Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT)

Standard Taxonomic Effort (STE) for the Identification of Aquatic Benthic Macroinvertebrates Used in Freshwater Bioassessment in California

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Assembled and reviewed by the taxonomists of the California Department of Fish & Wildlife Aquatic Bioassessment Laboratory.

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The SAFIT Standard Taxonomic Effort List

Introduction

Benthic macroinvertebrates (BMIs) are commonly used in the bioassessment of freshwater environments around the world (Mazor et al. 2019). In order for BMI datasets collected by different bioassessment programs and management agencies to be compatible, sampled organisms must be identified to a common, standardized and reproducible level of taxonomic resolution. The Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) was chartered, in part, to help develop the standard taxonomic effort (STE) for bioassessment programs across the southwestern U.S. This document defines the STE for California's Surface Water Ambient Monitoring Program (SWAMP) bioassessment protocols (Ode et al. 2016) or similar procedures. While SWAMP bioassessment has focused primarily on wadeable streams and rivers, partner agencies such as the U.S. EPA and the U.S. Forest Service (among others) have included large rivers and/or lakes in their bioassessment programs, with the California Dept. of Fish & Wildlife Aquatic Bioassessment Lab (ABL) performing identification of associated BMI samples. This document therefore encompasses the appropriate STE for benthic taxa found in large rivers and lakes in California in addition to wadeable streams.

A practical level of standard effort is determined by the cost-effectiveness of identification relative to effort. Cost-effectiveness is highly dependent on taxonomic skills, but is also determined by the availability of accurate keys in peer-reviewed literature that focus on aquatic life stages, the degree of special methodology needed to identify taxa (e.g., extraction of genitalia, slide mounting, etc.), and the level of taxonomic resolution required by interpretive tools used to convert raw taxonomic data into metrics or indices that convey a more simplified expression of ecological health to managers and the public. This STE uses the same two taxonomic effort levels defined in previous versions, and also introduces a third:

Level I: attempts to identify all groups to a relatively even level of taxonomic effort, usually genus (where possible) except for Chironomidae which are taken only to family and a few non-insect taxa that are taken only to Class (e.g., Oligochaeta, Turbellaria). Monotypic taxa may be taken to species[1].

Level II: attempts to identify many groups to species (where possible) and is therefore much more driven by the availability of species-level keys compared to Level I. Chironomidae are identified to genus or species-group, and again, a few non-insect taxa are taken only to Class (e.g., Oligochaeta, Turbellaria). Monotypic taxa may be taken to species[1].

Level IIa: *a new intermediate level* that was instituted in approximately 2013 (i.e., after the previous version of this STE was released) to align with input requirements of the California Stream Condition Index, or CSCI (Mazor et al. 2016). Although posted on the SAFIT website and in general use by many labs in California for several years now, it has not been previously documented in a formal version of the STE for California. This level coincides with Level II above, except that Chironomidae are identified to subfamily per the input requirements of the CSCI. Identification of Chironomidae only to subfamily may allow some cost savings for programs interested in using the CSCI as an

[1] When a genus is truly monotypic (i.e., contains only a single described species), or when only one species within a more speciose genus is known from California, then the species may be listed even if the recommended level of effort within the family or order is higher.

interpretive tool, but without the need for Level II resolution within the diverse Chironomidae which often requires slide mounting. Recommended taxonomic levels of effort (and any exceptions) are listed in the heading for each taxonomic group in the tables that follow. For Level II and Level IIa, wherever species identifications are recommended, it is implicit from the tables which genera can be identified to species by the listing of all species within our geographic range under their current generic assignment, and by the indication of literature references best suited for species-level identification within each genus. It should be noted however that species-level (and sometimes even genus-level) identifications require well-preserved specimens, often of late-instar larvae in the case of insects, that if lacking in a sample will preclude identification to finer taxonomic resolution.

Taxonomic and Geographic Scope

The STE is based on current understanding of BMI taxonomy and was prepared following rules established by SAFIT (Rogers & Richards, 2006). It is a compilation and distillation of data gleaned (as of the date of this revision) from peer-reviewed literature, museum records, the input of various taxonomic experts and the SWAMP database which includes BMI records from thousands of California bioassessment samples collected over more than 25 years. The primary purpose of the STE is to provide a list of reproducible taxonomic endpoints for BMI taxa known from California, relevant to SWAMP bioassessment protocols or similar procedures, and achievable given the most current taxonomic literature and suitable specimen preservation. Distributional records are provided from states immediately surrounding California for informational purposes only, and to indicate taxa that, while in some cases are currently unknown from California, could potentially occur in bioassessment samples based on their geographic proximity. The STE is not a checklist of all aquatic species known from California or the southwestern U.S.; distributional information for species-level occurrences is not provided in the tables below where available taxonomic keys do not support species-level identification, i.e., distributional information in such cases is restricted to genus or higher[2].

Organization and Changes from the Previous Version

Major taxonomic groups were presented in (roughly) phylogenetic order in previous versions of the STE (e.g., Richards and Rogers, 2011). By contrast, higher taxa in this list are artificially split into two major sections based on two primary reference volumes widely used to identify taxa within each section. The first section includes the insects and close relatives (i.e., subclass Hexapoda) that will key to genus in Merritt et al. (eds), 2019, *An Introduction to the Aquatic Insects of North America*, *5th edition*. The second section includes non-insect taxa, most of which can be keyed using Thorp and Rogers (eds), 2016, *Thorp and Covich's Freshwater Invertebrates: Keys to Nearctic Fauna, Volume II, 4th edition*. Within each of these two major sections, taxonomic groups at all hierarchical levels are presented in alphabetical order rather than phylogenetic order to facilitate the ease of locating taxonomic names within the tables, and since phylogenetic arrangements are in flux for many groups.

[2] SAFIT has recently expanded its membership and region of interest to the United States west of the Rockies and British Columbia. A species-level database and associated checklist (i.e., the 'Master Source File') of all freshwater taxa known from that larger region, with associated literature references and independent of STE considerations, is being developed and is available at URL: http://safit.org/downloads/. Other states within the SAFIT region may use the checklist as a starting point to develop their own STE lists as appropriate for their individual programs.

Taxa newly described since 2011 were added and necessary changes in nomenclature such as synonymies were included. In the tables below, names added since the previous STE are denoted by a single asterisk (*), whereas names that have changed relative to the previous STE are denoted by two asterisks (**). Erroneous distribution records were deleted and new distributional records added. For the most part, only published distributional records (and records from the SWAMP database consistent with published distributions) or unpublished records verified by an expert within a given taxonomic group were included. In a few cases, taxa identified by ABL staff in California bioassessment samples, but with no known published records from California, were included in the STE list with an associated comment, either with distributional information left completely blank if the taxon would not otherwise be in the list because it is known only from outside the encompassed geographic range, or with its published occurrence in a surrounding state noted where applicable, but with the tentative California record unmarked.

Habitat Information

The primary focus of this list is BMIs. A few non-benthic taxa (e.g., water column or shore-dwellers) have been included in the tables below because they can occur in bioassessment samples, but are excluded from data analyses if identified and included in taxa lists submitted to the SWAMP database. See STE Rules section 3.4 (Rogers and Richards 2006) for a full list of taxa that are excluded from benthic data sets and analyses. Basic habitat association (lotic, lentic, estuarine) has been included for all benthic taxa. This data should always be viewed as a generalization, and represents only what is found in the literature. Species with preferences for lentic environments may be found in static or backwater portions of a stream. Likewise, species with lotic preferences may be found along the edges of lakes, where wave action is sufficient to produce the oxygenation and turbulence that would normally be found in a river or stream.

Life Stage Terminology

The information in the STE deals primarily with those life stages of BMIs that are aquatic. Some additional information is given for terrestrial life stages. Though the term ‘larva’ has been used by some authors to refer to any immature insect, other authors have used the term ‘nymph’ to refer to immature stages of hemimetabolous insects (Ephemeroptera, Odonata and Plecoptera). This document continues use of the term nymph for immature stages of hemimetabolous insects, and reserves the term larva for the immature, pre-pupal stage of holometabolous insects (Coleoptera, Diptera, Lepidoptera, Megaloptera, Neuroptera and Trichoptera).

Rare, Threatened and Endangered Species

Rare, threatened and endangered species are defined to include aquatic macroinvertebrate species listed as threatened or endangered under the federal Endangered Species Act (ESA) (50 CFR 17.11 for listed animals and various Federal Register notices for proposed species), the California Endangered Species Act (CESA), and the California Environmental Quality Act (CEQA). The latter two pieces of legislation do not necessarily cover aquatic macroinvertebrate species that may be listed under state law in adjacent states. Rare, threatened and endangered species are afforded various levels of protection under the aforementioned laws. Any individual, private company or agency that violates these laws may be subject to substantial fines, imprisonment, or both. Inclusion of names of rare, threatened and endangered aquatic macroinvertebrates in this document and the STE list is meant to be strictly informative and in no way authorizes collecting or harming these taxa without

proper permits. Note that organisms that are non-target with respect to BMI-based bioassessment (e.g., fish and amphibians) can also be impacted by collection efforts.

Rare species may be given some protection under CEQA depending upon the action being reviewed under a specific CEQA document. These species are not typically protected, however they may at any time become listed under CESA or ESA.

Threatened species are partially protected under CESA and ESA. While it is illegal to collect, harm, harass, or kill threatened species, some activities may still be legal (varying depending on the species) without the requirement of permits.

Endangered species are fully protected under CESA, CEQA and ESA. It is illegal to collect, harm, harass, or kill endangered species without the appropriate state Memorandum of Understanding and/or federal 10(A) 1(a) permits.

Abbreviations in the STE list

CA = California, OR = Oregon, NV = Nevada, AZ = Arizona, Baja = Baja California (at present this term does not distinguish between Baja California Norte and Baja California Sur). For definitions of other terms used in this document, please refer to the STE Rules document located on the SAFIT website.

Acknowledgments

We thank Brady Richards and Christopher Rogers for their work on previous versions of this document. This current version was built and heavily relies on their work. We also thank all the people who assisted by reviewing various sections of this and the previous versions of the document. For a full list of contributors see STE document 2011 version. We want to thank the SAFIT membership for their cooperation and their role with SSCWRP in formalizing SAFIT. We gratefully acknowledge SWAMP for support and funding in this endeavor.

Contacts and Further Information

For the latest version of the STE document, visit the link on the SAFIT website (http://safit.org/downloads/). Tolerance values and functional feeding group information was included in earlier versions of the STE, but has been removed from more recent versions in the interest of space; this information is available on the SAFIT website (http://safit.org/downloads/).

Taxonomic updates and other changes documented herein will be integrated into the SWAMP database and the California Environmental Data Exchange Network (CEDEN). Any suggestions for modifications of this list should comply with the STE Rules (see link for Rogers and Richards [2006] below) and be sent to the attention of Doug Post at CDFW Aquatic Bioassessment Laboratory (doug.post@wildlife.ca.gov) or any member of SAFIT's Standard Taxonomic Effort committee (see STE Rules, sections 2.2 and 2.6). Doug is currently the keeper of the STE database and should be included in anything that is taxonomic in nature.

Literature Cited

Mazor, R. D., A. C. Rehn, P. R. Ode, M. Engeln, K. Schiff, E. D. Stein, D. J. Gillett, D. B. Herbst, and C. P. Hawkins. 2016. Bioassessment in complex environments: designing an index for consistent meaning in different settings. Freshwater Science 35:249–271.

Mazor, R.D., D.M. Rosenberg and V.H. Resh. 2019. Chapter 7: Use of Aquatic Insects in Bioassessment. pp. 141-164. *In*: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), *An Introduction to the Aquatic Insects of North America*, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Merritt, R. W., K. W. Cummins and M. B. Berg (editors). 2019. *An Introduction to the Aquatic Insects of North America, fifth edition*. xviii + 1480 pp. Kendall Hunt, Dubuque, IA.

Ode, P.R., A.E. Fetscher and L.B. Busse. 2016. Standard Operating Procedures (SOP) for the Collection of Field Data for Bioassessment of California Wadeable Streams: Benthic Macroinvertebrates, Algae and Physical Habitat. California State Water Resources Control Board Surface Water Ambient Monitoring Program: SWAMP-SOP-SB-2016- 001. 73pp. URL: https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/docs/01-combined-sop-final-v4-11mar2016.pdf

Rogers, D. C. and A. B. Richards. 2006. Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) Rules for Developing a Standard Level of Taxonomic Effort. Version 28 November 2006. URL: http://safit.org/downloads/.

