



**List of Californian Macroinvertebrate Taxa
and Standard Taxonomic Effort**

revision date: 27 January, 2003

**For comments or questions,
please contact:**

Peter Ode
WPCL/ABL
CA Department of Fish and Game
2005 Nimbus Road
Rancho Cordova, CA 95670
pode@ospr.dfg.ca.gov



Table of Contents

INTRODUCTION.....	3
<i>Standard Taxonomic Effort</i>	3
<i>The CAMLnet Standard Taxonomic List</i>	3
<i>California Tolerance Value</i>	4
<i>Functional Feeding Group</i>	5
<i>List of Taxa to Reject from Benthic Lists</i>	5
<i>On “Phantom Taxa” and the concept of “Distinct Taxa”</i>	6
<i>CSBP Level II Standard Effort</i>	6
GENERAL TAXONOMIC KEYS	7
<i>For Insects:</i>	7
<i>For Other Aquatic Macroinvertebrates:</i>	7
<i>Acknowledgements</i>	7
SECTION I: INSECT TAXA	8
EPHEMEROPTERA: MAYFLIES.....	8
ODONATA: DRAGONFLIES AND DAMSELFLIES.....	11
PLECOPTERA: STONEFLIES	13
HEMIPTERA: TRUE BUGS.....	16
MEGALOPTERA: ALDERFLIES AND DOBSONFLIES.....	17
TRICHOPTERA: CADDISFLIES.....	18
LEPIDOPTERA: MOTHS AND BUTTERFLIES.....	22
COLEOPTERA: BEETLES.....	23
DIPTERA: TRUE FLIES.....	26
NON-INSECT TAXA	32
SUBPHYLUM CHELICERATA (ACARI).....	32
PHYLUM COELENTERATA.....	36
PHYLUM MOLLUSCA	37
PHYLUM PLATYHELMINTHES.....	39
PHYLUM ANNELIDA.....	40
PHYLUM NEMERTEA	42
ADDITIONAL REFERENCES.....	43

INTRODUCTION

This document provides current information on the taxonomy of macroinvertebrate taxa found in California streams and lakes. It also describes the standard level of taxonomic effort that the California Aquatic Bioassessment Laboratory Network (CAMLnet) has defined for bioassessment projects using the California State Bioassessment Procedure (CSBP). Specialized references are suggested for particular taxa. For the latest version of this document and for other bioassessment resources, visit the CAMLnet link on the California Aquatic Bioassessment Workgroup (CABW) website (www.dfg.ca.gov/cabw/cabwhome.html).

This list should not be interpreted as a comprehensive list of the aquatic macroinvertebrate fauna of California; it lists the macroinvertebrate taxa identified in bioassessment samples as of the date of this revision together with literature records from published taxonomic monographs. Insect orders are listed as in Merritt and Cummins (1996); families and genera are listed alphabetically. Any suggestions for modifications of this list should be sent to the attention of Peter Ode, CDFG Aquatic Bioassessment Laboratory (pode@ospr.dfg.ca.gov).

Standard Taxonomic Effort

The goal of the accompanying list is to standardize levels of taxonomic effort among labs conducting the CSBP. For benthic macroinvertebrate (BMI) datasets to be compatible, taxa need to be identified to a common level, thus CAMLnet has defined a level of taxonomic resolution that labs performing the CSBP should use—the “standard taxonomic effort”.

When datasets are combined, all datasets must default to the least precise taxonomic information resulting in a loss of the more precise information. Therefore, levels of taxonomic effort that are more precise than the standard taxonomic effort are acceptable since the resulting taxonomic information can be collapsed into the standard levels when comparisons are being made. In contrast, less precise levels should be avoided because they result in a loss of information relative to the standard taxonomic effort.

The CAMLnet Standard Taxonomic List

A practical level of standard effort is determined by the cost-effectiveness of identification relative to effort. Obviously, cost-effectiveness is highly dependent on taxonomic skills, but it is also determined by the availability of accurate keys and the degree of special methodology (e.g. slide-mounting) needed to identify taxa.

Some bioassessment programs use the availability of species keys to establish standard levels of effort, and for some taxonomic groups we do provide a list of species known to occur in California and references to species level keys where they exist. However, in the CSBP, the objective is to identify all taxa to an even level of taxonomic effort, which is the genus level for most insects. When a genus is monotypic the species designation is listed for that taxon. Most non-insects also are identified to genus, but many are left at family level or higher taxonomic levels. It is CAMLnet’s goal to improve the taxonomic resolution in these groups.

The standard taxonomic list includes the California Tolerance Value and Functional Feeding Group classifications used in the CSBP.

California Tolerance Value

This metric is based on the Hilsenhoff Biotic Index that uses a set of taxon-specific tolerance values to calculate an overall, or community level tolerance. Based on a scale of 0 (highly intolerant) to 10 (highly tolerant), this metric was originally designed to serve as a measure of community tolerance to organic pollution in Wisconsin streams, but is commonly used as a general index of pollution tolerance. Application of this metric to all types of disturbance is complicated by the fact that the original values are regionally specific, and by the fact that different organisms can respond uniquely to different pollution or disturbance types. For example, a genus that is highly tolerant to sediment or organic pollution might be very intolerant to disturbance from heavy metals or pesticides. However, this index has been found to be useful as a general measure of community tolerance to human disturbance, although its use should be treated with caution. In future iterations, it is proposed that there will be disturbance-specific tolerance values.

Robert Wisseman (Aquatic Biology Associates, Inc., Corvallis Oregon.) has developed regionally specific tolerance values for BMI communities in the Pacific Northwest. In addition, the EPA has established a list of tolerance values applicable to BMI communities in the northwestern U.S. based on their bioassessment program in Idaho. The CSBP uses the tolerance values assigned by Aquatic Biology Associates, Inc. unless a taxon found in California is not assigned a value in the Pacific Northwest, in which case the EPA value for Idaho is used. Taxa for which the EPA value is used are marked with an asterisk (*) in the tables below. Although there is a large degree of overlap in the distributions of macroinvertebrates in the northwestern U.S. and California, California shares much of its fauna with other southwestern states and Mexico. Furthermore, California has a remarkable diversity of ecoregions, many of which are unique and contain taxa that are endemic to the state. For this reason there are many genera and several families that do not currently have tolerance values assigned to them.

For purposes of assigning tolerance values to taxa that currently have no assigned value in the aforementioned documents (**listed in boldface in the tables below**), we have adopted the following conventions:

- 1) A genus or species not currently assigned a tolerance value defaults to the value of the next highest ranking taxon (but see convention 3 below).
- 2) Families (and all constituent genera) not currently assigned a tolerance value are left as unknown (Insect orders are not assigned tolerance values).
- 3) Families with great variability in the tolerance values of their constituent genera are not assigned a value. Genera and species with unknown tolerance are not assigned a value if there is great variability in related taxa.

As more information becomes available for individual genera, they will be given distinct tolerance values. In the absence of tolerance information for a taxon (e.g. a member of a rare family that has not been assigned a tolerance value, or an undetermined genus in a family with a wide range of possible tolerance values), bioassessment metrics should be adjusted to ignore this taxon in the CTV metric calculation. This will usually not affect the metrics calculations unless the taxon in question is very abundant in the sample.

Functional Feeding Group

The FFG assigns taxa to classes based on the primarily feeding mechanism of the group as opposed to its trophic level. Easier versions of the CSBP listed only 5 categories: Predators, Grazers, Shredders, Filterers (~Collector-filterers) and Collectors (~Collector-gatherers). This set of FFGs has been valuable, but this set was determined to be too restrictive. The new list presented below is intended to give more precise designations and to make our categories more consistent with other bioassessment programs.

As with the California Tolerance Values, most of the functional feeding group information in this document has been derived from the lists developed for the Pacific Northwest by Aquatic Biology Associates, Inc., which in turn was derived from Merritt and Cummins (1996) and other primary reference texts. In cases where information regarding FFG was lacking from the northwestern document, the information was derived directly from the general texts cited below. Taxa are commonly variable in their feeding mechanisms; we have attempted to represent this variability by listing primary and secondary feeding mechanisms where appropriate. As with the CTV designation the FFG defaults to the value for the family when generic values are not designated.

Abbreviations used in denoting functional feeding groups are as follows:

P= predator	MH= macrophyte herbivore	OM= omnivore
PA= parasite	PH= piercer herbivore	XY= xylophage (wood eater)
CG= collector-gatherer	SC= scraper	
CF= collector filterer	SH= shredder	

Note: For the FFG proportional bioassessment metrics we recommend the use of the following major categories of FFGs: Predators, Collector-gatherers, Collector-filterers, Scrapers, Shredders and Other (which includes all other functional groups).

List of Taxa to Reject from Benthic Lists

The following taxa are not to be included in benthic analyses. Some of these have never been included in CSBP lists and some are newly dropped from the list. Most of these changes reflect an attempt to make the CSBP standards move toward the standards adopted by the Northwestern Taxonomic Group's standards with the eventual goal of adopting a Western Standard for Taxonomic Effort.

Cladocera	These are not generally benthic and in some cases can bias samples collected in close proximity to reservoirs.
Copepoda	These are not generally benthic and in some cases can bias samples because of proximity to reservoirs.
Branchiura	Commensals on crayfish
Non-Benthic Insects	Gerridae, Gyridae (adults), Hydrometridae, Notonectidae, Collembola
Nematoda	

On “Phantom Taxa” and the concept of “Distinct Taxa”

Taxonomists are often forced to back identifications off to a coarser level of identification than specified by the Standard Effort. This may occur because specimens are damaged or are too small (i.e. early instar) to have developed diagnostic characters. One concern among data analysts is that backing off to coarser taxonomic levels creates “phantom taxa” that may not be truly distinct from identifiable specimens, but nonetheless get counted as an additional taxon and artificially add to taxonomic richness metrics.

In an attempt to effectively deal with this problem, the Northwest Taxonomic Workgroup (sponsored by EPA Region 10, see the following link for more information about this group:

www.xerces.org/aquatic/taxonomic_workshops.htm) instituted a concept known as the “Distinct Taxon” to avoid the problem with “phantom taxa” while maintaining high quality, defensible data. Essentially, any final ID that is not taken to the standard level of effort [e.g. a species of *Baetis* that is left at the genus level, even though standard effort is species (as it will be in Level II CSBP)] is recorded as “Not Distinct” unless there are good confirming characters indicating that specimens in question are not the same as ones already identified in a sample. If such characters do exist, specimens are labeled as “Distinct”. This provides the data analyst with the ability to either count or not count such taxa, depending on the goals of the analysis. DFG-ABL has adopted this procedure, and we recommend it over other alternatives such as EPA’s 1 through 5 “scale of confidence”. **We strongly recommend that all labs generating taxonomic data follow this method for designating distinct and non-distinct taxa.**

In a related issue, the US Geological Survey National Water Quality Laboratory (Moulton *et al.* 2000) recommends the addition of a justification code for any organisms that could not be identified to the recommended level. Examples include damaged organisms, early instars, inadequate literature, etc. **We also recommend this, but note that this is not as critical as recording the distinct/ non-distinct information.**

CSBP Level II Standard Effort

In several recent projects, the DFG ABL has experimented with a more precise level of taxonomic resolution than that described here. For several projects we routinely identify many insect taxa to species and most chironomid midges to genus or species. We are currently investigating the possibility of recommending an additional taxonomic effort, CSBP Level II, to be used in some situations. We recommend that that the Level II standard effort match as closely as possible the taxonomic levels used by the Pacific Northwest Taxonomic Group and that used for the EPA’s Environmental Monitoring and Assessment Program (EMAP). A goal of establishing a common Western Taxonomic Standard may be realized in the next few years.

