	12.40	15.30	19.00	15.86	4.88	0.14	15.59	16.13	8.4	23	24.7
Timpanoga hecuba	67	10.10	28.00	17.90	13.00	14.95	18.00	15.56	3.28	0.40	14.75	16.37	11.5	18.6	22
Tipula sp.	283	4.00	34.20	30.20	11.50	13.00	16.00	13.73	3.60	0.21	13.31	14.16	8.6	18.9	20
Tipulidae	204	4.00	28.40	24.40	12.00	15.20	16.90	14.61	4.15	0.29	14.04	15.18	7.5	19.4	20.8
Tokunagaia sp.	129	4.60	24.90	20.30	8.00	9.90	11.20	9.97	3.06	0.27	9.43	10.50	5.1	13.8	15.5
Torrenticola sp.	570	4.90	29.30	24.40	11.70	13.80	16.30	14.20	3.64	0.15	13.90	14.50	8.91	19.4	20.8
											95% CIs		Percentiles		

Macroinvertebrate Temperature Occurrence Models

Taxon	N	Min	Max	Rng	1st Q	Med	3rd Q	Mean	St.Dev	S.E.	Lower	Upper	5th	90th	95th
Trichoptera	195	5.30	29.00	23.70	10.90	12.50	14.70	12.74	3.67	0.26	12.22	13.26	6.8	18	19
Tricorythodes minutus	79	6.00	29.00	23.00	16.00	18.00	19.00	17.71	2.74	0.31	17.09	18.32	15	21	21
Tricorythodes sp.	288	6.70	31.00	24.30	16.00	19.20	22.60	18.87	4.56	0.27	18.34	19.40	11	24	25.6
Tubificidae	110	6.00	28.00	22.00	11.00	15.50	19.00	15.31	5.37	0.51	14.29	16.33	7	23	23
Tubificidae w/ cap setae	777	4.70	34.20	29.50	12.00	15.30	18.10	15.26	4.37	0.16	14.95	15.57	8	20.5	23.3
Tubificidae w/o cap setae	305	5.90	27.40	21.50	13.00	16.90	19.20	16.62	4.74	0.27	16.08	17.15	9.4	23.6	26
Turbellaria	658	1.00	30.60	29.60	8.30	11.00	14.00	11.83	4.82	0.19	11.46	12.20	5.6	18	22.3
Tvetenia bavarica gr.	2138	4.30	34.20	29.90	10.20	12.30	15.00	12.84	3.86	0.08	12.67	13.00	7.1	18.4	20
Tvetenia discoloripes gr.	33	5.30	23.76	18.46	5.30	14.00	18.80	13.12	6.17	1.09	10.89	15.34	5.3	20.1	23
Uenoidae	39	1.00	19.20	18.20	8.00	8.00	13.00	9.79	2.54	0.41	8.96	10.62	8	13	13
Valvatidae	30	6.30	28.00	21.70	16.70	18.80	25.00	20.06	5.40	1.00	18.01	22.11	12.1	27	27
Visoka cataractae	799	3.00	23.00	20.00	8.00	10.00	12.50	10.40	2.93	0.10	10.20	10.61	6	14	15
Wandesia sp.	47	5.00	21.40	16.40	10.50	11.80	14.00	12.07	3.52	0.52	11.03	13.12	5	17	17.8
Wiedemannia sp.	173	4.90	24.00	19.10	8.50	10.90	13.40	11.49	3.77	0.29	10.93	12.06	6.3	16.6	18.9
Wormaldia sp.	370	5.80	28.00	22.20	13.00	15.80	18.00	15.82	3.70	0.19	15.45	16.20	11	21	22
Yoraperla brevis	182	5.00	21.00	16.00	8.00	10.00	12.00	10.28	2.44	0.18	9.92	10.64	7	13	14
Yoraperla sp.	867	3.00	23.00	20.00	7.00	9.00	11.00	9.30	2.64	0.09	9.12	9.48	5.3	12.7	14.1
Zaitzevia parvula	32	7.00	28.00	21.00	16.00	20.00	21.00	19.01	4.35	0.78	17.42	20.60	11	25	25
Zaitzevia sp.	1570	0.00	30.60	30.60	13.00	15.70	18.40	15.86	3.80	0.10	15.67	16.05	10.4	21	22.4
Zapada cinctipes	1692	3.15	34.20	31.05	11.00	13.00	16.00	13.60	3.83	0.09	13.41	13.78	10.4	21	22.4
Zapada columbiana	1323	2.00	22.00	20.00	8.00	10.00	12.00	10.14	2.76	0.08	9.99	10.29	6	14	15
Zapada frigida	99	5.20	18.80	13.60	9.30	11.50	13.20	11.58	2.78	0.28	11.02	12.14	7.1	15.1	16
Zapada oregonensis gr.	625	3.00	24.00	21.00	7.30	9.00	11.50	9.47	2.87	0.11	9.25	9.70	5.36	13	14
Zapada sp.	249	0.00	26.60	26.60	7.00	10.00	14.00	10.85	4.52	0.29	10.28	11.41	5	16	17.5
Zavrelimyia sp.	71	6.00	26.60	20.60	11.60	15.20	20.50	16.30	5.59	0.67	14.97	17.63	8	24.7	24.7