Richards, A. B. and D. C. Rogers. 2011. Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) List of Freshwater Macroinvertebrate Taxa from California and Adjacent States including Standard Taxonomic Effort Levels. Version: 1 March 2011.
URL: http://safit.org/downloads/.

Thorp, J. H. and D. C. Rogers (editors). 2016. *Thorp and Covich's Freshwater Invertebrates: Keys to Nearctic Fauna - Volume II, fourth edition*. xxii + 740 pp. Academic Press, San Diego, CA.

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Coleoptera - Beetles**
Standard Effort Level I: Genus
Standard Effort Level II: Species (where possible).
Standard Taxonomic Reference(s): Short and White (2019).

Aquatic beetles (larvae and adults) can generally be identified to genus using the keys in Merritt, Cummins and Berg (Short and White, 2019). Most larvae cannot be keyed to species. Although designed for the Florida beetle fauna, Epler (2010) can be a useful resource. For specimens from the Southwest, other supplementary references may be required for species identifications. Miller and Bergsten (2016), is an excellent resource for Dytiscidae, even if it is a world key. Larson et al., (2000) is still the best recourse for species level identifications on the dytiscids. The SAFIT workshop manual, Post (2005), though starting to get dated, is still a good reference for California taxa.

Fery and Ribera (2018) have reworked the genera of Deronectina, which, for North America, previously included *Boreonectes*, *Nebrioporus*, *Oreodytes* and *Stictotarsus*. This revision fractures the group into nine genera for North America. This revision most likely came out too late to be included in the Short and White (2019) key, so identification of any of these genera will have to be verified through the use of the key in Fery and Ribera (2018). Brown (1972a) is still the best source for elmid species keys. The keys in White and Roughley (2008) for the Chrysomelidae, Staphylinidae and Curculionidae can be used, but used with caution because each of these families have only a few truly aquatic representatives, with the majority of the genera being terrestrial. White and Roughley (2008) make the assumption that the specimen being keyed is aquatic, and not a terrestrial specimen that was accidentally collected in an aquatic sample.

Species level identification is possible for nearly all adult aquatic beetles, however many of the keys require the dissection of the male and sometimes the female specimens in order to extract the genitalia. This is generally considered an expertise above what is required by the average bench taxonomist doing bioassessment work and should be reserved for more specialty work.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Coleoptera**										
Family - **Amphizoidae**										Generic key in Short and White (2019).
Genus - *Amphizoa*										Adult key to species in Kavanaugh (1986)
Amphizoa insolens	x	x			x	x	x			
Amphizoa lecontei	x	x				x	x	x		
Amphizoa striata	x	x				x				
Family - **Carabidae**										No generic key in Short and White (2019). Shore dwellers. Excluded from benthic datasets.
Genus - *Diplochaetus* **					x	x	x	x	x	Saline habitats along lakes, ponds and marshes.
Genus - *Omophron*					x	x	x	x	x	Sandy shores along rivers and streams.
Genus - *Thalassotrechus*										Pacific coast intertidal.
Family - **Chrysomelidae**										Surface dwellers. Excluded from benthic datasets.
Family - **Curculionidae**										Surface dwellers. Excluded from benthic datasets.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Dryopidae**										Generic key in Short and White (2019). Species key in Brown (1972a), generally requires dissection of male.
Genus - *Dryops*										
Dryops arizonensis	x	x			x			x		Only one western species. Riparian, rarely collected in benthic samples.
Genus - *Helichus*	x	x			x	x	x	x		
Genus - *Postelichus*	x	x			x			x		
Family - **Dytiscidae**										Generic key in Short and White (2019). Species keys in Larson et al. (2000). Many species that are considered lentic can be found in backwater areas of rivers and streams.
Genus - *Acilius*										
Acilius abbreviatus	x		x		x	x	x			Only species known from California.
Genus - *Agabinus*										
Agabinus glabrellus	x	x			x	x				
Agabinus sculpturellus	x	x			x	x				
Genus - *Agabus*	x	x	x		x	x	x	x	x	Species id. usually requires dissection of male. Leave at genus. Larvae of *Agabus*, *Ilybiosoma*, *Ilybius* and *Platambus* are not separable, leave at subfamily - Agabinae.
Genus - *Boreonectes* *	x		x		x	x				Keys to *Stictotarsus/ Boreonectes* in Short and White (2019). Id. with Fery and Ribera (2018). For species id., use *Stictotarsus* key in Larson et al. (2000). Leave larvae at subfamily - Hydroporinae.
Boreonectes expositus**	x		x		x	x				
Boreonectes griseostriatus **	x	x	x		x	x	x	x		
Genus - *Celina*	x		x		x			x	x	Species id. usually requires dissection of male.
Genus - *Clarkhydrus* *										Keys to *Stictotarsus/ Boreonectes* in Short and White (2019). Id. with Fery and Ribera (2018). For species id., use *Stictotarsus* key in Larson et al. (2000). Leave larvae at subfamily - Hydroporinae.
*Clarkhydrus corvinus***	x	x						x		
*Clarkhydrus decemsignatus***	x	x						x		
*Clarkhydrus deceptus***	x	x			x				x	
*Clarkhydrus eximius***	x	x			x				x	
*Clarkhydrus falli***	x	x						x		
*Clarkhydrus roffi***	x	x	x					x	x	
*Clarkhydrus spectabilis***	x	x						x		
Genus - *Clemnius* *										Keys to *Hygrotus* in Short and White (2019), see Villastrigo et al. (2017) for separation. For species id. use *Hygrotus* key in Larson et al. (2000). Leave larvae at subfamily - Hydroporinae. Uncommon in bioassessment samples.
Clemnius acaroides **	x	x	x			x				
Clemnius hydropicus **	x	x	x		x	x			x	
Genus - *Colymbetes*	x		x		x	x	x	x		Species id. usually requires dissection of male.
Genus - *Copelatus*										Species key in Larson et al. (2000).
Copelatus chevrolati	x		x		x			x	x	
*Copelatus distinctus**	x		x					x		
Copelatus glyphicus	x		x		x	x				
Genus - *Coptotomus*										
Coptotomus longulus	x		x		x	x	x			Only one western species.
Genus - *Cybister*										Species key in Miller (2013).
Cybister explanatus	x		x		x	x	x		x	
Cybister fimbriolatus **	x		x		x			x	x	
Genus - *Desmopachria*										Species key in Larson et al. (2000).
Desmopachria dispersa	x		x		x			x	x	
Desmopachria latissima	x		x		x				x	
Desmopachria mexicana	x		x		x			x		
Desmopachria portmanni	x		x					x		

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Dytiscidae** - Continued										
Genus - *Deuteronectes*[*]										Keys to *Oreodytes* in Short and White (2019). Id. with Fery and Ribera (2018). For species id., use *Oreodytes* key in Larson et al. (2000). Leave larvae at subfamily - Hydroporinae.
Deuteronectes angustior[**]	x	x				x				
Deuteronectes picturatus[**]	x	x			x	x	x			
Genus - *Dytiscus*										Species key in Larson et al. (2000).
Dytiscus cordieri	x		x		x	x				
Dytiscus dauricus	x	x	x		x	x	x	x		
Dytiscus habilis	x		x					x		
Dytiscus hatchi	x		x		x	x				
Dytiscus hybridus	x		x			x				
Dytiscus marginicollis	x		x		x	x	x	x	x	
Genus - *Eretes*										Species key in Miller (2002).
Eretes sticticus	x		x		x			x	x	Only one species known from California.
Genus - *Graphoderus*										Species key in Larson et al. (2000).
Graphoderus liberus	x		x							Unverified record from California.
Graphoderus occidentalis	x		x		x	x				
Graphoderus perplexus	x		x		x					
Genus - *Hornectes* [*]										Keys to *Oreodytes* in Short and White (2019). Id. with Fery and Ribera (2018). For species id., use *Oreodytes* key in Larson et al. (2000). Leave larvae at subfamily - Hydroporinae.
Hornectes quadrimaculatus[**]	x	x			x	x	x			
Genus - *Hydaticus*										Species key in Larson et al. (2000).
Hydaticus aruspex	x	x	x		x	x				Only one western species.
Genus - *Hydroporus*	x	x	x		x	x	x	x		Species id. may require dissection of male for verification of closely related species. Leave at genus.
Genus - *Hydrotrupes*										
Hydrotrupes palpalis	x	x			x	x				Only one species known from North America. Primarily found in seeps. Uncommon in bioassessment samples.
Genus - *Hydrovatus*	x	x	x		x			x		Species id. usually requires dissection of male.
Genus - *Hygrotus*	x	x	x		x	x	x	x	x	*Clemnius* will also key out to *Hygrotus* in Short and White (2019). See Villastrigo et al. (2017) for separation. Species id. may require dissection of male for verification of closely related species. Leave at genus. Leave larvae at subfamily - Hydroporinae.
Genus - *Ilybiosoma* [*]	x	x			x	x	x	x	x	Species id. usually requires dissection of male. Leave at genus. Larvae of *Agabus*, *Ilybiosoma*, *Ilybius* and *Platambus* are not separable, leave at subfamily - Agabinae.
Genus - *Ilybius*	x	x	x		x	x	x	x		Species id. usually requires dissection of male. Leave at genus. Larvae of *Agabus*, *Ilybiosoma*, *Ilybius* and *Platambus* are not separable, leave at subfamily - Agabinae.
Genus - *Laccophilus*										Species key in Larson et al. (2000). Species key in Zimmerman (1970) can be helpful, especially for specimens collected in the southern portion of the state.
Laccophilus biguttatus	x		x		x					
Laccophilus fasciatus	x		x		x	x		x	x	
Laccophilus horni	x		x					x		
Laccophilus maculosus	x		x		x	x	x	x	x	
Laccophilus mexicanus	x		x		x	x	x	x	x	
Laccophilus oscillator	x		x					x		
Laccophilus pictus	x		x					x	x	
Laccophilus quadrilineatus	x		x		x			x		
Laccophilus salvini	x		x					x		
Laccophilus sonorensis	x		x		x			x	x	
Laccophilus vacaensis	x		x					x		
Genus - *Laccornis*										
Laccornis pacificus	x	x	x			x				Only one species known from states around California.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Dytiscidae** - Continued										
Genus - *Leconectes*[*]										Keys to *Stictotarsus/ Boreonectes* in Short and White (2019). Id. with Fery and Ribera (2018). For species id., use *Stictotarsus* key in Larson et al. (2000). Leave larvae at subfamily - Hydroporinae.
Leconectes striatellus [**]	x	x	x		x	x	x	x	x	Monotypic.
Genus - *Liodessus*	x	x	x		x	x	x	x	x	Species key in Larson et al. (2000). Species id. may require dissection of male. Leave at genus.
Genus - *Megadytes*[*]	x	x	x						x	Baja species uncertain. See Leech (1948).
Genus - *Meridiorhantus*[*]										Formerly in the genus *Rhantus*. Larvae will key out to *Rhantus*.
Meridiorhantus calidus[*]	x	x	x						x	Only one species known from North America.
Genus - *Mystonectes*[*]										Keys to *Stictotarsus/ Boreonectes* in Short and White (2019). Id. with Fery and Ribera (2018). For species id., use *Stictotarsus* key in Larson et al. (2000. Leave larvae at subfamily - Hydroporinae.
Mystonectes coelamboides [**]	x	x	x		x			x		
Mystonectes panaminti [**]	x	x			x			x		
Genus - *Nectoboreus*[*]										Keys to *Stictotarsus/ Boreonectes* in Short and White (2019). Id. with Fery and Ribera (2018). For species id., use *Stictotarsus* key in Larson et al. (2000). Leave larvae at subfamily - Hydroporinae.
Nectoboreus aequinoctialis [**]	x	x	x					x		
Nectoboreus dolerosus [**]	x	x	x		x					
Nectoboreus funereus [**]	x	x	x		x				x	
Genus - *Nectoporus*[*]										Keys to *Oreodytes* in Short and White (2019). Id. with Fery and Ribera (2018). For species id., use *Oreodytes* key in Larson et al. 2000. Leave larvae at subfamily - Hydroporinae.
Nectoporus abbreviatus[**]	x	x			x	x				
Nectoporus congruus[**]	x	x			x	x	x			
Nectoporus crassulus[**]	x	x			x	x				
Nectoporus obesus[**]	x	x			x	x	x			
Nectoporus rhyacophilus[**]	x	x			x					
Nectoporus sierrae[**]	x	x			x					
Nectoporus subrotundus[**]	x	x			x	x				
Genus - *Neobidessus*[*]										Larvae not included in Short and White (2019) key.
Neobidessus youngi[*]	x		x						x	Only species known from region.
Genus - *Neoclypeodytes*	x	x	x		x	x	x	x	x	Species id. may requires dissection of male. Leave at genus. Species key in Miller (2001).
Genus - *Neoporus*										Species key in Larson et al. 2000.
Neoporus arizonicus	x	x						x		
Neoporus dimidiatus	x	x	x					x		
Neoporus undulatus	x	x	x			x				
Genus - *Oreodytes*										Keys to *Oreodytes* in Short and White (2019). Id. with Fery and Ribera (2018). For species id., use *Oreodytes* key in Larson et al. (2000). Leave larvae at subfamily - Hydroporinae.
Oreodytes humboltensis	x	x			x					
Oreodytes scitulus	x	x	x		x	x				
Genus - *Platambus*[*]	x	x	x		x		x	x		Species id. usually requires dissection of male. Leave at genus. Larvae of *Agabus*, *Ilybiosoma*, *Ilybius* and *Platambus* are not separable, leave at subfamily - Agabinae.
Genus - *Rhantus*										Species key in Larson et al. (2000). Key in Short and White (2019) does not separate the larvae of *Rhantus*, *Meridiorhantus* and *Nartus*, but only the genus *Rhantus* is found in California.
Rhantus anisonychus	x		x	x	x	x	x		x	
Rhantus atricolor	x	x						x	x	
Rhantus binotatus	x	x	x		x	x	x	x		
Rhantus consimilis	x	x	x		x	x	x			
Rhantus gutticollis	x	x	x		x	x	x	x	x	
Rhantus sericans	x		x		x	x				
Rhantus wallisi	x		x		x	x				