As bioassessment programs in California expand, it is likely that more than one level of standard effort will be used depending on the goals of the project. We are currently exploring the benefits of more precise analysis levels and will use the results of our findings to inform any future recommendations about taxonomic standards. CAMLnet will make recommendations for future standards in future documents. For more information, please contact Peter Ode at DFG-ABL: pode@ospr.dfg.ca.gov.

GENERAL TAXONOMIC KEYS

Most aquatic insects can be identified to genus using the keys in Merritt and Cummins (1996). In addition, the species keys, general descriptions and figures in Usinger (1956) are still very useful, although much of the taxonomy is out of date.

For Insects:

- Merritt, R.W. and K.C. Cummins. 1996. An Introduction to the Aquatic Insects of North America (3rd edition). Kendall/ Hunt Publishing Company, Dubuque, Iowa.
- Usinger, R.L. (ed.). 1956. Aquatic Insects of California. University of California Press, Berkeley, CA.

For Other Aquatic Macroinvertebrates:

Pennak, R. M. 1989. Freshwater Invertebrates of the United States (2nd edition). J. Wiley and Sons, N.Y.

Thorp, J.H. and A. P. Covich, eds. 2001. Ecology and Classification of North American Freshwater Invertebrates. 2nd edition. Academic Press, San Diego, CA.

In addition to these general keys, there are many supplemental keys to specific orders, families, genera and species that are listed in the sections for each group.

Acknowledgements

Much of the information in this document was compiled from the following sources in addition to literature cited in the text:

Lester, Gary, Scott Lindstrom, John Pfeiffer, Chad Robinson, Michael Walters. August 2000- Unpublished. Laboratory methods and a proposed standard taxonomic effort for aquatic macroinvertebrate samples collected in Idaho. Prepared by EcoAnalysts, Inc.

Moulton, S.R., J.L. Carter, S.A. Groetheer, T.F. Cuffney, and T.M. Short. 2000. Methods of analysis by the US Geological Survey National Water Quality Laboratory- Processing, taxonomy and quality control of benthic macroinvertebrate samples. Open-File Report 00-212. Denver, Colorado.

Plotnikoff, R.W. and J. S. White. 1996. Taxonomic laboratory protocol for stream macroinvertebrates collected by the Washington State Department of Ecology. Washington State Department of Ecology Publication No. 96-323.

Wissemann, Robert. March 1996-Unpublished. Common Pacific Northwest benthic invertebrate taxa: Suggested levels for standard taxonomic effort. Aquatic Biology Associates, Corvallis, Oregon.

SECTION I: INSECT TAXA

EPHEMEROPTERA: MAYFLIES

Standard Effort: Genus.

Mayflies can be identified to genus using the chapter by Edmunds and Waltz in Merritt and Cummins (1996). A large number of taxonomic revisions exist for various mayfly families and genera. It is beyond the scope of this guide to provide a full listing, and the papers listed below represent those that the CDFG-ABL refers to regularly as supplements. Anyone interested in a more comprehensive listing should consult the references in Merritt and Cummins 1996.

- Lugo-Ortiz, C.R. and W.P. McCafferty. 1998. A new North American genus of Baetidae (Ephemeroptera) and key to *Baetis* complex genera. Entomological News 109:345-353.
- McCafferty, W.P. and R.D. Waltz. 1990. Revisionary synopsis of the Baetidae (Ephemeroptera) of North America. Transactions of the American Entomological Society 116:769-799.
- Morihara, D.K. and W.P. McCafferty. 1979. The *Baetis* larvae of North America (Ephemeroptera: Baetidae). Transactions of the American Entomological Society 105:139-221.

EPHEMEROPTERA	CTV	1° FFG	2° FFG	Comments/ Specific Taxonomic Literature/ Distributional Information
Ameletidae				
<i>Ameletus</i>	0	cg		Zloty and Pritchard (1997) provided a key to larvae of Alberta, though it is of limited use in CA.
Baetidae	4	cg	sc	Lugo-Ortiz and McCafferty (1998).
<i>Acentrella</i> *	4	cg		For species, see McCafferty et al. (1994).
<i>A. insignificans</i> (McDunnough)*	4	cg		
<i>A. turbida</i> (McDunnough)	4	cg	sc	
<i>Baetis</i>	5	cg	sc	For species, see Morihara and McCafferty (1979), but beware of recent nomenclatural changes (McCafferty and Waltz [1990]).
<i>B. adonis</i> Traver	5	cg	sc	
<i>B. bicaudatus</i> Dodds	4	cg	sc	
<i>B. flavistriga</i> McDunnough*	4	cg		
<i>B. magnus</i> McCaff. & Waltz	5	cg	sc	
<i>B. tricaudatus</i> Dodds	6	cg	sc	
<i>Callibaetis</i>	9	cg		
<i>Camelobaetidius</i>	4	cg	sc	For species, see Lugo-Ortiz and McCafferty (1995).
<i>C. similis</i> Lugo-Ortiz & McCaf.	4	cg	sc	
<i>C. warreni</i> (Traver & Edmunds)	4	cg	sc	
<i>Centroptilum</i>	2	cg	sc	Western <i>Centroptilum</i> and <i>Procloeon</i> are very difficult to separate (McCafferty and Waltz 1990) and may be left at <i>Centroptilum/Procloeon</i> .

EPHEMEROPTERA	CTV	1° FFG	2° FFG	Comments/ Specific Taxonomic Literature/ Distributional Information
<i>Cloeodes excogitatus</i> Waltz & McCaf.	4	cg	sc	Known in CA from Humboldt and Ventura counties.
<i>Dipheter hageni</i> (Eaton)	5	cg	sc	Monotypic genus; keys as <i>Baetis hageni</i> in Morihara and McCafferty (1979).
<i>Fallceon quilleri</i> (Dodds)	4	cg	sc	For species, see Lugo-Ortiz et al. (1994); <i>F. quilleri</i> is only sp. in CA.
<i>Paracloeodes minutus</i> (Daggy)	4	cg	sc	Monotypic genus.
<i>Procloeon</i>	4	cg	sc	Western <i>Centroptilum</i> and <i>Procloeon</i> are very difficult to separate (McCafferty and Waltz 1990) and may be left at <i>Centroptilum/ Procloeon</i> .
Caenidae	7	cg		
<i>Caenis</i>	7	cg		For species, see Provonsha (1990)
<i>C. amica</i> Hagen	7	cg		
<i>C. bajaensis</i> Allen & Murvosh	7	cg		
<i>C. latipennis</i> Banks*	7	cg	sc	
Ephemerellidae	1	cg	sc	
<i>Attenella</i>	2	cg	sc	For species-Allen and Edmunds (1961b)
<i>A. delantala</i> (Mayo)	2	cg	sc	
<i>A. soquele</i> (Day)	2	cg	sc	
<i>Caudatella</i>	1	cg	sc	For species-Allen and Edmunds (1961a)
<i>C. cascadia</i> (Allen & Edmunds)	1	cg	sc	
<i>C. heterocaudata</i> (McDunnough)	1	cg	sc	
<i>C. hystrix</i> (Traver)	1	cg	sc	
<i>Drunella</i>	0	cg	sc	For species- Allen and Edmunds (1962).
<i>D. coloradensis</i> (Dodds)	0	p		
<i>D. doddsi</i> (Needham)	0	cg	sc	
<i>D. flavinea</i> (McDunnough)	0	cg	sc	
<i>D. grandis</i> (Eaton)	0	cg	sc	
<i>D. pelosa</i> (Mayo)	0	cg	sc	
<i>D. spinifera</i> (Needham)	0	p		
<i>Ephemerella</i>	1	cg	sc	For species- Allen and Edmunds (1965). <i>Ephemerella</i> and <i>Serratella</i> can be difficult to distinguish as generic characters sometimes overlap. Species level identification can confirm generic placement.
<i>E. aurivillii</i> (Bengtsson)	1	cg	sc	
<i>E. inermis/infrequens</i>	1	cg	sc	
<i>E. maculata</i> Traver	1	cg	sc	
<i>Eurylophella lodi</i> (Mayo)	1	cg	sc	
<i>Serratella</i>	2	cg	sc	For species- Allen and Edmunds (1963). <i>Ephemerella</i> and <i>Serratella</i> can be difficult to distinguish as generic characters sometimes overlap. Species level identification can confirm generic placement.
<i>S. levis</i> (Day)	2	cg	sc	
<i>S. micheneri</i> (Traver)*	1	cg	sc	
<i>S. teresa</i> (Traver)	2	cg	sc	
<i>S. tibialis</i> (McDunnough)	2	cg	sc	
<i>S. velmae</i> (Allen & Edmunds)	2	cg	sc	

EPHEMEROPTERA	CTV	1° FFG	2° FFG	Comments/ Specific Taxonomic Literature/ Distributional Information
<i>Timpanoga hecuba pacifica</i> (Allen & Edmunds)	7	cg		
Ephemeridae				
<i>Hexagenia limbata californica</i> Upholt	6	cg		Only ephemerid in CA.
Heptageniidae	4	sc		
<i>Cinygma</i>	2	sc	sh	
<i>Cinygmula</i>	4	sc		
<i>Epeorus</i>	0	sc		For Rocky Mtn. spp. see Edmunds and Allen (1964); 6 western spp. are not included in that key.
<i>Heptagenia</i>	4	sc		
<i>Ironodes</i>	3	sc		
<i>Leucrocuta/Nixe</i>	3	sc		According to Merritt and Cummins (1996), <i>Leucrocuta</i> has many dark spots near the anterior margin of the head and the head is wider than the prothorax. However, there is at least one species in the state (coastal distribution) that has the head barely wider than the thorax and has faint spots near the front of the head. This is probably a <i>Nixe</i> species. Doubtful specimens should be left at family, or <i>Leucrocuta/Nixe</i> .
<i>Rhithrogena</i>	0	sc		
Isonychiidae	2			
<i>Isonychia velma</i> Needham	2	cf		Only CA species; see Kondratieff and Voshell (1984).
Leptohyphidae	4	cg		
<i>Asioplax</i>	4	cg		Recently described by Wiersema and McCafferty (2000).
<i>Tricorythodes</i>	4	cg		
Leptophlebiidae	2	cg		
<i>Choroterpes</i>	2	cg		
<i>Paraleptophlebia</i>	4	cg		<i>P. helena</i> Day and <i>P. zayante</i> Day have tusks; both are in CA
<i>Traverella</i>	2	cg		In California???
Siphonuridae	7	cg		
<i>Edmundsius agilis</i> Day	7	cg		Described from Madera County, Yosemite Park, 6500-8000 feet.
<i>Siphonurus</i>	7	cg		For spp: Needham, Travers & Hsu 1935.