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Dytiscidae** - Continued										
Genus - *Sanfilippodytes*	x	x	x		x	x	x	x		Species key in Larson et al. (2000). Species id. usually requires both males and females as well as dissection of male. Leave at genus.
Genus - ~~*Stictotarsus/ Boreonectes*~~	-	-	-	-	-	-	-	-	-	**DO NOT USE - Not a valid final ID** Adults - Id. with Fery and Ribera (2018) or SAFIT workshop key. Larvae - leave at subfamily - Hydroporinae.
Genus - *Stygoporus*										Stygobiontic. Larvae unknown. Unlikely in bioassessment samples.
Stygoporus oregonensis	x		x			x				Monotypic.
Genus - *Thermonectus*										Species key in Larson et al. (2000).
Thermonectus intermedius	x		x		x	x	x	x	x	
Thermonectus marmoratus	x	x			x			x	x	
Thermonectus nigrofasciatus	x	x	x					x	x	
Thermonectus sibleyi	x	x	x					x		
Thermonectus succinctus[*]	x		x						x	
Genus - *Uvarus*										Species key in Larson et al. (2000).
Uvarus amandus	x	x			x				x	
Uvarus subtilis	x	x			x	x		x	x	
Genus - *Vatellus*[*]										
Vatellus mexicanus[*]	x	x							x	Only one species known from region.
Family - **Elmidae**										Generic key in Short and White (2019). Species key in Brown (1972). Species id. may require dissection of male.
Genus - *Ampumixis*										
Ampumixis dispar	x	x			x	x				Monotypic.
Genus - *Atractelmis*										
Atractelmis wawona	x	x			x	x				Monotypic.
Genus - *Bryelmis*[*]										Key to species in Barr (2011).
Bryelmis rivularis[*]	x	x				x				
Bryelmis siskiyou[*]	x	x			x	x				
Genus - *Cleptelmis*										
Cleptelmis addenda	x	x			x	x	x	x		Monotypic.
Genus - *Cylloepus*										
Cylloepus abnormis	x	x						x		
Cylloepus parkeri	x	x						x		
Genus - *Dubiraphia*										
Dubiraphia brunnescens	x	x	x		x					Known only from Clear Lake, California.
Dubiraphia giulianii	x	x			x					May be a synonym of *Dubiraphia brunnescens*.
Genus - *Heterelmis*	x	x			x	x	x	x		Species id. requires dissection of male.
Genus - *Heterlimnius*										
Heterlimnius corpulentus	x	x			x	x	x	x		Only one species known from North America.
Genus - *Hexacylloepus*	x	x						x		Arizona species in question.
Genus - *Huleechius*										
Huleechius marroni	x	x						x	x	Only one species known from North America.
Genus - *Lara*										Adults are usually terrestrial, rarely found in benthic samples.
Lara avara	x	x	x		x	x				
Lara gehringi	x	x	x		x	x				May be a synonym of *Lara avara*.
Genus - *Macrelmis*	x	x						x	x	Species of *Macrelmis* keyed in Barr (2021).
Genus - *Microcylloepus*	x	x			x		x	x		Possible undescribed species, leave at genus.
Genus - *Narpus*										
Narpus angustus	x	x			x					
Narpus arizonicus	x	x						x		
Narpus concolor	x	x			x	x	x	x		
Genus - *Neocylloepus*	x	x						x		Arizona species in question.
Genus - *Neoelmis*	x	x						x		Arizona species in question.
Genus - *Optioservus*	x	x			x	x	x	x		Species id. requires dissection of male.
Genus - *Ordobrevia*										
Ordobrevia nubifera	x	x			x	x				Only one species in North America.
Genus - *Rhizelmis*										
Rhizelmis nigra	x	x			x					Monotypic.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Elmidae** - Continued										
Genus - *Stenelmis*	x	x	x			x	x	x		Species key in Schmude (1999), designed for the Nevada springs, but will serve for the West in general. Species id. requires dissection of male.
Genus - *Xenelmis*										
Xenelmis sandersoni	x	x						x		Only one species known from North America.
Genus - *Zaitzevia*	x	x			x	x	x	x		Species key in Brown (2001). Species id. requires dissection of male.
Family - **Epimetopidae**										Only one genus in North America. Species key in Perkins (2012). Species id. requires dissection of male. Leave at genus.
Genus - *Epimetopus*	x	x	x					x	x	
Family - **Eulichadidae**										
Genus - *Stenocolus*										Only one genus and species in North America.
Stenocolus scutellaris	x	x			x					Monotypic. Adults are terrestrial.
Family - **Georissidae**										Shore dwellers. Excluded from benthic datasets. Second species *Georissus pusillus* supposedly found in Oregon.
Family - **Gyrinidae**										Generic key in Short and White (2019). Adults not benthic and so are excluded from benthic sets. No species key for larvae.
Genus - *Dineutus*	x	x	x		x			x	x	
Genus - *Gyretes*	x	x			x			x		
Genus - *Gyrinus*	x	x	x		x	x	x	x	x	
Family - **Haliplidae**										Generic key in Short and White (2019).
Genus - *Brychius*										Species key in Mousseau and Roughley (2007).
Brychius hornii	x	x	x		x	x	x			
Brychius pacificus	x	x	x		x	x				
Genus - *Haliplus*	x		x		x	x	x	x	x	Species key in Leech and Chandler (1956) is still the most recent. Out of date leave at genus? *Apteraliplus parvulus* has been moved into this genus.
Genus - *Peltodytes*	x	x	x		x	x	x	x	x	Species key in Leech and Chandler (1956) is the still the most recent. Out of date leave at genus?
Family - **Helophoridae**										Only one genus.
Genus - *Helophorus*	x	x	x		x	x	x	x	x	Species key in Smetana (1985). Species id. usually requires dissection of the male. Leave at genus.
Family - **Heteroceridae**					x	x	x	x		Shore dwellers. Excluded from benthic datasets.
Family - **Hydraenidae**										Generic key in Short and White (2019).
Genus - *Gymnochthebius*	x	x			x	x		x	x	Species key in Perkins (1980). Species id. usually requires dissection of the male.
Genus - *Hydraena*	x	x	x		x	x	x	x	x	Species key in Perkins (1980). Species id. usually requires dissection of the male.
Genus - *Limnebius*	x	x	x		x	x		x	x	Species key in Perkins (1980). Species id. usually requires dissection of the male.
Genus - *Neochthebius*										Species key in Perkins (1980). Species id. usually requires dissection of the male.
Neochthebius vandykei	x			x	x					Intertidal zone of rocky coastlines. Only one species in North America.
Genus - *Ochthebius*	x	x	x	x	x	x	x	x	x	Species key in Perkins (1980). Species id. usually requires dissection of the male.
Family - **Hydrochidae**										Only one genus.
Genus - *Hydrochus*	x	x	x		x				x	No species key available at this time.
Family - **Hydrophilidae**										Generic key in Short and White (2019).
Genus - *Ametor*										Species key in Smetana (1988) or Leech and Chandler (1956).
Ametor latus	x		x		x					
Ametor scabrosus	x		x		x					
Genus - *Anacaena*										California species key in Leech and Chandler (1956).
Anacaena limbata	x	x	x		x					
Anacaena signaticollis	x	x	x		x			x	x	
Genus - *Berosus*	x	x	x	x	x	x	x	x	x	No species key available at this time.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Hydrophilidae** - Continued										
Genus - *Chaetarthria*	x	x	x		x	x	x	x	x	Species key in Miller (1974). Species id. usually requires dissection of the male.
Genus - *Crenitis*										Species key in Leech and Chandler (1956), with modification in Miller (1965).
Crenitis alticola	x	x	x		x			x		
Crenitis dissimilis	x	x	x		x	x				
Crenitis malkini	x	x	x			x				
Crenitis morata	x	x	x		x					
Crenitis palpalis	x	x	x		x	x				
Crenitis paradigma	x	x	x			x				
Crenitis rufiventris	x	x	x		x			x		
Crenitis snoqualmie	x	x	x			x				
Genus - *Crenitulus*[*]										
Crenitulus suturalis[*]	x	x	x					x	x	Only one species known from North America.
Genus - *Cymbiodyta*	x	x	x		x	x	x	x	x	Species key in Smetana (1974). Species id. usually requires dissection of the male.
Genus - *Enochrus*	x		x		x	x		x	x	Species key in Gundersen (1978). Species id. usually requires dissection of the male.
Genus - *Helochares*										
Helochares normatus	x	x	x		x			x	x	Only one species in western North America.
Genus - *Hemiosus*										Species key in Short and Torres (2006).
Hemiosus exilis	x	x	x					x		
Hemiosus maculatus[*]	x	x	x						x	
Genus - *Hydrobius*										*Hydrobius*/ *Limnohydrobius* listed in Short and White (2019) larval key, but only *Hydrobius* is found in California.
Hydrobius fuscipes	x		x		x					Only one species listed for SAFIT region.
Genus - *Hydrochara*										Species key in Smetana (1980).
Hydrochara lineata	x	x	x		x		x	x	x	
*Hydrochara ricksecker*i	x		x		x					Only known from vernal pools.
Genus - *Hydrophilus*										Species key in Leech and Chandler (1956).
Hydrophilus insularis	x	x	x					x	x	
Hydrophilus triangularis	x	x	x							Found throughout North America.
Genus - *Laccobius*	x	x	x		x	x	x	x	x	Species key in Smetana (1980).
Genus - *Paracymus*	x	x	x	x	x	x	x	x	x	Species key in Wooldridge (1966) with notes in Wooldridge (1975) for Paracymus securus.
Genus - *Tropisternus*	x	x	x	x	x	x	x	x	x	Species key in Leech and Chandler (1956).
Family - **Hydroscaphidae**										Species key in Gentili (1986).
Genus - *Hydroscapha*										Only one species reported from California.
Hydroscapha natans	x	x			x		x	x		Found in thin films of water.
Family - **Lampyridae**										Shore dwellers. Excluded from benthic datasets.
Family - **Limnichidae**										Shore dwellers. Excluded from benthic datasets.
Family - **Lutrochidae**										Shore dwellers. Excluded from benthic datasets.
Family - **Noteridae**										Generic key in Short and White (2019).
Genus - *Hydrocanthus*[*]										Species key in Young (1985).
Hydrocanthus iricolor[*]	x	x	x							California records are suspect.
Genus - *Suphisellus*										Species key in Young (1979).
Suphisellus bicolor	x	x	x							California records are suspect.
Suphisellus levis[*]	x	x	x						x	
Suphisellus lineatus[*]	x	x	x						x	
Family - **Psephenidae**										Generic key in Short and White (2019). Species id. is not possible for nymphs. Adults are terrestrial and so are excluded from benthic sets.
Genus - *Acneus*	x	x			x	x				
Genus - *Eubrianax*										
Eubrianax edwardsii	x	x			x	x	x			Only one species in North America.
Genus - *Psephenus*	x	x			x	x	x	x	x	
Psephenus falli	x	x			x	x	x			Only one species known from California.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Ptilodactylidae**										Generic key in Short and White (2019). Adults are terrestrial and so are excluded from benthic sets.
Genus - *Anchycteis*										Larvae are mainly found in seeps and headwater streams.
Anchycteis velutina	x	x			x	x				Monotypic.
Genus - *Araeopidius*										Larvae are mainly found in seeps and headwater streams.
Araeopidius monachus	x	x			x	x				Monotypic.
Family - **Scarabaeidae**										Surface dwellers, excluded from benthic datasets.
Family - **Scirtidae**	x	x	x		x	x	x	x		No generic key in Short and White (2019). Leave at family. Adults are terrestrial; excluded from benthic sets.
Family - **Sphaeriusidae***										Shore dwellers, excluded from benthic datasets. Genus *Sphaerius* previously listed in the family Microsporidae.
Family - **Staphylinidae**										Shore dwellers, excluded from benthic datasets.

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Barr, C. B., 2011. *Bryelmis* Barr (Coleoptera: Elmidae: Elminae), A New Genus of Riffle Beetle with Three New Species from the Pacific Northwest, U.S.A. The Coleopterists Bulletin, 65(3): 197–212.

Barr, C. B. 2021. Revision of *Macrelmis* Motschulsky, 1860 in the Southwestern United States and Northern Mexico with Description of Four New Species (Coleoptera: Elmidae: Elminae). The Coleopterists Bulletin, 75(1) : 93-120.

Brown, H. P. 1972. Biota of freshwater ecosystems identification manual no. 6: aquatic dryopoid beetles (Coleoptera) of the United States. Washington, D.C.. ix + 82 pp.

Brown, H. P. 2001. Synopsis of the riffle beetle genus *Zaitzevia* (Coleoptera: Elmidae) in North America, with description of a new subgenus and species. Entomological News 112(3): 201-211.

Epler, J. H. 2010. The Water Beetles of Florida - an identification manual for the families Chrysomelidae, Curculionidae, Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Noteridae, Psephenidae, Ptilodactylidae and Scirtidae. Florida Department of Environmental Protection. Tallahassee, FL. 399+iv pp.

Fery, H. and I. Ribera. 2018. Phylogeny and taxonomic revision of Deronectina Galewski, 1994 (Coleoptera: Dytiscidae: Hydroporinae: Hydroporini). Zootaxa 4474 (1): 001–104.

Gentili, E. 1986. *Laccobius* americani - II. II genere *Laccobius* a sud del Canada (Coleoptera: Hydrophilidae). Annuario Osservatorio di Fisica terrestre e Museo Antonio Stoppani del seminario Arcivescoville di Milano (new series) 7(1984): 31-40.

Gundersen, R. W. 1978. Nearctic *Enochrus* biology, keys, descriptions and distribution (Coleoptera: Hydrophilidae). St. Cloud, MN, privately published. Dept. Biol. Sci., 54 pp.

Kavanaugh, D. H. 1986. A systematic review of amphizoid beetles (Amphizoidae: Coleoptera) and their phylogenetic relationships to other Adephaga. Proceedings of the California Academy of Sciences 44(6): 67-109.

Larson, D. J., Y. Alarie, R. E. Roughley. 2000. Predaceous diving beetles (Coleoptera: Dytiscidae) of the Nearctic Region with emphasis on the fauna of Canada and Alaska. Ottawa, NRC Research Press, xiv + 982 pp.

Leech, H. B. 1948. Contributions toward a knowledge of the insect fauna of Lower California. Coleoptera: Haliplidae, Dytiscidae, Gyrinidae, Hydrophilidae, Limnebiidae. Proceedings of the California Academy of Sciences 24(11):375-484.

Leech, H. B., and H. P. Chandler. 1956. Aquatic Coleoptera. [pp. 293-371]. In: R. L. Usinger (editor), Aquatic Insects of California, ix + 508 pp. University of California Press, Berkeley & Los Angeles.

Miller, D. C. 1965. Three new species of *Crenitis* from the Pacific Northwest (Coleoptera: Hydrophilidae). Coleopterists Bulletin 19(2): 33-36.

Miller, D. C. 1974. Revision of the new world *Chaetarthria* (Coleoptera: Hydrophilidae). Entomologica Americana 49(1): 1-123.

Miller, K. B. 2001. Revision and phylogenetic analysis of the New World genus *Neoclypeodytes* Young (Coleoptera: Dytiscidae: Hydroporinae: Bidessini). Systematic Entomology 26: 87-123.

Miller, K. B. 2002. Revision of the genus *Eretes* Laporte, 1833 (Coleoptera: Dytiscidae). Aquatic Insects 24(4): 247-272.

Miller, K. B. 2013. Review of the Genus *Cybister* Curtis, 1827 (Coleoptera: Dytiscidae: Dytiscinae: Cybistrini) in North America. The Coleopterists Bulletin, 67(4): 401–410.

Miller, K. B. and J. Bergsten. 2016. Diving Beetles of the World: Systematics and Biology of the Dytiscidae. 320 pages, 305 color images John Hopkins University Press, Baltimore, MD

Mousseau, T., and R. E. Roughley. 2007. Taxonomy, classification, reconstructed phylogeny and biogeography of Nearctic species of *Brychius* Thomson (Coleoptera: Haliplidae). Coleopterists Bulletin 61(3):351-397.

Perkins, P. D. 1980. Aquatic beetles of the family Hydraenidae in the Western Hemisphere: classification, biogeography and inferred phylogeny (Insecta: Coleoptera). Quaestiones Entomologicae 16(1,2): 3-554.

Perkins, P. D., 2012. A revision of *Epimetopus* Lacordaire, the New World hooded shore beetles (Coleoptera: Epimetopidae). Zootaxa 3531: 1–95.

Post, D. 2005. Dytiscidae of California. CAMLNet Taxonomy Workshop November 5-6, 2005, California State University, Chico, California. Rancho Cordova, CA, California Department of Fish and Game.

Schmude, K. L. 1999. Riffle beetles in the genus *Stenelmis* (Coleoptera: Elmidae) from warm springs in southern Nevada: new species, new status, and a key. Entomological News 110(1): 1-12.

Short, E. Z. and Torres, P. J. 2006. Review of the *Hemiosus* Sharp and *Derallus* Sharp of North America, Central America, and the Caribbean (Coleoptera: Hydrophilidae: Berosini). Zootaxa, 1369: 1-17.

Short, A. E. Z. and D.S.White. 2019. Chapter 21: Aquatic Coleoptera. pp. 791-908. *In*: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), *An Introduction to the Aquatic Insects of North America*, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Smetana, A. 1974. Revision of the genus *Cymbiodyta* Bed. (Coleoptera: Hydrophilidae). Memoirs of the Entomological Society of Canada(93): 1-113.

Smetana, A. 1980. Revision of the genus *Hydrochara* Berth. (Coleoptera: Hydrophilidae). Memoirs of the Entomological Society of Canada(111): 1-100.

Smetana, A. 1985. Revision of the subfamily Helophorinae of the Nearctic region (Coleoptera: Hydrophilidae). Memoirs of the Entomological Society of Canada (131):1-154.

Smetana, A. 1988. Review of the family Hydrophilidae of Canada and Alaska (Coleoptera). Memoirs of the Entomological Society of Canada(142): 316 pp.

Villastrigo A., Ribera I., Manuel M., Millán A. & Fery H. 2017: A new classification of the tribe Hygrotini Portevin, 1929 (Coleoptera: Dytiscidae: Hydroporinae). Zootaxa 4317(3): 499-529.

White, D. S., and Roughley, R. E. 2008. Chapter 20: Aquatic Coleoptera. [pp. 571-671]. In: Merritt, R. W., Cummins, K. W. & Berg, M. B. (editors), An introduction to the aquatic insects of North America, 4th ed., xvi + 1158 pp. + 39 color plates. Kendall/Hunt Publishing Co., Dubuque, Iowa.

White, D. S., and A. E. Z. Short. 2019. Chapter 21: Aquatic Coleoptera. pp. 791-908. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Wooldridge, D. P. 1966. Notes on Nearctic *Paracymus* with descriptions of new species (Coleoptera: Hydrophilidae). Journal of the Kansas Entomological Society 39(4): 712-725.

Young, F. N. 1979. Water Beetles of the Genus *Suphisellus* Crotch in the Americas North of Colombia (Coleoptera: Noteridae). The Southwestern Naturalist, 24(3): 409-429.

Young, F. N. 1985. A Key to the American Species of *Hydrocanthus* Say, with Descriptions of New Taxa (Coleoptera: Noteridae). Proceedings of the Academy of Natural Sciences of Philadelphia, 137: 90-98.

Wooldridge, D. P. 1966. Notes on Nearctic Paracymus with descriptions of new species (Coleoptera: Hydrophilidae). Journal of the Kansas Entomological Society 39(4):712-725.

Wooldridge, D. P. 1975. *Paracymus securus*, a new species from Baja California (Coleoptera: Hydrophilidae). Journal of the Kansas Entomological Society 48(1): 81-83.

Zimmerman, J. R. 1970. A taxonomic revision of the aquatic beetle genus *Laccophilus* (Dytiscidae) of North America. Memoirs of the American Entomological Society 26: 1-275.

Useful Websites:

Jasper, S. K. Water Beetle World - the newsletter for aquatic Coleoptera workers. University of Texas at Austin. www.zo.utaxas.edu/FACULTY/SJASPER/BEETLES/index.html.

Shepard, W. D. Worldwide Bibliography of Aquatic and Semiaquatic Dryopoidea. ResearchGate. Accessed 23 September 2022 at: https://www.researchgate.net/publication/305851192_Worldwide_Bibliography_of_Aquatic_and_Semiaquatic_Byrrhoid_Coleoptera_-_8_July_2020

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Collembola - Springtails**
Standard Effort Level I: Excluded from benthic datasets
Standard Effort Level II: Excluded from benthic datasets
Standard Taxonomic Reference(s): Snider (2019).

Collembolans can be identified to genus using the key in Merritt, Cummins and Berg (Snider, 2019). Collembola live on the surface film of water or near any aquatic or moist habitat including stream and pond margins, intertidal pools, water soaked wood and leaf litter. Collembola are not benthic, when aquatic, and are excluded from benthic datasets.

Literature

Snider, R. J. 2019. Chapter 12: Aquatic Collembola. pp. 245-261. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Checklist of the Collembola of the World, Last updated on 2020.03.31. URL: http://www.collembola.org/

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Diptera** - True Flies - General
Standard Effort Level I: Genus (where possible), pupae to family.
Standard Effort Level II: Genus/species (where possible), pupae to family.
Standard Taxonomic Reference(s): Courtney (2019).