ODONATA: DRAGONFLIES AND DAMSELFLIES

Standard Effort: Genus (unless monotypic or only one species occurs in California; see table for species).

Minter Westfall's chapter on Odonata in Merritt and Cummins (1996) is very suitable for general taxonomic work. It is sometimes difficult to distinguish larval Corduliidae and Libellulidae because of overlapping characters. Westfall and May's (1996) reference on damselflies is comprehensive and provides species keys to all known larvae. Needham, Westfall and May (2000) provides equivalent coverage of North American dragonflies. Andrew Rehn's supplement to the CAMLnet Odonata workshop also contains many useful resources.

- Westfall, M.J. and May. 1996. Damselflies of North America. Scientific Publishers. Gainesville, FL.
- Needham, J., M. J. Westfall and M.L. May 2000. Dragonflies of North America. Scientific Publishers, Gainesville
- Rehn, Andrew. September 2000. Proceedings of the California Aquatic Macroinvertebrate Laboratory Network (CAMLnet) Odonata Workshop. Contains a California species checklist and distributional information, regional keys, some supplemental species keys, illustrations of common taxa and a bibliography.
- Walker, E. M. 1953. The Odonata of Canada and Alaska. Vol. 1. University of Toronto Press, Toronto. (Original volumes are out of print and very hard to locate, but Univ. of Toronto Press issued a fairly good quality reprint in 1998.)
- Walker, E. M. 1958. The Odonata of Canada and Alaska. Vol. 2. University of Toronto Press, Toronto.
- Walker, E.M. and P.S. Corbet. 1975. The Odonata of Canada and Alaska. Vol. 3. University of Toronto Press, Toronto.

Note on Odonate CTV: The tolerance values currently established for Odonata are likely to undergo considerable revisions in the near future. These are the values used in the Pacific Northwest, but several of the family and genus level tolerance numbers are inaccurate measures for these taxa. We strongly recommend the use of caution when assigning tolerance values to the numbers listed.

Odonata	CTV	FFG()	Comments/ Specific Taxonomic Literature/ Distributional Information
Aeshnidae			
<i>Aeshna</i>	5	p	Even late instar larvae are difficult to distinguish and should be left at genus.
<i>Anax</i>	8	p	
<i>Oplonaeshna armata</i> (Hagen)		p	Only one CA record from Water Canyon in Inyo County

Calopterygidae	5	p	
<i>Calopteryx aequabilis</i> Say	5	p	Relatively intolerant of pollution; rare in northern California
<i>Hetaerina americana</i> (Fabricius)	6	p	Relatively tolerant of pollution
Coenagrionidae		p	
<i>Amphiagrion abbreviatum</i> (Selys)*	5	p	
<i>Argia</i>	7	p	
<i>Coenagrion resolutum</i> (Hagen)		p	Uncommon in northern Sierra lakes and bogs; larvae hard to distinguish from <i>Enallagma</i> spp.
<i>Enallagma</i>	9	p	
<i>Ischnura</i>	9	p	
<i>Telebasis salva</i> (Hagen)		p	Widespread but uncommon at low to middle elevations
<i>Zoniagrion exclamationis</i> (Selys)*	9	p	CA endemic; monotypic; so why was it assigned a TV of 9 by EPA in Idaho?
Cordulegrastridae	3	p	
<i>Cordulegaster dorsalis</i> Hagen	3	p	
Corduliidae*	2	p	Corduliids are very unlikely in samples collected by the CSBP.
<i>Cordulia shurtleffi</i> Scudder	2	p	N. Cal. Ponds and lakes at higher elevation.
<i>Epithea canis</i> McLachlan	2	p	Found in lakes and slower sections of N. Cal. Streams.
<i>Somatochlora</i> *	9	p	Boggy marshes and lakes at higher elevation in N. Cal. Uncommon.
Gomphidae	4	p	
<i>Erpetogomphus</i> *	4	p	
<i>Gomphus kurilis</i> Hagen	4	p	Northern California streams.
<i>Octogomphus specularis</i> (Hagen)	4	p	Monotypic genus.
<i>Ophiogomphus</i>	4	p	
<i>Progomphus borealis</i> McLachlan	4	p	
Lestidae	9	p	
<i>Archilestes</i>	9	p	
<i>Lestes</i> *	9	p	
Libellulidae	9	p	
<i>Brachymesia furcata</i> (Hagen)	9	p	Southern Californian ponds
<i>Brechmorhoga mendax</i> (Hagen)	9	p	Deep crenulations in labial palps make this key to Corduliidae in Merritt and Cummins
<i>Erythemis collocata</i> (Hagen)	9	p	
<i>Leucorrhinia</i>	9	p	
<i>Libellula</i> *	9	p	
<i>Macrodiplax balteata</i> (Hagen)	9	p	Riverside County desert springs
<i>Orthemis ferruginea</i> (Fabricius)	9	p	
<i>Pachydiplax longipennis</i> (Burm.)	9	p	Monotypic genus.
<i>Paltothemis lineatipes</i> Karsch	9	p	Deep crenulations in labial palps make this key to Corduliidae in Merritt and Cummins
<i>Pantala flavescens</i> (Fabricius)	9	p	
<i>Perithemis intensa</i> Kirby	9	p	
<i>Plathemis</i>	9	p	
<i>Sympetrum</i>	9	p	
Macromiidae			
<i>Macromia magnifica</i> McLachlan	2	p	N. Cal. foothills and coast ranges; CTV is from Corduliidae, in which this genus is sometimes placed.
Petaluridae			Gets a 10 for TV in EPA document, which is absurd.
<i>Tanypteryx hageni</i> (Selys)		p	Rare and localized in northern California seeps and springs

PLECOPTERA: STONEFLIES

Standard Effort: Genus

Early instar stoneflies can be very difficult to identify, and in the families Capniidae, Chloroperlidae, and Leuctridae should be left at family when mature specimens are not available.

The generic keys in Merritt and Cummins (1996) are suitable, although the keys in Stewart and Stark (1993) are more comprehensive. A new edition of Stewart and Stark is in the works and is due out in the near future.

- Stewart, K.W. and B.P. Stark. 1993. Nymphs of North American stonefly genera (Plecoptera). University of North Texas Press, Denton, Texas.

Additional references of interest include:

- Baumann, R.W., A.R. Gaufin and R.F. Surdick. 1977. The stoneflies (Plecoptera) of the Rocky Mountains. Memoirs of the American Entomological Society No. 31.
- Bottorff, R.L., K.W. Stewart and A.W. Knight. 1989. Description and drumming of *Susulus*, a new genus of stonefly (Plecoptera: Perlodidae) from California. Annals of the Entomological Society of America 82:545-554.
- Stark, B.P. and C.R. Nelson. 1994. Systematics, phylogeny and zoogeography of the genus *Yoraperla* (Plecoptera: Pletoperlidae). Entomologica Scandinavica 25:241-273.

All distributional information for this group derived from Stewart and Stark (1993).

PLECOPTERA	CTV	1°FFG	2°FFG	Comments/ Specific Taxonomic Literature/ Distributional Information *
Capniidae	1	sh		
<i>Bolshecapnia maculata</i> (Jewett)	1	sh		Only species in CA.
<i>Capnia</i> *	1	sh		
<i>Eucapnopsis brevicauda</i> Claassen *	1	sh		Only North American species
<i>Mesocapnia</i>	1	sh		
<i>Utacapnia</i>	1	sh		
Chloroperlidae	1	p		
<i>Alloperla</i> *	1	p		
<i>Bisancora</i>	1	p		
<i>Haploperla chilnualna</i> (Ricker)	1	p		Only species in CA
<i>Kathroperla</i>	0	p		Two known species, both of which occur in CA.
<i>K. perdita</i> Banks	0	p		
<i>K. tahoma</i> Stark & Surdick	0	p		
<i>Paraperla</i>	0	p		Two known species, both of which occur in CA.
<i>P. frontalis</i> (Banks)	0	p		
<i>P. wilsoni</i> Ricker	0	p		

PLECOPTERA	CTV	1 ^o FFG	2 ^o FFG	Comments/ Specific Taxonomic Literature/ Distributional Information *
<i>Plumiperla</i>	1	p		Genus is difficult to distinguish from <i>Triznaka</i> . Two known species, both of which occur in CA.
<i>P. diversa</i> (Frison)	1	p		
<i>P. spinosa</i> (Surdick)	1	p		
<i>Suwallia</i> *	1	p		Two species known to occur in CA..
<i>S. autumnna</i> (Hoppe)	1	p		
<i>S. pallidula</i> (Banks)	1	p		
<i>Sweltsa</i>	1	p		
Leuctridae	0	sh		
<i>Calileuctra</i>	0	sh		Two known species, both endemic to CA.
<i>C. dobryi</i> Shepard & Baumann	0	sh		
<i>C. ephemera</i> Shepard & Baumann	0	sh		
<i>Despaxia augusta</i> (Banks)*	0	sh		Monotypic; fairly rare in CA
<i>Moselia infuscata</i> (Claassen)	0	sh		Monotypic.
<i>Paraleuctra</i> *	0	sh		Most common leuctrid stonefly found in the Sierra Nevada mountain range.
<i>Perlomyia</i> *	0	sh		Two known species, both of which occur in CA..
<i>P. collaris</i> Banks	0	sh		
<i>P. utahensis</i> Ndm. & Claassen	0	sh		
<i>Pomoleuctra</i>	0	sh		
Nemouridae	2	sh		
<i>Malenka</i>	2	sh		
<i>Nemoura spiniloba</i> Jewett	1	sh		Only species found in CA
<i>Podmosta delicatula</i> (Claassen)	2	sh		Only species found in CA
<i>Prostoia besametsa</i> (Ricker)	2	sh		Only species found in CA
<i>Soyedina</i>	2	sh		Two species known to occur in CA. Both have a dark head spot (R. Bottorff, pers. comm..).
<i>S. nevadensis</i> (Claassen)	2	sh		
<i>S. producta</i> (Claassen)	2	sh		
<i>Visoka cataractae</i> (Naeve)	0	sh		Monotypic.
<i>Zapada</i>	2	sh		For spp., see Baumann et al. (1977)
<i>Z. cinctipes</i> (Banks)	2	sh		
<i>Z. columbiana</i> (Claassen)	2	sh		
<i>Z. frigida</i> (Claassen)	2	sh		
Peltoperlidae	1	sh		
<i>Sierraperla cora</i> (Ndm. & Smith)	1	sh		Monotypic; known from CA, OR and NV.
<i>Soliperla</i>	1	sh		
<i>Yoraperla</i>	1	sh		Two known species, both of which occur in CA. See Stark and Nelson 1994 for key.
<i>Y. brevis</i> (Banks)	1	sh		
<i>Y. mariana</i> (Ricker)	1	sh		
<i>Y. nigrisoma</i> (Banks)	1	sh		
<i>Y. siletz</i> Stark & Nelson	1	sh		
Perlidae	1	p		
<i>Calineuria californica</i> (Banks)	2	p		Only North American species
<i>Claassenia sabulosa</i> (Banks)	3	p		Only North American species