This large Order has been split into three groups (Diptera – general, Chironomidae and Tipuloidea) to make taxa searches quicker. Keys to families and genera are given in Merritt, Cummins and Berg (An Introduction to the Aquatic Insects of North America) where Courtney (2019) provides keys to larvae and pupae. See also McAlpine et al. (1981, 1987 and 1989) for additional keys, illustrations, biological and phylogenetic information, and bibliographic references for all Diptera families. The North American Simuliidae were revised (Adler et al., 2004), but larval species identification is still impractical. Stone et al. (1983) is a good source for distributional information.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Diptera**										Generic key for larvae and family key for pupae in Courtney (2019).
Family - **Athericidae**										
Genus - *Atherix*										
Atherix pachypus	x	x			x	x	x			Only one species in western North America.
Family - **Axymyiidae***										Larvae are found in saturated wood above the waterline, unlikely in bioassessment samples.
Genus - *Axymyia**	x	x				x				One undescribed species discovered in Oregon.
Genus - *Protaxymyia**										
*Protaxymyia thuja**	x	x				x				Only one species in western North America.
Family - **Blephariceridae**										
Genus - *Agathon*										Species key in Hogue (1973).
Agathon arizonica	x	x			x	x		x		Listed under *Dioptopsis alpina* in Hogue (1973).
Agathon aylmeri	x	x			x	x				Listed under the genus *Dioptopsis* in Hogue (1973).
Agathon comstocki	x	x			x	x	x			
Agathon dismalea	x	x			x	x	x			Listed under the genus *Dioptopsis* in Hogue (1973).
Agathon doanei	x	x			x	x				
Agathon elegantulus	x	x			x	x	x			
Agathon markii	x	x			x	x				Listed under the genus *Dioptopsis* in Hogue (1973).
Agathon sequoiarum	x	x			x					Listed under the genus *Dioptopsis* in Hogue (1973).
Genus - *Bibiocephala*										
Bibiocephala grandis	x	x			x	x	x			Only one species in North America.
Genus - *Blepharicera*										Species key in Hogue (1973) plus description in Jacobson and Courtney (2008) to separate *B. kalmiopsis* from *B. jordani*.
Blepharicera jordani	x	x			x	x				
Blepharicera kalmiopsis	x	x			x	x				
Blepharicera micheneri	x	x			x					
Blepharicera ostensackeni	x	x			x	x				
Genus - *Philorus*										Species key in Hogue (1973)
Philorus californicus	x	x			x	x				
Philorus jacinto	x	x			x					
Philorus vanduzeei	x	x			x				x	
Philorus yosemite	x	x			x					
Family - **Canacidae**					x	x	x	x	x	Only two of the eight western genera listed in key, leave at family. Habitat - Beach zones. Uncommon in benthic samples.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Ceratopogonidae**										
Subfamily - Ceratopogoninae	x	x	x	x	x	x	x	x	x	The genera *Bezzia, Ceratopogon, Culicoides, Palpomyia, Probezzia* and *Stilobezzia* cannot readily be separated and should be left at subfamily.
Subfamily - Dasyheleinae										
Genus - *Dasyhelea*	x	x	x	x	x	x	x	x	x	
Subfamily - Forcipomyiinae										
Genus - *Atrichopogon*	x	x	x		x	x	x	x		
Genus - *Forcipomyia*	x	x	x		x	x	x	x	x	
Subfamily - Leptoconopinae*										
Genus - *Leptoconops**	x		x		x	x	x	x	x	
Family - **Chaoboridae**			x		x	x		x		Live in water column, not benthic. Should not be included in benthic bioassessment samples.
Family - **Corethrellidae***										
Genus - *Corethrella**	x	x	x		x			x	x	Unlikely in bioassessment samples. Live in marginal or heavily vegetated habitats, some in arboreal habitats like tree holes.
Family - **Culicidae**		x	x		x	x	x	x		Not benthic. Should not be included in benthic bioassessment samples. Generic key in Wallace (2019). Key to species available in Darsie and Ward (2005), designed for last instar larvae only.
Family - **Deuterophlebiidae**										
Genus - *Deuterophlebia*										Species key in Courtney (1990).
Deuterophlebia coloradensis	x	x			x	x				
Deuterophlebia inyoensis	x	x			x	x				
Deuterophlebia nielsoni	x	x			x					
Deuterophlebia personata	x	x			x	x				
Deuterophlebia shasta	x	x			x	x				
Family - **Dixidae**										
Genus - *Dixa*	x	x			x	x	x	x		
Genus - *Dixella*	x	x			x	x	x	x	x	
Genus - *Meringodixa*										
Meringodixa chalonensis	x	x			x					Monotypic.
Family - **Dolichopodidae**	x	x	x		x	x	x	x		Thirty genera known from California. Larvae found in a variety of aquatic, semiaquatic and terrestrial habitats. No larval key, leave at family.
Family - **Empididae**										Additional keys for the Hemerodromiinae in Brammer, et al. 2009.
Genus - *Chelifera*	x	x			x	x				*Chelifera* and *Metachela* are not separable use slash id.
Genera - *Chelifera*/*Metachela*	x	x			x	x				
Genus - *Clinocera*	x	x			x	x	x	x	x	
Genus - *Dolichocephala**	x	x			x	x	x			
Genus - *Heleodromia**	x				x	x		x		Some authors place this genus in the Family Brachystomatidae.
Genus - *Hemerodromia*	x	x			x	x	x	x		
Genus - *Metachela*	x	x			x	x				*Chelifera* and *Metachela* are not separable use slash id.
Genus - *Neoplasta*	x	x			x	x		x		
Genus - *Oreogeton*	x	x				x				Some authors place this genus in the Family Oreogetonidae. Specimens that key out to this genus have been found by the ABL.
Genus - *Oreothalia**	x	x			x	x				
Genus - *Proclinopyga**	x	x			x					
Genus - *Rhamphomyia**	x	x			x	x	x	x		
Genus - *Roederiodes*	x	x			x					
Genus - *Trichoclinocera*	x	x			x	x				
Genus - *Wiedemannia*	x	x			x	x	x	x		
Family - **Ephydridae**	x	x	x		x	x	x	x	x	Not all western genera included in key, leave at family.
Family - **Muscidae**	x	x	x		x	x	x	x	x	No larval generic key at present.
Family - **Oreoleptidae**										
Genus - *Oreoleptis*										
Oreoleptis torrenticola	x	x								Monotypic. Unpublished records for California and Oregon.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Pelecorhynchidae**										
Genus - *Glutops*	x	x			x	x				*Bequaertomyia* also known from California. Unlikely in bioassessment samples, found in soil along stream banks and swampy areas.
Family - **Phoridae**	x	x	x		x	x	x	x		No larval generic key at present.
Family - **Psychodidae**										
Subfamily - Psychodinae*										
Tribe - Maruinini*										
Genus - Maruina										
Maruina lanceolata	x	x			x		x	x	x	Only one species known from California.
Tribe - Pericomaini*										
Genus - ~~*Pericoma*~~	x	x	x		x	x		x	x	*Pericoma* and *Telmatoscopus* are no longer used for North American species; no new generic names have been assigned. Leave at tribe.
Genus - ~~*Telmatoscopus*~~	x	x	x		x			x	x	*Pericoma* and *Telmatoscopus* are no longer used for North American species; no new generic names have been assigned. Leave at tribe.
Tribe - Psychodini*										
Genus - *Psychoda*	x	x	x		x	x		x		
Family - **Ptychopteridae**										
Genus - *Bittacomorpha*	x	x	x		x	x				
Genus - *Bittacomorphella*	x	x			x	x				
Genus - *Ptychoptera*	x	x	x		x	x	x	x		
Family - **Scathophagidae***	x	x	x		x	x	x			No larval generic key at present. Larvae of the genus *Acanthocnema* are known to prey on the egg masses of *Neophylax rickeri*.
Family - **Sciomyzidae**	x		x		x	x	x	x	x	Only six of the thirteen western genera included in key, leave at family.
Family - **Simuliidae**										Generic key in Adler and Currie (2019). Adler et al. (2004) provides species keys, but most identifications require either reared associated pupae or a chromosomal analysis making it basically unusable for bioassessment id work. Leave at genus.
Genus - *Gigantodax*	x	x						x		
Genus - *Greniera*	x	x			x	x				
Genus - *Helodon*	x	x			x	x	x	x		
Genus - *Metacnephia*	x	x			x					
Genus - *Parasimulium*	x	x			x	x				
Genus - *Prosimulium*	x	x			x	x	x	x		
Genus - *Simulium*	x	x			x	x	x	x		
Genus - *Stegopterna*	x	x			x	x	x	x		
Genus - *Tlalocomyia*	x	x			x	x		x		
Genus - *Twinnia*	x	x			x	x				
Family - **Stratiomyidae**										
Genus - *Caloparyphus*	x	x			x	x	x	x		*Caloparyphus* and *Euparyphus* are not separable except for last instars and pupae. For all others, use slash id.
Genera - *Caloparyphus/Euparyphus*	x	x			x	x	x	x		
Genus - *Euparyphus*	x	x			x	x	x	x		*Caloparyphus* and *Euparyphus* are not separable except for last instars and pupae. For all others, use slash id.
Genus - *Hedriodiscus*	x	x			x	x	x	x	x	*Hedriodiscus* is not separable from some species of *Odontomyia*. Use slash id.
Genera - *Hedriodiscus/Odontomyia*	x	x			x	x	x	x	x	
Genus - *Myxosargus*	x	x			x	x	x	x		
Genus - *Nemotelus*	x	x			x	x	x	x	x	
Genus - *Odontomyia*	x	x			x	x	x	x	x	*Hedriodiscus* is not separable from some species of *Odontomyia*. For those species, use slash id.
Genus - *Stratiomys*	x	x			x	x	x	x		
Family - **Syrphidae**	x	x	x		x	x	x	x		No larval generic key at present.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Tabanidae**										
Genus - *Apatolestes*	x			x	x	x	x	x		Found in beach zones.
Genus - *Atylotus*	x	x			x	x		x		Larvae of *Atylotus* are not separable from *Tabanus*. Use slash id.
Genera - *Atylotus/Tabanus*	x	x			x	x		x	x	
Genus - *Chrysops*	x	x	x	x	x	x	x	x	x	
Genus - *Haematopota*	x	x			x					
Genus - *Hybomitra*	x	x	x		x	x	x	x		
Genus - *Leucotabanus*[*]	x		x					x		Found in tree holes.
Genus - *Silvius*	x	x	x		x					
Genus - *Stenotabanus*[*]	x			x	x			x		Found in beach zones.
Genus - *Tabanus*	x	x	x		x	x		x	x	Larvae of *Atylotus* are not separable from *Tabanus*. Use slash id.
Family - **Tanyderidae**										
Genus - *Protanyderus*	x	x			x	x	x	x		Only one genus known from western North America. *Protanyderus* is considered by some to be a junior synonym of *Protoplasa*.
Family - **Thaumaleidae**										
Genus - *Androprosopa*[**]	x	x			x	x	x	x		Only one genus known from California.

Footnotes
[*] - Denotes a new name added after the previous STE.
[**] - Denotes a name change from previous STE.

Literature

Adler, P. H., D. C. Currie, and D. M. Wood. 2004. The Black Flies (Simulidae) of North America. Comstock Publishing Assoc. a division of Cornell University Press, Ithica & London. xv + 941 pp.

Adler, P. H., and D. C. Currie. 2019. Chapter 26: Simuliidae. pp. 1097-1118. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Brammer, C. A., Harkrider, J. R., and MacDonald, J. F. 2009. Differentiation of larvae and pupae of aquatic genera of Nearctic Hemerodromiinae (Diptera: Empididae). Zootaxa (2069):59-68.

Courtney, G. W. 1990. Revision of Nearctic mountain midges (Diptera: Deuterophlebiidae). Journal of Natural History 24: 81-118.

Courtney, G. W. 2019. Chapter 23: Aquatic Diptera. pp. 925-1022. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Hogue, C. L. 1973. The net-winged midges or Blephariceridae of California. Bulletin of the California Insect Survey (15):1-83.

Jacobson, A. J. and G. W. Courtney. 2008. A new species of Blepharicera Macquart (Diptera: Blephariceridae) form western North America. Proceedings of the Entomological Society of Washington 110(4):978-987.

McAlpine, J. F., B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth and D. M. Wood (editors). 1981. Manual of Nearctic Diptera, Volume 1. Research Branch: Agriculture Canada, Monograph, (27): 1-674.

McAlpine, J. F., B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth and D. M. Wood (editors). 1987. Manual of Nearctic Diptera, Volume 2. Research Branch: Agriculture Canada, Monograph, (28): 675-1332.

McAlpine, J. F. and D. M. Wood (editors). 1989. Manual of Nearctic Diptera, Volume 3. Research Branch: Agriculture Canada, Monograph, (32): 1333-1581.

Middlekauff, W. W. and R. S. Lane. 1980. Adult and immature Tabanidae (Diptera) of California. Bulletin of the California Insect Survey 22: vi + 1-99.

Stone, A., C. W. Sabrosky, W. W. Wirth, R. H. Foote, and J. R. Coulson. 1983. A catalog of the Diptera of America North of Mexico. Smithsonian Institution Press, Washington, D.C. 1696 p.

Wallace, J. R. 2019. Chapter 25: Culicidae. pp. 1071-1096. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Diptera** - True Flies - Chironomidae
Standard Effort Level I: Family.
Standard Effort Level IIa: Subfamily/Tribe.
Standard Effort Level II: Genus or species group (where noted).
Standard Taxonomic Reference(s): Ferrington and Berg (2019).