PLECOPTERA	CTV	1 ^o FFG	2 ^o FFG	Comments/ Specific Taxonomic Literature/ Distributional Information *
<i>Doroneuria baumanni</i> Stark & Gauf.	1	p		Only species in CA
<i>Hesperoperla</i>	2	p		Two known species, both of which occur in CA.
<i>H. hoguei</i> Baumann & Stark	2	p		
<i>H. pacifica</i> (Banks)	2	p		
Perlodidae	2	p		
<i>Calliperla luctuosa</i> (Banks)	2	p		Monotypic.
<i>Cascadoperla trictura</i> (Hoppe)	2	p		Monotypic.
<i>Cosumnoperla hypocrenea</i> Szczytko & Bottorff	2	p		Monotypic; known only from the headwaters of the Consumnes River watershed in N. Calif.
<i>Cultus</i>	2	p		Two species are known in CA. Early instars of this genus may be difficult to distinguish from <i>Osobenus</i> sp.
<i>C. pilatus</i> (Frison)	2	p		
<i>C. tostonus</i> (Ricker)	2	p		
<i>Diura knowltoni</i> (Frison)	2	p		Only species found in CA. Noted as a high elevation species, found only above 1800m in CA.
<i>Frisonia picticeps</i> (Hanson)	2	p		Monotypic.
<i>Isogenoides colubrinus</i> (Hagen)	2	p		Only species found in CA
<i>Isoperla</i>	2	p		Extremely diverse genus. Early instars should be keyed with caution.
<i>Kogotus nonus</i> (Ndm. & Claassen)	2	p		Only two known species, one of which occurs in CA.
<i>Megarcys</i>	2	p		Two species are known to occur in CA.
<i>M. subtruncata</i> Hanson	2	p		
<i>M. yosemite</i> Ndm. & Claassen	2	p		
<i>Oroperla barbara</i> Needham *	2	p		Monotypic; endemic to streams and rivers of the Sierra Nevada Mountains, CA
<i>Osobenus yakimae</i> (Hoppe)	2	p		Monotypic; apparently confined to CA, OR, WA and British Columbia. . Early instars of this genus may be easily confused with those of <i>Cultus</i> sp.
<i>Perlinodes aureus</i> (Smith)	2	p		Monotypic.
<i>Rickera sorpta</i> (Ndm. & Claassen)	2	p		Monotypic; confined to the west.
<i>Skwala parallela</i> (Frison)	2	p		Only two North American species; one is known to occur in CA.
<i>Salmoperla sylvanica</i> Baumann & Lauck	0	p		Monotypic; endemic to CA. We have specimens from Siskiyou Co.
<i>Susulus venustus</i> (Jewett)	2	p		Monotypic; endemic to CA
Pteronarcyidae	0	om	sh	
<i>Pteronarcella regularis</i> (Hagen)	0	om	sh	Only North American species known to occur in CA
<i>Pteronarcys</i>	0	om	sh	For species, see Baumann et al. (1977)
<i>P. californica</i> Newport	1	om	sh	
<i>P. princes</i> Banks	0	om	sh	
Taeniopterygidae	2	om	sh	
<i>Oemopteryx vanduzeeae</i> (Claassen)	2	om	sh	
<i>Taenionema</i>	2	om	sh	Eight North American species, six of which are known to occur in CA FFG
<i>Taeniopteryx nivalis</i> (Fitch)	2	om	sh	We have this from the Pit River in Modoc Co only.

HEMIPTERA: TRUE BUGS

Standard Effort: Genus (Merritt and Cummins 1996)

Keys and detailed distributional information for species of aquatic and semi-aquatic Hemiptera of California are available in the following monograph:

- Menke, A.S. (ed.) 1979. The semiaquatic and aquatic Hemiptera of California. Bulletin of the California Insect Survey Volume 21. UC Press, Berkeley.

HEMIPTERA	CTV	FFG(U)	Comments/ Specific Taxonomic Literature/ Distributional Information
Belostomatidae	8	p	
<i>Abedus</i>	8	p	
<i>Belostoma</i>	8	p	
Corixidae	8	p	
<i>Callicorixa</i>	8	p	
<i>Cenocorixa</i> *	8	p	
<i>Corisella</i>	8	p	
<i>Graptocorixa</i>	8	p	
<i>Hesperocorixa</i>	8	p	
<i>Sigara</i> *	8	p	
<i>Trichocorixa</i>	8	p	
Naucoridae*	5	p	
<i>Ambrysus</i>	5	p	
Notonectidae		p	Do not include in benthic datasets
<i>Notonecta</i>		p	

MEGALOPTERA: ALDERFLIES AND DOBSONFLIES

Standard Effort: Genus (Merritt and Cummins [1996]).

MEGALOPTERA	CTV	FFGD	Comments/ Specific Taxonomic Literature/ Distributional Information
Corydalidae	0	p	
<i>Corydalis</i>	0	p	
<i>Dysmicohermes</i>	0	p	
<i>Neohermes</i>	0	p	
<i>Orohermes crepusculus</i> (Chandler)*	0	p	
Sialidae	4	p	
<i>Sialis</i>	4	p	

TRICHOPTERA: CADDISFLIES

Standard Effort: Genus, unless monotypic.

The standard taxonomic reference for this group is:

Wiggins, G.B. 1996. Larvae of the North American Caddisfly Genera (Trichoptera). 2nd edition.
University of Toronto Press, Toronto.

* All distributional information for Tricoptera was derived from Wiggins (1996).

TRICHOPTERA	CTV	1°FFG	2°FFG	Comments/ Specific Taxonomic Literature/ Distributional Information
Apataniidae	1	sc		
<i>Apatania</i>	1	sc		Eastern and western montane species; have been collected from lakes.
<i>Pedomoecus sierra</i> Ross	0	sc		Monotypic genus.
Brachycentridae	1			
<i>Amiocentrus aspilus</i> (Ross)	3	cg	sc	Only species known to occur in North America.
<i>Brachycentrus</i>	1	om	sc	See Flint (1984).
<i>B. americanus</i> (Banks)	1	om	sc	
<i>B. echo</i> (Ross)	1	om	sc	
<i>B. occidentalis</i> Banks	1	om	sc	
<i>Micrasema</i>	1	mh	sc	Common and widely distributed throughout North America. See Chapin (1978) for key to 14 spp. of N. American larvae.
Calamoceratidae	1	sh	xy	
<i>Heteroplectron californicum</i> McLach.	1	sh	xy	Only species known to occur in CA, larvae usually found in pools or areas of slower moving water.
Glossosomatidae	0	sc		
<i>Agapetus</i>	0	sc		Only larvae in the family with two mesonotal scerites.
<i>Anagapetus</i>	0	sc		Six species are known to occur in the western montane areas
<i>Culoptila</i>	2	sc		We have specimens from the East Walker R. and a handful of other sites, otherwise unrecorded from CA.
<i>Glossosoma</i>	1	sc		
<i>Protoptila</i>	1	sc		
Goeridae	1	sc		
<i>Goeracea</i>	0	sc		
Helicopsychidae	3	sc		
<i>Helicopsyche borealis</i>	3	sc		
Hydropsychidae	4	cf	p	
<i>Arctopsyche</i> *	1	p	cf	For species, see Givens and Smith (1980).
<i>A. californica</i> Ling *	2	p	cf	
<i>A. grandis</i> (Banks)	1	p	cf	
<i>Cheumatopsyche</i>	5	cf		Immature larvae- see Mackay 1978
<i>Diplectrona californica</i> Banks*	0	cf		
<i>Homoplectra</i>	4	cf	p	We have this from Jones Gulch, San Mateo Co.

Trichoptera

TRICHOPTERA	CTV	1°FFG	2°FFG	Comments/ Specific Taxonomic Literature/ Distributional Information
<i>Hydropsyche</i>	4	cf		Immature larvae- see Mackay 1978
<i>Parapsyche</i>	0	p	cf	For species, see Givens and Smith (1980)
<i>P. almota</i> Ross	2	p	cf	
<i>P. elsis</i> Milne	1	p	cf	
Smicridea	4	cf		We have early instar specimens from the upper San Joaquin.
Hydroptilidae	4	ph	sc	See Blickle (1979) for additional information on hydroptilids north of Mexico.
<i>Agraylea</i>	8	ph		
<i>Hydroptila</i>	6	ph	sc	
<i>Ithytrichia clavata</i> Morton	6	sc		Only western species.
<i>Leucotrichia pictipes</i> (Banks)	6	sc	cg	Only species in CA.
Metrichia	4	ph		In California?? Probably not in CA... see Flint (1972) and Blickle (1979)
<i>Neotrichia</i>	4	sc		
Nothotrichia shasta Harris & Armitage	4	ph	sc	ID based on pharate adults; we have specimens from El Dorado, Fresno, Placer and Trinity counties.
<i>Ochrotrichia</i>	4	ph	cg	See Flint (1972) for distributional information.
<i>Oxyethira</i>	3	ph	cg	
Palaeagapetus nearcticus Banks	4	ph		Only species known in the western U.S.
<i>Stactobiella</i>	4	mh	sh	
Lepidostomatidae	1	sh		
<i>Lepidostoma</i>	1	sh		Weaver 1988
Leptoceridae	4	om		
<i>Ceraclea</i>	3	om		
<i>Mystacides</i>	4	om		Yamamoto and Wiggins 1964
M. alafimbriata Hill-Griffen	4	om		
M. sepulchralis (Walker)	4	om		
<i>Nectopsyche</i>	3	om		Haddock 1997
<i>N. gracilis</i> (Banks)*	3	om		
<i>Oecetis</i>	8	p	sh	Floyd 1995
O. disjuncta (Banks)	8	p	sh	
<i>Triaenodes</i>	6	sh		See Glover (1996) for species
T. injustus (Hagen)	6	sh		We have specimens from Lake Davis and S.D. county; otherwise unrecorded from the state.
Limnephillidae	4	s		
<i>Allocosmoecus parditus</i> Banks	0	sc		Monotypic genus.
<i>Amphicosmoecus canax</i> (Ross)	1	sh		Monotypic genus.
<i>Chyranda centralis</i> (Banks)	1	sh		Monotypic genus.
<i>Clostoecca disjuncta</i> (Banks)	4	sh		Monotypic genus.
<i>Cryptochia</i>	0	sh	xy	
<i>Desmona</i>	1	sh		Only two known species; both occur in CA.
<i>D. bethula</i> Denning	1	sh		
<i>D. mono</i> (Denning)	1	sh		
<i>Dicosmoecus</i>	1	om		Wiggins and Richardson 1982
<i>D. atripes</i> (Hagen)	1	om		