Keys to families and genera are given in Merritt, Cummins and Berg (Ferrington and Berg, 2019). When identifying chironomids, it may be helpful to have a number of additional texts at hand including Wiederholm (1983), Wiederholm (1986), Epler (2001) and Anderson et al. (2013). Epler (2001), although designed for use in North and South Carolina, is well illustrated and contains many of the Nearctic genera. It also contains useful information on the hazards of midge larva identification including ecology, nomenclature, slide-mounting, and quality assurance. There are no comprehensive works on the chironomids of the western United States, like there are for the eastern part of the country. As a result a lot of the western genera do not have published records. Many genera have been added to this list based on records accumulated by the Aquatic Bioassessment Laboratory. These are included to show what is possible, but should not be considered verified record until such time as they get published.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Diptera**										
Family - **Chironomidae**										Generic keys for both larvae and pupae in Ferrington and Berg (2019).
Subfamily - Chironominae										
Tribe - Chironomini										
Genus - *Apedilum*	x	x	x		x		x	x		
Genus - *Chernovskiia*	x	x			x					
Genus - *Chironomus*	x	x	x		x	x	x	x		
Genus - *Cladopelma*	x	x			x		x	x		
Genus - *Cryptochironomus*	x	x	x		x	x				
Genus - *Cryptotendipes*	x	x	x		x		x	x		
Genus - *Cyphomella*	x	x	x					x		
Genus - *Demeijerea*	x	x				x				Not listed in 2019 Merritt and Cummins key. See Epler, Ekrem and Cranston (2013) for separation.
Genus - *Demicryptochironomus*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Dicrotendipes*	x	x			x	x	x	x		
Genus - *Endochironomus*	x	x	x		x	x				
Genus - *Endotribelos*	x		x		x					
Genus - *Glyptotendipes*	x	x	x		x	x				
Genus - *Goeldichironomus*	x	x	x		x					
Genus - *Harnischia*	x	x	x		x					
Genus - *Kiefferulus*	x	x			x	x				
Genus - *Lauterborniella*	x	x	x		x					
Genus - *Microchironomus*	x	x	x		x					
Genus - *Microtendipes*										Species complex key in Wiederholm (1983) or Anderson et al. (2013).
Species Complex - *Microtendipes pedellus* grp.	x	x			x	x				
Species Complex - *Microtendipes rydalensis* grp.	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Tribe - Chironomini - Continued										
Genus - *Nilothauma*	x	x			x					
Genus - *Pagastiella*	x	x	x							No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Parachironomus*	x	x			x	x				
Genus - *Paracladopelma*	x	x	x		x	x				
Genus - *Paralauterborniella*	x	x	x		x					
Genus - *Paratendipes*	x	x	x		x	x	x	x		
Genus - *Phaenopsectra*	x	x	x		x	x	x	x		
Genus - *Polypedilum*	x	x	x		x	x	x	x		
Genus - *Robackia*										Species key in Wiederholm (1983).
Robackia demeijerei	x	x			x					Only one species reported from California.
Genus - *Saetheria*[*]	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Sergentia*	x	x	x		x		x			
Genus - *Stenochironomus*	x	x			x	x		x		
Genus - *Stictochironomus*	x	x	x		x					
Genus - *Synendotendipes*	x	x			x					Monotypic - *Synendotendipes luski*
Genus - *Tribelos*	x	x	x		x	x				
Genus - *Xenochironomus*	x	x	x			x				Found in sponges.
Genus - *Xestochironomus* [*]	x	x				x				
Tribe - Pseudochironomini										
Genus - *Pseudochironomus*	x	x			x		x			
Tribe - Tanytarsini										
Genus - *Caladomyia*	x		x		x					Not listed in 2019 Merritt and Cummins key. See Epler, Ekrem and Cranston (2013) for separation.
Genus - *Cladotanytarsus*	x	x	x		x		x	x		
Genus - *Micropsectra*	x	x	x		x	x		x		
Genera - *Micropsectra*/*Tanytarsus*	x	x	x		x	x		x		For immature or indeterminate larvae with long lauterborn stalks.
Genus - *Paratanytarsus*	x	x			x					Only one species recorded from western North America - *Paratanytarsus grimmii*.
Genus - *Rheotanytarsus*	x	x			x			x		
Genus - *Stempellina*	x	x	x							No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Stempellinella*	x	x	x							No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus – *Sublettea*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Tanytarsus*	x	x	x		x	x				
Subfamily - Diamesinae										
Genus - *Boreoheptagyia*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Diamesa*	x	x			x		x	x		
Genus - *Pagastia*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Potthastia*										
Species Complex - *Potthastia gaedii* grp.	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Species Complex - *Potthastia longimana* grp.	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Protanypus*	x	x			x					
Genus - *Pseudodiamesa*	x	x			x	x				
Genus - *Sympotthastia*	x	x			x	x				
Subfamily - Orthocladiinae										
Genus – *Allocladius*	x	x			x			x		
Genus - *Brillia*	x	x			x	x				
Genus - *Cardiocladius*	x	x			x		x	x		

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Subfamily - Orthocladiinae - Continued										
Genus - *Chaetocladius*	x	x				x				
Genus - *Chasmatonotus*	x	x			x					
Genus - *Clunio*	x			x	x					Marine Intertidal. See Anderson et al. (2013) for separation.
Genus - *Corynoneura*	x	x	x		x					
Genus - *Cricotopus*	x	x	x		x	x		x		
Genus – *Cricotopus* (*Nostococladius*)	x	x			x	x				The Subgenus *Nostococladius* contains two inseparable species, *C. fuscatus* & *C. nostocicola*, which are found in colonies of the blue-green algae *Nostoc*. See key in Anderson et al. (2013) for separation of subgenera. These are not the only two species of *Cricotopus* found in *Nostoc*.
Species Complex - *Cricotopus bicinctus* grp.	x	x	x		x					
Species Complex - *Cricotopus trifascia* grp.	x	x			x			x		
Genera – *Cricotopus*/*Orthocladius*[*]	x	x	x		x	x	x	x		The formerly listed *Orthocladius* complex – now only contains two genera.
Genus - *Diplocladius*	x	x			x					
Genus - *Doithrix*	x	x			x					
Genus - *Eretmoptera*	x			x	x					Marine intertidal. See Anderson et al. (2013) for separation. Only one species recorded from western North America - *Eretmoptera browni*.
Genus - *Eukiefferiella*	x	x	x		x			x		Leave at genus. Species group key in Anderson et al. (2013).
Species Complex - *Eukiefferiella brehmi* group.	x	x								No species from this group are listed for California.
Species Complex - *Eukiefferiella brevicalcar* group.	x	x								No species from this group are listed for our region.
Species Complex - *Eukiefferiella claripennis* group.	x	x			x			x		
Species Complex - *Eukiefferiella coerulescens* group.	x	x			x			x		
Species Complex - *Eukiefferiella cyanea* group.	x	x								Possibly Oregon.
Species Complex - *Eukiefferiella devonica* group.	x	x			x			x		
Species Complex - *Eukiefferiella gracei* group.	x	x	x							No species from this group are listed for our region.
Species Complex - *Eukiefferiella pseudomontana* group.	x	x	x							No species from this group are listed for our region.
Genus - *Euryhapsis*	x	x			x					
Genus - *Georthocladius*	x	x			x					
Genus - *Gymnometriocnemus*	x	x	x							Semiaquatic - margins.
Genus - *Heleniella*	x	x			x					
Genus - *Heterotanytarsus*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Heterotrissocladius*	x	x			x					
Genus - *Hydrobaenus*	x	x	x		x					
Genus - *Krenosmittia*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Limnophyes*	x	x	x		x	x		x		
Genus - *Lopescladius*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Mesocricotopus*	x	x			x					Not listed in 2019 Merritt and Cummins key. See Anderson et al. (2013) for separation. No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Metriocnemus*	x	x			x	x		x		
Genus - *Nanocladius*	x	x	x		x					
Genus - *Oliveiriella*	x	x	x					x		

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Subfamily - Orthocladiinae - Continued										
Genus - *Onconeura*	x	x						x		Not listed in 2019 Merritt and Cummins key. See Anderson et al. (2013) for separation.
Genus - *Oropuella*[*]	x	x				x				Not listed in 2019 Merritt and Cummins key. See Fasbender, A. (2020) for separation. Specimens that key out to this genus from California have been found by the ABL.
Genus - Orthocladius	x	x	x		x	x	x	x		
Orthocladius lignicola	x	x			x	x				
Genus - *Parachaetocladius*	x	x			x					
Genus - *Paracladius*	x	x						x		
Genus - *Paracricotopus*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Parakiefferiella*	x	x	x		x			x		
Genus - *Parametriocnemus*	x	x			x			x		
Genus - *Paraphaenocladius*	x	x			x			x		
Genus - *Parorthocladius*	x	x				x				
Genus - *Platysmittia*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Psectrocladius*	x	x	x		x					
Genus - *Pseudorthocladius*	x	x			x					
Genus - *Pseudosmittia*	x	x			x	x				
Genus - *Psilometriocnemus*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Rheocricotopus*	x	x			x			x		
Genus - *Rheosmittia*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Smittia*	x		x		x					
Genus - *Symbiocladius*	x	x			x					
Genus - *Synorthocladius*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Tempisquitoneura*										
Tempisquitoneura merrillorum	x	x					x	x		Monotypic. Larvae phoretic on Corydalidae.
Genus - *Tethymyia*	x			x	x					Marine intertidal. See Anderson et al. (2013) for separation.
Genus - *Thalassosmittia*	x			x	x					Marine intertidal. See Anderson et al. (2013) for separation.
Genus - *Thienemanniella*	x	x	x		x					
Genus - *Tokunagaia*	x	x								Species group *Eukiefferiella rectangularis* in Bode (1983). No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Tvetenia*										Species group key in Bode (1983).
Species Complex - *Tvetenia bavarica* grp.	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Species Complex - *Tvetenia discoloripes* grp.	x	x			x			x		
Subfamily - Podonominae										
Genus - *Boreochlus*	x	x			x	x				
Genus - *Paraboreochlus*	x	x			x					
Genus - *Parochlus*	x	x			x	x		x		
Subfamily - Prodiamesinae										
Genus - *Monodiamesa*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Odontomesa*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Prodiamesa*	x	x								No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Subfamily - Tanypodinae										
Genus - *Ablabesmyia*	x	x	x		x	x	x	x		
Genus - *Alotanypus*	x	x			x			x		
Genus - *Apsectrotanypus*	x	x			x	x	x	x		

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Subfamily - Tanypodinae - Continued										
Genus - *Bilyjomyia*	x	x				x				
Genus - *Brundiniella*	x	x			x	x	x	x		
Genus - *Clinotanypus*	x	x	x		x					
Genus - *Conchapelopia*	x	x	x		x	x		x		*Thienemannimyia* group.
Genus - *Derotanypus*	x	x	x		x	x	x			
Genus - *Djalmabatista*	x	x						x		Specimens that key out to this genus have been found by the ABL.
Genus - *Helopelopia*	x	x			x					*Thienemannimyia* group.
Genus - *Krenopelopia*	x	x			x					
Genus - *Labrundinia*	x	x	x		x			x		
Genus - *Larsia*	x	x	x		x			x		
Genus - *Macropelopia*	x	x	x		x					
Genus - *Meropelopia*	x	x			x					*Thienemannimyia* group.
Genus - *Monopelopia*	x	x			x					
Genus - *Natarsia*	x	x			x					
Genus - *Nilotanypus*	x	x			x					
Genus - *Pentaneura*	x	x	x		x			x		
Genus - *Procladius*	x	x	x		x	x	x	x		
Genus - *Psectrotanypus*	x	x			x		x			
Genus - *Radotanypus*	x	x			x	x				
Genus - *Rheopelopia*	x	x								*Thienemannimyia* group. No published records for this genus in the west, but specimens that key out to this genus have been found by the ABL.
Genus - *Tanypus*	x	x	x		x		x	x		
Genus - *Thienemannimyia*	x	x	x		x	x	x	x		Thienemannimyia group.
Genus Complex - *Thienemannimyia* grp.	x	x			x	x	x	x		Contains the following genera: *Conchapelopia*, *Helopelopia*, *Meropelopia*, *Rheopelopia* and *Thienemannimyia*.
Genus - *Trissopelopia*	x	x	x		x			x		
Genus - *Xenopelopia*	x	x	x		x					
Genus - *Zavrelimyia*	x	x	x		x	x				*Paramerina* is now a subgenus of *Zavrelimyia*.
Subfamily - Telmatogetoninae										Generic key in Wiederholm (1983) or Anderson et al. (2013).
Genus - *Telmatogeton*	x			x	x	x				Marine Intertidal

Footnotes

* - Denotes a new name added after the previous STE.