TRICHOPTERA	CTV	1°FFG	2°FFG	Comments/ Specific Taxonomic Literature/ Distributional Information
<i>D. gilvipes</i> (Hagen)	2	sc		
<i>D. pallicornis</i> Banks	1	om		
<i>Ecclisomyia</i>	2	om		
<i>Glyphopsyche irrorata</i> (Fabricius)	1	sh		Only species known in CA.
<i>Hesperophylax</i>	3	om		Parker and Wiggins 1985
<i>H. designatus</i> (Walker)	3	om		
<i>Homophylax</i>	0	sh		
<i>Hydatophylax hesperus</i> (Banks)	1	sh	cg	Only species known in CA
<i>Lenarchus</i>	3	sh	cg	
<i>Limnephilus</i>	3	sh	cg	
<i>Onocosmoecus</i>	1	sh		Only two known species; both occur in CA.
<i>O. sequoiae</i> Wiggins & Richardson	1	sh		
<i>O. unicolor</i> Banks	1	om	sh	
<i>Philocasca</i>				
<i>Pseudostenophylax edwardsi</i> (Banks)	1	sh	cg	Only species known in the western U.S.
<i>Psychoglypha</i>	2	sh	cg	
Odontoceridae	0	sh		
<i>Marilia flexuosa</i> Ulmer	0	sh		Only species in CA
<i>Namamyia plutonis</i> Banks	0	sh		Monotypic genus.
<i>Nerophilus californicus</i> (Hagen)*	0	sh		Monotypic genus.
<i>Parthina</i>	0	sh		Only two known species; both occur in CA.
<i>P. linea</i> Denning	0	sh		
<i>P. vierra</i> Denning	0	sh		
Philopotamidae	3	cf		
<i>Chimarra</i>	4	cf		
<i>Dolophilodes</i>	2	cf		
<i>Wormaldia</i>	3	cf		
Phryganeidae	4	sh	p	
<i>Agrypnia</i>	4	sh		
<i>Phryganea cinerea</i> Walker *	4	sh	p	Only species known in the western U.S.
<i>Yphria californica</i> (Banks)	1	p		Monotypic genus.
Polycentropodidae	6	p		
<i>Polycentropus</i>	6	p		
Psychomyiidae	2	sc	cg	
<i>Psychomyia</i>	2	cg	sc	
<i>Tinodes</i>	2	sc	cg	
Rhyacophilidae	0	p		
<i>Himalopsyche phryganea</i> (Ross)	0	p		Only species known in North America
<i>Rhyacophila</i>	0	p		For spp. groups- Smith 1997 (unpublished)
<i>R. alberta</i> group	0	p		
<i>R. angelita</i> group	0	p		
<i>R. arnaudi</i> Denning	0	p		Only member of <i>R. lieftincki</i> group in CA

TRICHOPTERA	CTV	1°FFG	2°FFG	Comments/ Specific Taxonomic Literature/ Distributional Information
<i>R. betteni</i> group	1	p		
<i>R. brunnea</i> group	1	p		
<i>R. coloradensis</i> group	2	p		
<i>R. grandis</i> group	1	p		
<i>R. hyalinata</i> group	1	p		
<i>R. rotunda</i> group	0	p		
<i>R. sibirica</i> group*	0	p		
<i>R. vagrita</i> group	0	p		
Sericostomatidae	3	sh		
<i>Gumaga</i>	3	sh		Only two known N.A. species; both occur in CA.
<i>G. griseola</i> (McL.)	3	sh		
<i>G. nigricula</i> (McL.)	3	sh		
Uenoidae	0	sc	cg	
<i>Farula</i>	0	g	cg	
<i>Neophylax</i>	3	g		
<i>Neothremma</i>	0	g	cg	
<i>Oligophlebodes</i>	0	g	cg	

LEPIDOPTERA: MOTHS AND BUTTERFLIES
Standard Effort: Genus (Merritt and Cummins 1996)

Lepidoptera	CTV	FFG(I)	Comments/ Specific Taxonomic Literature/ Distributional Information
Nepticulidae		s	
<i>Stigmella</i>		sh	
Pyralidae	5		
<i>Parapoynx</i>	5	sh	
<i>Petrophila</i>	5	sc	

COLEOPTERA: BEETLES

Standard Effort: Genus

Early instar larvae may be difficult to identify. Most beetles can be readily identified to genus using White and Brigham's keys in Merritt and Cummins. Several supplemental keys are available for Californian taxa.

- Bill Shepard's key to the Dryopoidea (Elmidae, Psephenidae, Dryopidae) of California is very good, especially in that it includes only taxa found in California.
- Brown's key to the Dryopoidea (Elmidae/ Dryopidae/ Psephenidae) is very useful, but in some places is out of date. Contains good supplemental figures.
- Larson, D.J., Y. Alarie and R.E. Roughley. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, With Emphasis on the Fauna of Canada and Alaska. National Research Council of Canada, Ottawa.

Hydraenids and hydrophilids have larval and adult aquatic stages belonging to distinct functional feeding groups. FFG (l) indicates functional group designation of the larvae, while FFG (a) indicates the designation of the adults if different from the larvae.

Coleoptera	CTV	1° FFG (l)	2° FFG (l)	FFG (a)	Comments/ Specific Taxonomic Literature/ Distributional Information
Amphizoidae					Amphizoids (trout stream beetles) are typically found in high altitude streams. They are uncommon in most benthic samples
Amphizoa	1	p			
Dryopidae	5	sh			Larvae are terrestrial; occasional in headwater seeps.
Helichus*	5	-		sh	
Postelichus	5	-		sh	
Dytiscidae	5	p			See Challet and Brett (1998) for list of CA dytiscid species by county.
Acilius abbreviatus Mann.	5	p			Only species in CA.
Agabus*	8	p			
Celina occidentalis Young	5	p			Only species in CA.
<i>Colymbetes</i> *	5	p			
Copelatus	5	p			
Coptotomus longulus LeConte	5	p			Only species in CA.
Cybister	5	p			
<i>Desmopachria</i> *	5	p			
<i>Dytiscus</i> *	5	p			
Eretes occidentalis (Erichson)	5	p			Monotypic genus.
Graphoderus	5	p			
<i>Hydaticus aruspex</i> Clark *	5	p			Only species in CA.
<i>Hydroporus</i> *	5	p			
Hydrotrupes palpalis Sharp	5	p			Monotypic genus.

Coleoptera	CTV	1° FFG (I)	2° FFG (I)	FFG (a)	Comments/ Specific Taxonomic Literature/ Distributional Information
<i>Hydrovatus</i>	5	p			
<i>Hygrotus</i>	5	p			
<i>Ilybius</i>	5	p			
<i>Laccophilus</i> *	5	p			
<i>Liodessus obscurellus</i> (LeConte)	5	p			Main CA species; <i>L. saratogae</i> is known only from Death Valley; <i>L. obscurellus</i> has often been confused with <i>L. affinis</i> (Larson et al. 2000)
<i>Nebrioporus</i>	5	p			
<i>Neoclypeodytes</i>	5	p			
<i>Oreodytes</i>	5	p			
<i>Rhantus</i>	5	p			
<i>Sanfillipodytes</i>	5	p			This genus does not key out in M/C but is common in California coast range streams. Keys in Larson et al. (2000) will separate this genus.
<i>Stictotarsus</i>	5	p			
<i>Thermonectus</i>	5	p			
<i>Uvarus subtilis</i> (LeConte)	5	p			Only species in CA.
Elmidae	4	cg	sc		All the Californian elmids will key out in M/C, but Shepard's elm mid key and Brown's dryopoid key are valuable supplements.
<i>Ampumixis dispar</i> (Fall)	4	cg	sc		Monotypic genus.
<i>Atractelmis wawona</i> Chandler *	4	cg	sc		Monotypic genus.
<i>Cleptelmis addenda</i> (Fall)	4	cg	sc		Monotypic genus.
<i>Dubiraphia</i>	6	cg	sc		
<i>Heterelmis</i> *	4	cg	sc		
<i>Heterlimnius</i>	4	cg	sc		
<i>Lara</i>	4	sh	xy		
<i>Microcylloepus</i>	4	cg	sc		
<i>Narpus</i>	4	cg	sc		
<i>Optioservus</i>	4	sc	cg		
<i>Ordobrevia nubifera</i> (Fall)	4	sc	cg		Monotypic genus.
<i>Rhizelmis nigra</i> Chandler	2	sc	cg		Monotypic genus.
<i>Zaitzevia</i>	4	sc	cg		
Gyrinidae				-	Adults are not benthic, do not include in benthic lists
<i>Gyrinus</i>	5	p			
Haliplidae	5	s			
<i>Brychius</i>	5	mh			
<i>Haliplus</i>	5	mh			
<i>Peltodytes</i>	5	mh			
Helophoridae		sh			
<i>Helophorus</i>		sh			
Hydraenidae*	5	p		sc	
<i>Hydraena</i> *	5	p		sc	
<i>Limnebius</i>	5	p		sc	
<i>Ochthebius</i> *	5	p		sc	

Coleoptera	CTV	1° FFG (I)	2° FFG (I)	FFG (a)	Comments/ Specific Taxonomic Literature/ Distributional Information
Hydrophilidae	5	p		cg	For supplemental information on hydrophilids, see Archangelsky 1997.
<i>Anacaena</i>	5	p		cg	
<i>Ametor</i> *	5	p		cg	
<i>Berosus</i>	5	p		mh	
<i>Chaetarthria</i> *	5	p		cg	
<i>Cymbiodyta</i> *	5	p		cg	
<i>Enochrus</i> *	5	cg		mh	
<i>Hydrochara</i>	5	p		cg	
<i>Laccobius</i>	5	mh		mh	
<i>Paracymus</i> *	5	p		cg	
<i>Tropisternus</i> *	5	p		cg	
Hydroscaphidae*	7	sc			
<i>Hydroscapha natans</i> LeConte *	7	sc			Uncommon, only one aquatic species
Noteridae		p			Generally lentic
Psephenidae	4	sc		-	Adults are terrestrial and non-feeding.
<i>Acneus</i>	4	sc		-	
<i>Eubrianax edwardsii</i> (LeConte)	4	sc		-	Monotypic genus.
<i>Psephenus falli</i> Casey	4	sc		-	Only species in CA.
Ptilodactylidae		sh		-	Uncommon, adults are terrestrial
<i>Anchyteis velutina</i> Horn		sh		-	Monotypic genus.
<i>Stenocolus scutellaris</i> (LeConte)		sh		-	Monotypic genus.
Scirtidae		sc		-	Uncommon, adults are terrestrial
<i>Elodes</i>		sc		-	

DIPTERA: TRUE FLIES

Standard Effort: Genus when possible, Chironomidae to family.

Merritt and Cummins (1996), is the standard reference used for this order. McAlpine et al., (1981, 1987, and 1989) provides additional useful taxonomic information.

Other useful references are listed by group below

➤ **Tabanidae:**

Middlekauff, W.W. and R.S. Lane. 1980. Adult and immature Tabanidae (Diptera) of California. Bulletin of the California Insect Survey, Volume 22. UC Press, Berkeley.

Lane, R.S. 1975. Immatures of some Tabanidae (Diptera) from Mendocino County, Calif. Annals of the Entomological Society of North America 68(5):803-819.

➤ **Blephariceridae:**

Courtney, Greg, Department of Entomology, Iowa State University
Website: www.ent.iastate.edu/dept/research/systematics/bleph/classification.html

Hogue, C.L. 1987. Blephariceridae. Vol. II, Part 4. In G.C.D. Griffiths (ed.) Flies of the Nearctic Region. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart.

➤ **Simuliidae:**

Hall, F. 1974. A Key to the *Simulium* Larvae of Southern California (Diptera: Simuliidae). California Vector Views 21:65-71.

➤ **Ceratopogonidae:**

Glukhova, V.M. 1979. Translated from the Russian original.

Diptera	CTV	FFG(0)		Comments/ Specific Taxonomic Literature/ Distributional Information
Athericidae	2	p		
<i>Atherix pachypus</i> Bigot	2	p		Only species in CA.
Blephariceridae	0	sc		
<i>Agathon</i>	0	sc		
<i>Bibiocephala</i>	0	sc		
<i>Blepharicera</i>	0	sc		
<i>Philorus</i>	0	sc		
Canacidae		sc		
Ceratopogonidae	6	p	cg	
<i>Atrichopogon</i> *	6	cg	sc	
<i>Bezzia/ Palpomyia</i> *	6	p		EPA LISTS PRIMARY FFG AS GC
<i>Ceratopogon</i>	6	p		
<i>Culicoides</i>	6	p	cg	
<i>Dasyhelea</i>	6	cg		

Diptera	CTV	FFG(1)		Comments/ Specific Taxonomic Literature/ Distributional Information
<i>Forcipomyia</i> *	6	cg	sc	
<i>Probezzia</i>	6	p		
<i>Sphaeromyias</i>	6	p	cg	
<i>Stilobezzia</i>	6	p		
Chaoboridae	7	p		
<i>Chaoborus</i>	7	p		
Chironomidae	6			
<i>Chironominae</i>	6	cg		
Tribe Chironomini	6	cg	p	
<i>Chironomus</i>	10	cg		
<i>Cryptochironomus</i>	8	p		
<i>Demicryptochironomus</i>	6	cg		
<i>Dicrotendipes</i>	8	cg		
<i>Einfeldia</i>	9	cg		
<i>Endochironomus</i>	10	cg		
<i>Endotribelos</i>	6	cg		
<i>Harnischia</i>	6	cg		
<i>Lauterborniella</i>	6	cg		
<i>Microtendipes pedellus</i> group	6	cf		
<i>Nilothauma</i>	6	cg		
<i>Parachironomus</i>	10	p	cg	
<i>Paracladopelma</i>	7			
<i>Paralauterborniella</i>	8	cg		
<i>Paratendipes</i>	8	cg		
<i>Phaenopsectra</i>	7	sc		
<i>Polypedilum</i>	6	om		Maschwitz & Cook (2000) for spp. in subgenera <i>Polypedilum</i> and <i>Urespedilum</i> .
<i>Robackia claviger</i>	6	cg		
<i>Robackia demeijeri</i> (Kruseman)	6	cg		
<i>Stenochironomus</i>	5	cg		
<i>Stictochironomus</i>	9	cg		
<i>Synendotendipes</i>	6	cg		
<i>Tribelos</i>	6	cg		
<i>Xenochironomus xenolabis</i> (Kieffer)	0	p		
Tribe Pseudochironomini		cg		
<i>Pseudochironomus</i>	5	cg		
Tribe Tanytarsini	6	cg		
<i>Cladotanytarsus</i>	7	cg	cf	
<i>Constempellina</i>	4	cg		
<i>Micropsectra</i>	7	cg		
<i>Paratanytarsus</i>	6			
<i>Rheotanytarsus</i>	6	cf		
<i>Stempellina</i>	2	cg		

Diptera	CTV	FFG(I)		Comments/ Specific Taxonomic Literature/ Distributional Information
<i>Stempellinella</i>	4			
<i>Sublettea coffmani</i> (Roback)	4			
<i>Tanytarsus</i>	6	cf		
<i>Zavrelia</i>	6	cg		
Diamesinae	2	cg	sc	
Tribe Boreoheptagyini				
<i>Boreoheptagyia</i> *	6	cg		
Tribe Diamesini				
<i>Pagastia</i>	1	cg		
<i>Pseudodiamesa</i>	6	cg		
<i>Pothastia</i>	2	cg		
<i>Sympothastia</i>	2	cg		
Orthoclaadiinae	5	cg		
<i>Acricotopus</i>	5	cg		
<i>Brillia</i>	5	sh		
<i>Cardiocladius</i>	5	p		
<i>Chaetocladius</i>	6	cg		
<i>Corynoneura</i>	7	cg		
<i>Cricotopus</i>	7	cg	sh	For species and species groups, see Simpson <i>et al.</i> (1982).
<i>Cricotopus bicinctus</i> gp.	7	cg	sh	
<i>Cricotopus trifascia</i> gp.	7	cg	sh	
<i>Epicocladius</i>	5	cg		
<i>Eukiefferiella</i>	8	om		For species, see Bode (1983).
<i>Gymnometriocnemis</i>	5	cg		
<i>Heleniella</i> *	6	cg		
<i>Heterotrissocladius</i>	0	cg	sc	
<i>Hydrobaenus</i>	8	cg		
<i>Krenosmittia</i> *	1	cg		
<i>Limnophyes</i>	8	cg		
<i>Lopescladius</i>	6	cg		
<i>Nanocladius</i>	3	cg		
<i>Orthocladius</i>	6	cg		
<i>Parachaetocladius</i>	2	cg		
<i>Parakiefferiella</i>	4	cg		
<i>Paralimnophyes</i>	5	cg		
<i>Parametriocnemus</i>	5	cg		
<i>Paraphaenocladius</i>	4	cg		
<i>Psectrocladius</i>	8	cg		
<i>Rheocricotopus</i>	6	om		
<i>Smittia</i>	6	cg		
<i>Symbiocladius</i>	6	pa		Parasitic genus
<i>Synorthocladius</i>	2	cg		
<i>Thienemanniella</i>	6	cg		

Diptera	CTV	FFG(I)		Comments/ Specific Taxonomic Literature/ Distributional Information
<i>Tvetenia</i>	5	cg		
Podonominae	6			
<i>Boreochlus*</i>	6	cg	sc	
Prodiamesinae	6	cg		
<i>Monodiamesa</i>	7	cg		
<i>Prodiamesa</i>	3	cg		
Tanypodinae	7	p		
Tribe Macropelopiini				
<i>Macropelopia*</i>	6	p		
<i>Radotanypus submarginella</i> (Sublette)	7	p		
Tribe Natarsiini				
<i>Natarsia</i>	8	p		
Tribe Pentaneurini	6			
<i>Ablabesmyia</i>	8	cg	p	
<i>Krenopelopia</i>	6	p		
<i>Labrundinia</i>	6	p		
<i>Larsia</i>	6	p		
<i>Monopelopia</i>	6	p		
<i>Nilotanypus</i>	6	p		
<i>Paramerina</i>	6	p		
<i>Tanypus</i>	10	p		
<i>Thiennemannimyia</i> gp.	6	p		
<i>Zavrelimyia</i>	8	p		
<i>Zavrelimyia/ Paramerina</i>	7	p		
Tribe Procladiini				
<i>Procladius</i>	9	p		
Culicidae	8	cg		For species, see Bohart & Washino (1978)
<i>Anopheles</i>	8	cg		
<i>Culex</i>	8	cg		
Deuterophlebiidae	0	sc		
<i>Deuterophlebia</i>	0	sc		
Dixidae	2	cg		
<i>Dixa</i>	2	cg		
<i>Dixella</i>	2	cg		
<i>Meringodixa chalonensis</i> (Nowell)	2	cg		Monotypic genus.
Dolichopodidae	4	p		
Empididae	6	p		
<i>Chelifera</i>	6	p		
<i>Clinocera</i>	6	p		
<i>Hemerodromia</i>	6	p	cg	
<i>Metachela</i>	6	p		This genus will key to <i>Chelifera</i> in Merritt and Cummins
<i>Neoplasta</i>	6	p		This genus will key to <i>Chelifera</i> in Merritt and Cummins. MacDonald and Harkrider (1999) provide characters to split it

Diptera	CTV	FFG(I)		Comments/ Specific Taxonomic Literature/ Distributional Information
				from <i>Chelifera/Metachela</i> .
<i>Oreogeton</i>	6	p		
<i>Trichoclinocera</i>	6	p		
<i>Wiedemannia</i>	6	p		
Ephydriidae	6			
<i>Ephydra</i>	6	sh		
<i>Hydrellia</i>	6	sh		
<i>Notiphila</i>	6	cg	cf	
<i>Parydra</i>	6	sc		
<i>Scatella</i>	6	cg	sc	
<i>Setacera</i>	6	sh	sc	
Muscidae	6	p		
Pelecorynchidae	3	p		
<i>Glutops</i>	3	p		
Phoridae		cg	p	
Psychodidae		cg	sc	
<i>Maruina lanceolata</i> (Kincaid)	2	sc	cg	Only North American species.
<i>Pericoma /Telmatoscopus</i>	4	cg		These genera cannot be distinguished as larvae.
<i>Psychoda</i>	10	cg		
Ptychopteridae	7	cg		
<i>Ptychoptera</i>	7	cg		
Scathophagidae				
Sciomyzidae*	6	p		
Simuliidae	6	cf		Currie (1986) treats larvae of Alberta, but is of some use in California.
<i>Prosimulium</i>	3	cf		
<i>Simulium</i>	6	cf		For species, see Hall 1974.
Stratiomyidae	8	cg		
<i>Caloparyphus</i> *	7	cg		
<i>Euparyphus</i>	8	cg		
<i>Myxosargus</i>	8	cg		
<i>Nemotelus</i>	8	cg		
<i>Hedriodiscus /Odontomyia</i>	8	cg		
<i>Stratiomys</i>	8	cg		
Syrphidae	10	cg		
Tabanidae	8	p		Middlekauff and Lane 1980.
<i>Atylotus/ Tabanus</i> *	5	p		
<i>Chrysops</i>	8	p		
<i>Haematopida</i>	8	p		
<i>Silvius</i>	8	p		
Tanyderidae	1			
<i>Protanyderus</i>	1			
Thaumaleidae		sc		

Diptera	CTV	FFG()		Comments/ Specific Taxonomic Literature/ Distributional Information
<i>Thaumalea</i>		sc		
Tipulidae	3			
<i>Antocha</i>	3	cg		
<i>Cryptolabis</i>	3	sh		
<i>Dicranota</i>	3	p		
<i>Erioptera*</i>	3	cg		
<i>Gonomyia</i>	3	cg		
<i>Hesperoconopa</i>	1	cg		
<i>Hexatoma</i>	2	p		
<i>Holorusia hespera</i> Arnaud & Byers	5	sh		Monotypic genus.
<i>Limonia</i>	6	sh		
<i>Molophilus*</i>	4	sh		
<i>Ormosia</i>	3	cg		
<i>Rhabdomastix</i>	3	p		
<i>Tipula</i>	4	om		For subgenera and species see Gelhaus (1986).