** - Denotes a name change from previous STE.

Literature

Anderson, T., Cranston, P. S. and J. H. Epler (editors). 2013. Chironomidae of the Holarctic Region: Keys and Diagnosis. Part 1 - Larvae. Scadinavian Entomology, Vol. 66.

Andersen, T., O. A. Sæther, P. S. Cranston and J. H. Epler. 2013. 9. The larvae of Orthocladiinae (Diptera: Chironomidae) of the Holarctic Region - Keys and diagnoses. Insect Syst. Evol., Suppl. 66: 189-386.

Bode, R. W. 1983. Larvae of North American *Eukiefferiella* and *Tvetenia* (Diptera: Chironomidae). Bulletin of the New York State Museum(452): v + 1-40.

Epler, J. H. 2001. Identification manual for the larval Chironomidae (Diptera) of North and South Carolina, North Carolina Department of Environment and Natural Resources, Division of Water Quality.

Epler, J. H., T. Ekrem and P. S. Cranston. 2013. 10. The larvae of Holarctic Chironominae (Diptera: Chironomidae) — Keys and diagnoses. Insect Syst. Evol., Suppl. 66: 387-556.

Fasbender, A. 2020. *Oropuella*, a new genus of Orthocladiinae from the western Nearctic. Chironomus Journal of Chironomidae Research, 33: 17-30.

Ferrington, L. C., Jr. and M. B. Berg. 2019. Chapter 27: Chironomidae. pp. 1119-1274. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Wiederholm, T. 1983. Chironomidae of the Holarctic Region. Keys and diagnoses. Part 1. Larvae. Entomologica Scandinavica Supplement 19: 1-457.

Wiederholm, T. 1986. Chironomidae of the Holarctic Region. Keys and diagnoses. Part 2. Pupae. Entomologica Scandinavica Supplement 28: 1-482.

Useful Websites:

The Chironomid Homepage. Hosted by UMMZ-Insect Division, Ann Arbor, Michigan. Accessed on 14 February 2011 at - http://www.chironomidae.net/

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Diptera** - True Flies - Tipuloidea
Standard Effort Level I: Genus (where possible), pupae to superfamily.
Standard Effort Level II: Genus/species (where possible), pupae to superfamily.
Standard Taxonomic Reference(s): Gelhaus and Podeniene (2019).

Keys to families and genera, of Tipuloidea, are given in chapter 24 (Gelhaus and Podeniene, 2019) of Merritt, Cummins and Berg (An Introduction to the Aquatic Insects of North America). There are aquatic, semiaquatic and terrestrial species within the Superfamily Tipuloidea. Caution should be used when trying to key out specimens where the habitat unknown and attempting to key out earlier instars should be avoided. At this time there is no key for separation of the families of Tipuloidea. The Catalogue of the Craneflies of the World website is a good resource of distribution data.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order – **Diptera**										
Superfamily - **Tipuloidea***										Families and generic keys in Gelhaus and Podeniene (2019).
Family - **Cylindrotomidae***										
Genus - *Phalacrocera**	x		x			x				
Family - **Limoniidae***										Formerly part of Tipulidae.
Genus – *Antocha*										
Antocha monticola	x	x			x	x		x		Only one species known from western North America.
Genus - *Arctoconopa**	x	x			x	x				
Genus - *Cheilotrichia**	x	x	x		x	x		x		
Genus – *Cryptolabis*	x	x			x	x		x		
Genus - *Dactylolabis**	x	x			x	x		x		
Genus – *Dicranomyia**	x	x	x		x	x		x		
Genus – *Dicranophragma**	x	x	x		x	x				
Genus – *Elliptera**	x	x			x	x				
Genus – *Ellipteroides**	x	x	x		x			x		*Gonomyia*, *Idiocera* and *Ellipteroides* are not separable as larvae, use slash id.
Genus – *Eloeophila**	x	x			x	x		x		
Genus – *Epiphragma**	x	x						x		Semiaquatic.
Genus – *Erioptera*	x	x	x		x	x	x	x		
Genus – *Euphylidorea**	x	x	x		x	x	x	x		
Genus – *Geranomyia**	x	x	x		x	x		x		
Genus – *Gonempeda**	x	x	x		x	x				
Genus – *Gonomyia*	x	x	x		x	x		x		*Gonomyia*, *Idiocera* and *Ellipteroides* are not separable as larvae, use slash id.
Genus – *Gonomyia*, *Idiocera* and *Ellipteroides*	x	x	x		x	x		x		
Genus – *Gonomyodes**	x	x			x					
Genus – *Hesperoconopa*	x	x			x	x				
Genus – *Hexatoma*	x	x	x		x	x		x		
Genus – *Hoplolabis**	x	x	x		x					
Genus – *Idiocera**	x	x	x		x	x		x		*Gonomyia*, *Idiocera* and *Ellipteroides* are not separable as larvae, use slash id.
Genus – *Limnophila*	x	x	x		x	x				
Genus – *Lipsothrix**	x	x			x	x				
Genus – *Molophilus*	x	x	x		x	x		x		
Genus – *Orimarga**	x	x	x					x		
Genus – *Ormosia*	x	x	x		x	x		x		
Genus – *Paradelphomyia*	x	x	x		x	x		x		

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Limoniidae*** Continued										
Genus – *Pilaria*	x		x		x	x				
Genus – *Pseudolimnophila*	x	x	x		x					
Genus – *Rhabdomastix*	x	x			x	x		x		
Genus - *Rhypholophus**	x	x	x		x	x				
Genus - *Symplecta**	x	x	x		x	x				
Genus - *Thaumastoptera**										
*Thaumastoptera hynesi**	x	x			x					Only one species in North America.
Genus – *Ulomorpha*	x	x	x		x	x				
Family – **Pediciidae**										Formerly part of Tipulidae.
Genus – *Dicranota*	x	x	x		x	x		x		
Genus – *Pedicia*	x	x	x		x	x				
Genus - *Tricyphona**	x	x	x		x	x		x		
Family – **Tipulidae**										
Genus - *Angarotipula**	x		x		x					Swamps, Mashes, along weedy streams.
Genus – *Holorusia*										
Holorusia hespera	x	x	x		x	x	x	x		Only one species known from North America.
Genus – *Prionocera*	x		x		x	x	x	x		
Genus – *Tipula*	x	x	x		x	x	x	x		Key to subgenera of *Tipula* in Gelhaus and Podeniene (2019).
Subgenus – *Tipula* (*Arctotipula*)*	x	x	x		x	x				
Subgenus – *Tipula* (*Bellardina*)*	x	x	x		x			x		
Subgenus – *Tipula* (*Beringotipula*)*	x	x	x		x	x				Semiaquatic and Terrestrial.
Subgenus – *Tipula* (*Platytipula*)*	x	x	x			x				Aquatic and semiaquatic.
Subgenus – *Tipula* (*Savtshenkia*)*	x	x	x		x					Aquatic and semiaquatic.
Subgenus – *Tipula* (*Schummelia*)*	x	x	x		x	x				Semiaquatic.
Subgenus – *Tipula* (*Sinotipula*)*	x	x	x		x	x	x	x		
Subgenus – *Tipula* (*Tipula*)*	x	x	x		x					Aquatic, semiaquatic and terrestrial.
Subgenus – *Tipula* (*Trichotipula*)*	x	x	x		x	x	x	x		
Subgenus – *Tipula* (*Yamatotipula*)*	x	x	x		x	x		x		

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Gelhaus, J. K. and V. Podeniene. 2019. Chapter 24: Tipuloidea. pp. 1023-1070. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Useful Websites:

Catalogue of the Craneflies of the World
(Diptera, Tipuloidea: Pediciidae, Limoniidae, Cylindrotomidae, Tipulidae)
https://ccw.naturalis.nl/index.php.

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Ephemeroptera - Mayflies**
Standard Effort Level I: Genus
Standard Effort Level II: Species (where possible)
Standard Taxonomic Reference(s): Burian (2019).