NON-INSECT TAXA

Identification of most non-insect benthic macroinvertebrates is possible with two primary references:

- Pennak, R.W. 1989. *Freshwater Invertebrates of the United States*. 3rd edition. John Wiley and Sons, New York.
- Thorp, J.H. and A.P. Covich (eds.). 1991. *Ecology and Classification of North American Freshwater Invertebrates*. Academic Press, San Diego.

SUBPHYLUM CHELICERATA (ACARI)

Standard Effort: Genus, although some families cannot be reliably identified to the genus level.

The standard taxonomic reference for this group is:

Thorp, J.H. and A.P. Covich (eds.). 2001. *Ecology and Classification of North American Freshwater Invertebrates*. Second Edition. Academic Press, San Diego.

Additional taxonomic information can be found in:

Cook, D.R. 1974. Water mite genera and subgenera. *Memoirs of the American Entomological Institute* No. 21.

Subphylum Chelicerata Class Arachnoidea	CTV	FFG(0)	Comments/ Specific Taxonomic Literature/ Distributional Information
<u>Acari</u>	5	p	
Anisitsiellidae	5	p	
<i>Utaxatax</i>	5	p	Our past identifications of this are doubtful; probably all <i>Mideopsis</i> .
Arrenuridae	5	p	
<i>Arrenurus</i>	5	p	
Aturidae	5	p	
<i>Aturus</i>	5	p	
<i>Woolastookia</i>	5	p	
Frontipodopsidae			
<i>Frontipodopsis</i>	5	p	
Hydrodromidae	5	p	
<i>Hydrodroma</i>	5	p	
Hydryphantidae	5	p	
<i>Wandesia</i>	5	p	
<i>Partunia</i>	5	p	
<i>Protzia</i> *	8	p	
<i>Thyopsoides</i>	5	p	
Hygrobatidae*	8	p	
<i>Atractides</i>	8	p	
<i>Corticacarus</i> *	8	p	
<i>Hygrobates</i> *	8	p	

Chelicerata

Subphylum Chelicerata Class Arachnoidea	CTV	FFG(0)	Comments/ Specific Taxonomic Literature/ Distributional Information
Lebertiidae	8	p	
<i>Estelloxus</i>	8	p	
<i>Lebertia</i> *	8	p	
<i>Scutolebertia</i>	8	p	
Limnesiidae	5	p	
<i>Limnesia</i>			
<i>Neotyrrellia /Tyrellia</i>	5	p	
Limnocharidae	5	p	
<i>Limnochaeres./Neolimnochaeres</i>	5	p	
Mideopsidae			
<i>Mideopsis</i>	5	p	
Pionidae	5	p	
Sperchontidae*	8	p	
<i>Sperchon*</i>	8	p	
<i>Sperchonopsis</i>	8	p	
Stygothrombidiidae	5	p	
<i>Stygothrombium</i>	5	p	
Torrenticolidae	5	p	
<i>Pseudotorrenticola</i>	5	p	
<i>Testudacarus</i>	5	p	
<i>Torrenticola</i>	5	p	
Unioncolidae	5	p	
<i>Neumania</i>			
<i>Unionicola</i>	5	p	

SUBPHYLUM CRUSTACEA

Standard Effort: Genus, except Ostracoda which is left at class.

Supplemental references for various groups are as follows:

- Hobbs, H.H. 1972. Crayfishes (Astacidae) of North and Middle America. Biota of Freshwater Ecosystems Identification Manual No. 9. Environmental Protection Agency, Washington, D.C.
- Holsinger, J.R. 1972. The freshwater amphipod crustaceans (Gammaridae) of North America. Biota of Freshwater Ecosystems: Identification Manual No. 5. EPA, Washington, D.C.

SUBPHYLUM Crustacea	CTV	FFG(O)	Comments/ Specific Taxonomic Literature/ Distributional Information
<u>Cladocera</u>			Reject from benthic data sets.
<u>Copepoda</u>			Reject from benthic data sets.
Class Ostracoda	8	cg	Leave at class; unidentifiable if preserved in EtOH
Class Malacostraca			
Order <u>Amphipoda</u>	4	cg	
Corophiidae	4	cf	
<i>Corophium</i>	4	cf	
Crangonyctidae	4	cg	
<i>Crangonyx</i>	4	cg	
<i>Stygobromus</i>	4	cg	
<i>Synurella</i>	4	cg	
Gammaridae	6	cg	
<i>Gammarus</i>	6	cg	
Hyalellidae	8	cg	
<i>Hyalella</i>	8	cg	
Order <u>Decapoda*</u>	8	sh	
Astacidae*	8	om	
<i>Pacifasticus lenisculus</i> Dana	6	om	
<i>Pacifasticus fortis</i> (Faxon)	6	om	Shasta crayfish- federally listed endangered, endemic to Pit River, Fall River and adjacent streams in Shasta Co.
Atyidae			
<i>Syncaris pacifica</i> (Holmes)			California Freshwater Shrimp (federally listed endangered, endemic to pools in small streams in the San Francisco bay region: Marin, Napa and Sonoma Counties)
Cambaridae	8	sh	
<i>Orconectes virilis</i> (Hagen)			Introduced
<i>Procambarus</i>	8	sh	
<i>P. acutus</i> (Girard)	8	sh	Introduced
<i>P. clarki</i> (Girard)	8	sh	
<i>P. gambelii</i>	8	sh	Introduced

SUBPHYLUM Crustacea	CTV	FFG(0)	Comments/ Specific Taxonomic Literature/ Distributional Information
Graspidae			
<i>Eriocheir sinensis</i>			Chinese Mitten Crab: introduced, occurs in all tribs to the San Francisco Bay; also found in Sacramento River as far north as Glenn Co., and in San Joaquin River to Stockton.
Palaemonidae	8	s	
<i>Exopalaemon modestus</i>			Introduced in the tributaries of the Sacramento River, found from San Francisco Bay to Glenn Co.; appears to be moving northward.
<i>Palaemon macrodactylus</i>			Introduced to the Sacramento/ San Joaquin River system and coastal streams from Ventura Co. to Oregon.
<i>Palaemonetes</i>	8	om	<i>P. paludosa</i> and <i>P. kaikadensis</i> have both been found in pet stores in CA. <i>P. paludosa</i> has been introduced in southern CA in Los Angeles, Orange, San Diego Riverside and Ventura counties.
Order <u>Isopoda</u>	8	cg	
Asellidae	8	cg	
<i>Asellus</i>	8	cg	
<i>Caecidotea</i>	8	cg	
Sphaeromatidae			
<i>Gnorimosphaeroma</i>			
Order Mysidacea			
<i>Mysis relicta</i>		cf	Introduced
<i>Neomysis mercedis</i> (Holmes)		cf	

PHYLUM COELENTERATA

HYDROIDA: HYDRA

Standard Effort: Genus.

The standard taxonomic reference for this group is:

Thorp, J.H. and A.P. Covich (eds.). 1991. Ecology and Classification of North American Freshwater Invertebrates. Academic Press, San Diego.

Class Hydrozoa	CTV	FFG(D)	Comments/ Specific Taxonomic Literature/ Distributional Information
<u>Hydroida</u>			
Hydridae			
<i>Hydra</i>	5	p	

PHYLUM MOLLUSCA

Standard effort varies within Mollusca, as evident in the tables below, but identifications should generally be made to family or genus.

Supplemental references include the following:

- Burch, J.B. 1973. Freshwater unionacean clams (Mollusca: Pelecypoda) of North America. Biology of Freshwater Ecosystems Identification Manual No. 11. Environmental Protection Agency, Washington, D.C.
- Burch, J.B. 1989. North American Freshwater Snails. Malacological Publications, Hamburg, Michigan.
- Hershler, R. and T.J. Frest. 1996. A review of the North American freshwater snail genus *Fluminicola* (Hydrobiidae). Smithsonian Contributions to Zoology No. 583. Smithsonian Institution Press, Washington, D.C.
- Hershler, R. and W.F. Ponder. 1998. A review of morphological characters of hydrobioid snails. Smithsonian Contributions to Zoology No. 600. Smithsonian Institution Press, Washington, D.C.

CLASS GASTROPODA	CTV	FFGD	Comments/ Specific Taxonomic Literature/ Distributional Information
Subclass Prosobranchia			
Ampullaridae			
<i>Marisa</i>			Introduced
<i>Pomacea</i>			Introduced
Hydrobiidae	8	sc	
<i>Fluminicola</i>	5	sc	
Pleuroceridae	6	sc	
<i>Juga</i>	7	sc	
Thiaridae			
<i>Melanoides tuberculata</i>			Introduced
<i>Tarebia granifera</i>			Introduced
Valvatidae	8	sc	
<i>Valvata*</i>	8	sc	
Viviparidae			
<i>Cipangopaludina</i>			Introduced
Subclass Pulmonata			
Ancylidae	6	sc	
<i>Ferrissia</i>	6	sc	
Lymnaeidae	6	sc	
<i>Fossaria*</i>	8	sc	

CLASS GASTROPODA	CTV	FFG(1)	Comments/ Specific Taxonomic Literature/ Distributional Information
<i>Lanx</i>	6	ge	
<i>Radix auricularia</i> (L.)	6	sc	
<i>Stagnicola</i> *	10	sc	
Physidae	8	sc	
<i>Physa/Physella</i>	8	sc	
Planorbidae	6	sc	
<i>Gyraulus</i> *	8	sc	
<i>Helisoma</i>	6	sc	
<i>Menetus</i>	6	sc	
<i>Planorbella</i> *	6	sc	

CLASS Bivalvia	CTV	FFG(1)	Comments/ Specific Taxonomic Literature/ Distributional Information
<u>Pelecypoda</u>	8	cf	
Corbiculidae	10	cf	
<i>Corbicula fluminea</i> (Müller)	10	cf	
Margaritiferidae			
<i>Margaritopsis falcata</i> *	4	fc	
Sphaeriidae	8	cf	
<i>Musculium</i>	8	cf	
<i>Pisidium</i>	8	cf	
<i>Sphaerium</i>	8	gc	
Unionidae*	8	fc	
<i>Anodonta californensis</i> *	8	fc	
<i>Gonidea angulata</i> *	8	fc	

PHYLUM PLATYHELMINTHES

Standard effort is to family, except *Polycelis coronata*.

Accurate determination requires preservation in formalin. Unconfirmed use of the name *Dugesia tigrina* is strongly discouraged.

CLASS TURBELLARIA	CTV	1°FFG	2°FFG	Comments/ Specific Taxonomic Literature/ Distributional Information
<u>Tricladida</u>				
Planariidae	4	p	cg	
<i>Dugesia tigrina</i> (Girard)*	4	p	cg	
<i>Polycelis coronata</i> (Girard)*	1	om		

PHYLUM ANNELIDA

Standard Effort: Leeches and polychaetes are identified to genus; Oligochaetes are left at class, except that megadriles are pulled and labeled as such.

Supplemental references include the following:

- Brinkhurst, R.O. 1986. Guide to the freshwater aquatic microdile Oligochaetes of North America. Canadian Special Publication of Fisheries and Aquatic Sciences 84. Dept. of Fisheries and Oceans, Ottawa.
- Klemm, D.J. 1982. Leeches (Annelida: Hirudinea) of North America. EPA Publication 600/3-82-025.
- Kathman, R.D. and R.O. Brinkhurst. 1998. Guide to the Freshwater Oligochaetes of North America. Aquatic Resource Center, College Grove, Tennessee.
- Stimpson, K.S., D.J. Klemm and J.K. Hiltunen. 1982. A guide to the freshwater Tubificidae (Annelida: Clitellata: Oligochaeta) of North America. EPA-600/3-82-033.

ANNELIDA	CTV	1°FFG	2°FFG	Comments/ Specific Taxonomic Literature/ Distributional Information
CLASS HIRUDINEA	10	pa	p	
<u>Rhyncobdellida</u>				
Glossiphoniidae*	8	pa	p	
<i>Helobdella</i> *	6	pa	p	
<i>H. fusca</i> (Castle)	6	pa		
<i>H. stagnalis</i> (L.)	6	p		
<i>Placobdella</i> *	6	pa	p	
<u>Pharyngobdellida</u>				
Erpobdellidae*	8	p		
<i>Erpobdella punctata</i> (Leidy)	8	p		
<i>Moreobdella microstoma</i> (Moore)	8	p		

CLASS BRANCHIOBDELLIDA			Reject From Benthic Data Sets
-------------------------------	--	--	--------------------------------------

CLASS OLIGOCHAETA	5	cg	Leave at Class
--------------------------	----------	-----------	-----------------------

CLASS POLYCHAETA	CTV	FFG(D)	Comments/ Specific Taxonomic Literature/ Distributional Information
Sabellidae			
<i>Manayunkia speciosa</i> Leidy		cf	
<i>Loanome</i> sp. ??			We have these from Sac. Delta and ag. drains in Stanislaus Co.
Nereididae			
<i>Neanthes limnicola</i>		cf	For all freshwater Polychaeta, see Klemm 1985.
Serpullidae			
<i>Mercierella enigmatica</i>			Introduced

PHYLUM NEMERTEA

CLASS Enopla	CTV	FFGD	Comments/ Specific Taxonomic Literature/ Distributional Information
Tetrastemmatidae			
<i>Prostoma</i>	8	p	According to Thorp and Covich, the western <i>Prostoma</i> is unnamed.

ADDITIONAL REFERENCES

- Allen, R.K. and G.F. Edmunds. 1961a. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae). II. The subgenus *Caudatella*. *Annals of the Entomological Society of America* 54:603-612.
- Allen, R.K. and G.F. Edmunds. 1961b. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae). III. The subgenus *Attenuatella*. *Journal of the Kansas Entomological Society* 34:161-173.
- Allen, R.K. and G.F. Edmunds. 1962. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae). V. The subgenus *Drunella* in North America. *Entomological Society of America Miscellaneous Publications* 3:147-179.
- Allen, R.K. and G.F. Edmunds. 1963. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae). VI. The subgenus *Serratella* in North America. *Annals of the Entomological Society of America* 56:583-600.
- Allen, R.K. and G.F. Edmunds. 1965. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae). VIII. The subgenus *Ephemerella* in North America. *Entomological Society of America Miscellaneous Publications* 4:243-282.
- Archangelsky, M. 1997. Studies on the biology, ecology, and systematics of the immature stages of new world Hydrophiloidea (Coleoptera: Staphyliniformia). *Bulletin of the Ohio Biological Survey* (n.s.) 12(1):1-207.
- Bednarik, A.F. and W.P. McCafferty. 1979. Biosystematic revision of the genus *Stenonema* (Ephemeroptera: Heptageniidae). *Canadian Bulletin of Fisheries and Aquatic Sciences* No. 201.
- Blickle, R.L. 1979. Hydroptilidae (Trichoptera) of America north of Mexico. University of New Hampshire, Agricultural Experiment Station Bulletin 509.
- Bode, R.W. 1983. Larvae of North American *Eukiefferiella* and *Tvetenia* (Diptera: Chironomidae). *Bulletin of the New York State Museum* 452:1-40.
- Bohart, R.M. and R.K. Washino. 1978. Mosquitoes of California (3rd ed.). University of California Division of Agricultural Sciences Priced Publication No. 4084. 154 pp.
- Challet, G.L. and R. Brett. 1998. Distribution of the Dytiscidae (Coleoptera) of California by county. *The Coleopterists Bulletin* 52:43-54
- Chapin, J.W. 1978. Systematics of nearctic *Micrasema* (Trichoptera: Brachycentridae). Unpublished Ph.D. dissertation, Clemson University.
- Currie, D.C. 1986. An annotated list of and keys to the immature black flies of Alberta (Diptera: Simuliidae). *Memoirs of the Entomological Society of Canada* No. 134
- Day, W.C. 1953. A new mayfly genus from California. *Pan-Pacific Entomologist* 29:19-24.
- Edmunds, G.F. and R.K. Allen. 1964. The Rocky Mountain species of *Epeorus* (*Iron*) Eaton (Ephemeroptera: Heptageniidae) *Journal of the Kansas Entomological Society* 37: 275-288.

- Flint, O.S. 1972. Studies of neotropical caddisflies, XIII: The genus *Ochrotrichia* from Mexico and Central America (Trichoptera:Hydroptilidae). Smithsonian Contributions to Zoology 118. Smithsonian Institution Press, Washington, D.C.
- Flint, O.S., Jr. 1984. The genus *Brachycentrus* in North America, with a proposed phylogeny of the genera of Brachycentridae (Trichoptera). Smithsonian Contributions to Zoology 398. 58pp.
- Floyd, M.A. 1995. Larvae of the caddisfly genus *Oecetis* (Trichoptera: Leptoceridae) in North America. Bulletin of the Ohio Biological Survey (n.s.) 10(3):1-85.
- Gelhaus, J.K. 1986. Larvae of the crane fly genus *Tipula* in North America (Diptera: Tipulidae). University of Kansas Science Bulletin 53:121-182.
- Glover, J.B. 1996. Larvae of the caddisfly genera *Triaenodes* and *Ylodes* (Trichoptera: Leptoceridae) in North America. Bulletin of the Ohio Biological Survey (n.s.) 11(2):1-89.
- Givens, D.R. and S.D. Smith. 1980. A Synopsis of the Western Arctopsychninae. Melanderia 35:1-34.
- Haddock, J.D. 1977. The biosystematics of the caddisfly genus *Nectopsyche* in North America with emphasis on the aquatic stages. American Midland Naturalist 98(2):382-421.
- Hall, F. 1974. A Key to the *Simulium* Larvae of Southern California (Diptera: Simuliidae) California Vector Views 21:65-71.
- Klemm, D.J. (ed.) 1985. *A Guide to the Freshwater Annelida (Polychaeta, Naidid and Tubificid Oligochaeta, and Hirudinea) of North America*. Kendall/Hunt, Dubuque, Iowa.
- Kondratieff, B.C. and J.R. Voshell. 1984. The North and Central American species of *Isonychia* (Ephemeroptera: Oligoneuriidae). Transactions of the American Entomological Society 110:129-244.
- Lugo-Ortiz, C.R. and W.P. McCafferty 1995. Taxonomy of the North and Central American species of *Camelobaetidius* (Ephemeroptera:Baetidae). Entomological News 106:178-192.
- Lugo-Ortiz, C.R. and W.P. McCafferty. 1998. A new North American genus of Baetidae (Ephemeroptera) and key to *Baetis* complex genera. Entomological News 109(5):345-353.
- Lugo-Ortiz, C.R., W.P. McCafferty and R.D. Waltz. 1994. Contribution to taxonomy of the Panamerican genus *Fallceon* (Ephemeroptera:Baetidae). Journal of the New York Entomological Society 102:460-475.
- MacDonald, J.F. and J.R. Harkrider. 1999. Differentiation of larvae of *Metachela* Coquillette and *Neoplasta* Coquillette (Diptera:Empididae:Hemerodromiinae) based on larval rearing, external morphology and ribosomal DNA fragment size. Journal of the North American Benthological Society 18:414-419.
- Mackay, R.J. 1978. Larval identification and instar association in some species of *Hydropsyche* and *Cheumatopsyche* (Trichoptera:Hydropsychidae). Annals of the Entomological Society of America 71:499-509.
- Maschwitz, D.E. and E. F. Cook. 2000. Revision of the Nearctic Species of the Genus *Polypedilum* Kieffer (Diptera: Chironomidae) in the Subgenera *P. (Polypedilum)* Kieffer and *P. (Urespedilum)* Oyewo and Saether. Ohio Biological Survey Bulletin (New Series) Volume 12 Number 3. vii + 135 p.
- McCafferty, W.P., M.J. Wigle and R.D. Waltz. 1994. Systematics and biology of *Acentrella turbida* (McDunnough) (Ephemeroptera: Baetidae). Pan Pacific Entomologist 70:301-308.

- Middlekauff, W.W. and R.S. Lane. 1980. Adult and immature Tabanidae (Diptera) of California. Bulletin of the California Insect Survey, Volume 22. UC Press, Berkeley.
- Needham, J.G., J.R. Traver and Y.H. Hsu. 1935. *The Biology of Mayflies with a Systematic Account of North American Species*. Comstock Publishing Company. Ithaca, New York.
- Parker, C.R. and G.B. Wiggins. 1985. The Nearctic caddisfly genus *Hesperophylax* Banks (Trichoptera:Limnephilidae). Canadian Journal of Zoology 61(10): 2443-2472.
- Provonsha, A.V. 1990. A revision of the genus *Caenis* in North America (Ephemeroptera: Caenidae). Transactions of the American Entomological Society 116: 801-884.
- Simpson, K.W., R.W. Bode and P. Albu. 1982. Keys for the genus *Cricotopus* adapted from "Revision der Gattung *Cricotopus* van der Wulp and Ihrer Verwandten (Diptera: Chironomidae)" by M. Hirvenoja. Bulletin of the New York State Museum 450:1-133.
- Weaver, J.S. 1988. A synopsis of the North American Lepidostomatidae (Trichoptera). Contributions of the American Entomological Institute 24. 141pp.
- Wiersema, N.A. and W.P. McCafferty. 2000. Generic revision of the North and Central American Leptohyphidae (Ephemeroptera: Pannota). Transactions of the American Entomological Society 126:337-369.
- Wiggins, G.B. and J.S. Richardson. 1982. Revision and synopsis of the caddisfly genus *Dicosmoecus* (Trichoptera: Limnephilidae, Dicosmoecinae). Aquatic Insects 4(4):181-217.
- Yamamoto, T. and G.B. Wiggins. 1964. A comparative study of the North American species in the caddisfly genus *Mystacides* (Trichoptera: Leptoceridae). Canadian Journal of Zoology 42(6):1105-1126.
- Zloty, J. and G. Pritchard. 1997. Larvae and adults of *Ameletus* mayflies (Ephemeroptera: Ameletidae) from Alberta. Canadian Entomologist 129:251-289.