Nymphs can be identified to genus using the key in Merritt, Cummins and Berg (Burian, 2019). There has been a considerable amount of reorganization of the baetid genera in recent years, and there is some debate as to what should be followed. For the most part, the Burian key in Merritt, Cummins and Berg, 2019, is being followed with a few exceptions that were recommended by SAFIT member Jeff Webb, who works closely with Luke Jacobus and Steve Burian at Mayfly Central. Those exceptions will be noted in the table below. There are two useful websites on Ephemeroptera: Mayfly Central, which maintains the Mayflies of North America checklist and has distributional information, and Ephemeroptera Galactica, which has a bibliography that offers many mayfly papers for download as PDFs.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	**Recommended Levels and Comments**
Class - **Insecta**										
Order - **Ephemeroptera**										Generic key in Burian (2019).
Family - **Ameletidae**										Only one North American Genus. No key to species for the nymphs.
Genus - *Ameletus*	x	x			x	x	x	x		
Family - **Ametropodidae**										Only one North American Genus.
Genus - *Ametropus*										Species key in Allen and Edmunds (1976).
Ametropus ammophilus	x	x			x	x				Only one species reported from California.
Family - **Baetidae**										Generic key in Burian (2019), or Webb, et al. (2018). Species id. usually requires late instars in fairly good condition.
Genus - *Acentrella*										Species key in Webb (2017).
Acentrella insignificans	x	x			x	x	x	x		
Acentrella turbida	x	x			x	x	x	x		
Genus - *Acerpenna*										
Acerpenna pygmaea	x	x				x				Only one species known from western North America. Specimens have been found in California in samples id'ed by the ABL.
Genus - *Anafroptilum*[*]										Formerly the genus *Centroptilum*. Species key in Webb (2017).
Anafroptilum album[**]	x	x			x	x				
Anafroptilum asperatum[**]	x	x			x	x		x		
Anafroptilum bifurcatum[**]	x	x			x	x	x			
Anafroptilum conturbatum[**]	x	x			x	x				
Genus - *Apobaetis*										
Apobaetis etowah	x	x			x	x				Only one species known from western North America.
Genus - *Baetis*										Species & species complex keys in Webb (2017).
SpeciesComplex - *Baetis alius* group[*]										
Baetis alius	x	x			x	x				
SpeciesComplex - *Baetis fuscatus* group[*]										
Baetis notos	x	x			x	x		x		
Baetis flavistriga complex[*]	x	x			x	x	x			Use "*Baetis flavistriga* complex" - actual species in complex have not been worked out.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Genus - *Baetis* - Continued										
SpeciesComplex - Baetis rhodani group*										
Baetis adonis	x	x			x	x		x	x	
Baetis diablus	x	x			x					
Baetis magnus	x	x			x		x	x		
*Baetis mimbresaurus***	x	x						x		Previously listed as *Moribaetis mimbresaurus*, larvae unknown.
Baetis bicaudatus complex*	x	x			x	x	x			Use "*Baetis bicaudatus* complex" - actual species in complex have not been worked out.
Baetis piscatoris complex*	x	x			x					Use "*Baetis piscatoris* complex" - actual species in complex have not been worked out.
Baetis tricaudatus complex*	x	x			x	x	x	x	x	Use "*Baetis tricaudatus* complex" - actual species in complex have not been worked out.
Genus - *Baetodes*										Species key in Webb (2017).
Baetodes alleni	x	x						x		
Baetodes arizonensis	x	x						x		
Baetodes bibranchius	x	x				x				
Baetodes edmundsi	x	x						x		
Baetodes longus									x	
Genus - *Callibaetis*	x	x	x		x	x	x	x	x	Species key in Webb (2017), only recommended for last instar larvae and requires specimens in very good condition. In most cases leave at genus.
Genus - *Camelobaetidius*										Species key in Webb (2017).
Camelobaetidius arriaga	x	x							x	
Camelobaetidius kickapoo	x	x						x		
Camelobaetidius maidu	x	x			x					
Camelobaetidius mexicanus	x	x				x		x	x	
Camelobaetidius musseri	x	x					x	x	x	
Camelobaetidius warreni	x	x			x	x	x	x	x	
Genus - *Cloeodes*										Species key in Webb (2017).
Cloeodes excogitatus	x	x			x	x		x	x	
Cloeodes macrolamellus	x	x						x		
Cloeodes peninsulus	x	x						x	x	
Genus - *Diphetor*										Only one species in North America.
Diphetor hageni	x	x			x	x	x			
Genus - *Fallceon*	x	x			x	x	x	x	x	No key to species at present.
Genus - *Iswaeon**										Species key in Webb (2017).
*Iswaeon anoka***	x	x				x				Previously listed as *Heterocloeon anoka*. Distribution questionable; contradictory information in literature (see species account in Webb, et al. (2018)).
Genus - *Labiobaetis**										Species key in Webb (2017).
*Labiobaetis apache***	x	x				x		x		Previously listed as *Pseudocloeon apache*.
*Labiobaetis propinquus***	x	x			x	x				Previously listed as *Pseudocloeon propinquus*.
Genus - *Paracloeodes*										Only one species in western North America.
Paracloeodes minutus	x	x			x	x			x	
Genus - *Plauditus*	x	x								Specimens that appear to be *Plauditus*, have been found in samples from California.
Genus - *Procloeon*										Species key in Webb, et al. (2017).
Procloeon pennulatum	x	x			x	x	x			
Procloeon rivulare	x	x			x					
Procloeon venosum	x	x			x	x				
Family - **Baetiscidae**										
Genus - *Baetisca*										Species key in Jacobus, et al. (2014).
Baetisca lacustris	x	x			x		x			Only one species has been reported from California.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Caenidae**										Generic key in Burian (2019).
Genus - *Caenis*										Species key in Provonsha (1990).
Caenis amica	x	x	x		x	x		x		
Caenis bajaensis	x	x			x			x	x	
Caenis latipennis	x	x	x		x	x	x	x		
Caenis punctata	x	x	x		x					
Caenis youngi	x	x	x		x	x				
Genus - *Cercobrachys*	x	x								Specimens have been found in California in samples id'ed by the ABL. Species unknown, collected from a large river in California.
Family - **Ephemerellidae**										Generic key in Burian (2019). Allen and Edmunds (1959 - 1965) can be helpful with species id's.
Genus - *Attenella*										Species key in Jacobus and Randolph (2005).
Attenella delantala	x	x			x	x				
Attenella margarita	x	x			x	x				
Attenella soquele	x	x			x	x				
Genus - *Caudatella*										Species key in Jacobus, et al. (2014).
Caudatella columbiella	x	x			x					
Caudatella edmundsi	x	x			x	x				
Caudatella heterocaudata	x	x			x	x	x			
Caudatella hystrix	x	x			x	x	x			
Caudatella jacobi	x	x			x	x				
Genus - *Drunella*										Species key in Jacobus, et al. (2014).
Drunella coloradensis	x	x			x	x	x	x	x	
Drunella doddsii	x	x			x	x	x	x		
Drunella flavilinea	x	x			x	x	x		x	
Drunella grandis	x	x			x	x	x	x		
Drunella pelosa	x	x			x	x				
Drunella spinifera	x	x			x	x	x			
Genus - *Ephemerella*										Species key in Jacobus, et al. (2014).
Ephemerella alleni	x	x				x				
Ephemerella aurivillii	x	x			x	x	x			
Ephemerella dorothea	x	x			x	x	x			
Ephemerella excrucians	x	x			x	x	x	x		
Ephemerella maculata	x	x			x	x				
Ephemerella tibialis	x	x			x	x	x	x		
Ephemerella velmae	x	x			x	x				
Ephemerella verruca	x	x				x				
Genus - *Eurylophella*										Species key in Jacobus, et al. (2014).
Eurylophella lodi	x	x			x	x				Only one species reported from western North America.
Genus - *Matriella*										Monotypic.
Matriella teresa	x	x			x	x				
Genus - *Serratella*										Species key in Jacobus, et al. (2014).
Serratella levis	x	x			x	x				
Serratella micheneri	x	x			x	x		x	x	
Genus - *Timpanoga*										Monotypic.
Timpanoga hecuba	x	x			x	x	x			
Family - **Ephemeridae**										Generic key in Burian (2019).
Genus - *Ephemera*										Only one species known from western North America.
Ephemera simulans	x	x	x			x	x			
Genus - *Hexagenia*										Species key in Jacobus and Randolph (2005).
Hexagenia limbata	x	x	x		x	x	x			
Family - **Heptageniidae**										Generic key in Burian (2019). Species keys are not available for nymphs at present leave at genus.
Genus - *Afghanurus*[*]	x	x			x	x	x	x		Former species of *Ecdyonurus* and *Nixe* have been moved into this genus.
Genus - *Cinygma*	x	x			x	x	x			
Genus - *Cinygmula*	x	x			x	x	x	x		
Genus - *Epeorus*	x	x			x	x	x	x	x	The nymphs for several western species are unknown - leave at genus.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Heptageniidae** - continued										
Genus - *Heptagenia*	x	x			x	x	x	x		
Genus - *Ironodes*	x	x			x	x	x		x	
Genus - *Leucrocuta*	x	x				x				Listed as part of *Afghanurus* in Burian (2019). J. Webb recommends continued use of *Leucrocuta*.
Genus - *Maccaffertium*										Listed as *Stenonema* in Burian (2019). J. Webb recommends continued use of *Maccaffertium*.
Maccaffertium terminatum	x	x	x		x	x	x			
Genus - *Rhithrogena*	x	x			x	x	x	x	x	
Family - **Isonychiidae**										Only one genus. No key to species at present.
Genus - *Isonychia*										
Isonychia intermedia	x	x					x	x		
Isonychia velma	x	x			x	x				Only one species reported from California.
Family - **Leptohyphidae**										Generic key in Burian (2019). No key to species at present.
Genus - *Leptohyphes*	x	x					x	x		
Genus - *Tricorythodes*	x	x	x		x	x	x	x	x	The species formerly listed under *Asioplax*, *Homoleptohyphes* and *Tricoryhyphes* are now listed under the genus *Tricorythodes.*
Genus - *Vacupernius*										
Vacupernius packeri	x	x						x		Only one species known from western North America
Family - **Leptophlebiidae**										Generic key in Burian (2019). Species keys are not available for nymphs.
Genus - *Choroterpes*	x	x	x		x	x	x	x	x	
Genus - *Leptophlebia*	x	x			x	x				
Genus - *Neochoroterpes*	x	x	x					x		
Genus - *Neoleptophlebia*[*]	x	x			x	x	x	x	x	Previously part of *Paraleptophlebia*.
Genus - *Paraleptophlebia*	x	x			x	x	x			
Genus - *Thraulodes*	x	x						x	x	
Genus - *Traverella*	x	x					x	x		
Family - **Polymitarcyidae**										Generic key in Burian (2019).
Genus - *Ephoron*										Only one species in western North America.
Ephoron album	x	x	x		x	x	x			
Family - **Potamanthidae**										Generic key in Burian (2019).
Genus - *Anthopotamus*										Only one species in western North America.
Anthopotamus verticis	x	x			x					
Family - **Pseudironidae**										Generic key in Burian (2019). Some authors place in Heptageniidae.
Genus - *Pseudiron*										
Pseudiron centralis	x	x			x					Monotypic.
Family - **Siphlonuridae**										Generic key in Burian (2019).
Genus - *Edmundsius*										
Edmundsius agilis	x	x			x					Monotypic.
Genus - *Siphlonurus*	x	x	x		x	x	x	x		Species key in Jacobus, et al. (2014). Species key relies too much on coloration - leave at genus.

Footnotes
[*] - Denotes a new name added after the previous STE.
[**] - Denotes a name change from previous STE.

Literature:

Allen, R. K. and G. F. Edmunds, Jr. 1959. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae). I. The subgenus *Timpanoga*. Canadian Entomologist 41: 51-58.

Allen, R. K. and G. F. Edmunds, Jr. 1961a. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae) III. The subgenus *Attenuatella*. Journal of the Kansas Entomological Society 34(4): 161-173.

Allen, R. K. and G. F. Edmunds, Jr. 1961b. 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, Jr. 1962. A revision of the genus *Ephemerella* (Ephemeroptera, Ephemerellidae). V. The subgenus *Drunella* in North America. Miscellaneous Publications of the Entomological Society of America 3: 145-179.

Allen, R. K. and G. F. Edmunds, Jr. 1963a. A revision of the genus Ephemerella (Ephemeroptera: Ephemerellidae). VII. The subgenus Eurylophella. Canadian Entomologist 95: 597-623.

Allen, R. K. and G. F. Edmunds, Jr. 1963b. 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, Jr. 1965. A revision of the genus *Ephemerella* (Ephemeroptera, Ephemerellidae). VIII. The subgenus *Ephemerella* in North America. Miscellaneous Publications of the Entomological Society of America 4: 244-282.

Allen, R. K. and G. F. Edmunds, Jr. 1976. A revision of the genus *Ametropus* in North America (Ephemeroptera: Ametropodidae). Journal of the Kansas Entomological Society 49: 625-635.

Burian, S. K. 2019. Chapter 13: Ephemeroptera. pp. 263-339. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Jacobus, L. and P. Randolph. 2005. Northwest Ephemeroptera nymphs. Northwest Biological Assessment Workgroup 9th Annual Taxonomic Workshop, June 9-12, 2005. University of Idaho, Moscow, Idaho.

Jacobus, L., N. A. Wiersema and J. M. Webb. 2014. Identification of Far Northern and Western North American Mayfly Larvae (Insecta: Ephemeroptera), North of Mexico. Joint Aquatic Science meeting, Portland, OR. 176pp + suppl. Unpublished workshop manual.

Provonsha, A. V. 1990. A revision of the genus *Caenis* in North America (Ephemeroptera: Caenidae). Transactions of the American Entomological Society 116: 801-884.

Webb, J. M. 2017. Baetidae Larvae of the Western United States and Canada. SAFIT Taxonomic Workshop, October 2017. University of California Davis, Davis, CA.

Webb, J. M., L. M. Jacobus, and S. P. Sullivan. 2018. The state of systematics of North American *Baetis* Leach, 1815 (Ephemeroptera: Baetidae), with recommendations for identification of larvae. Zootaxa 4394(1):105-127.

Useful Websites:

Ephemeroptera Galactica, Bibliography of the Ephemeroptera. Accessed 14 February 2011 at URL: http://www.ephemeroptera-galactica.com/pubsbib.php.

Mayfly Central, Mayflies of North America checklist, at URL: https://www.entm.purdue.edu/mayfly/na-species-list.php.

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Hemiptera (Suborder Heteroptera) - True Bugs**
Standard Effort Level I: Genus
Standard Effort Level II: Species
Standard Taxonomic Reference(s): Polhemus (2019).

Keys to families and genera are provided in Merritt, Cummins and Berg (Polhemus, 2019). The best regional text for all families remains Menke (ed.) (1979), which gives keys to all genera and species then known to occur in California. Stonedahl and Lattin (1986) surveyed the Corixidae for Oregon and Washington. Polhemus and Polhemus (2002) discussed the distributions of aquatic bugs in the Great Basin. The STE includes only those families which are truly aquatic and excludes all surface and shore dwelling families. The Notonectidae and Pleidae, are not benthic and generally excluded in benthic datasets.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Hemiptera**										
Suborder - **Heteroptera**										
Family - **Belostomatidae**										Family and generic keys in Polhemus (2019).
Genus - *Abedus*										Key to species in Menke (1979).
Abedus breviceps	x	x						x		
Abedus herberti	x	x						x		
Abedus indentatus	x	x			x				x	
Abedus ovatus	x	x						x		
Abedus parkeri	x	x						x		
Abedus vicinus	x	x						x	x	
Genus - *Belostoma*										Key to species in Menke (1979).
Belostoma bakeri	x	x	x		x	x	x	x	x	
Belostoma confusum	x	x	x					x		
Belostoma flumineum	x	x	x		x	x	x	x		
Belostoma saratogae	x	x	x		x					Known only from Saratoga Spring, Death Valley, CA.
Belostoma subspinosum	x	x	x		x			x		
Genus - *Lethocerus*										Key to species in Goodwyn (2006).
Lethocerus americanus	x	x	x		x	x	x			
Lethocerus angustipes	x	x	x		x		x			
Lethocerus medius	x	x	x					x		
Family - **Corixidae**										Family and generic keys in Polhemus (2019).
Genus - *Arctocorisa*										Key to species in Hungerford (1948). High elevation ponds.
Arctocorisa sutilis	x		x							Unpublished record for California.
Genus - *Callicorixa*										Key to species in Stonedahl and Lattin (1986).
Callicorixa audeni	x		x		x	x	x			
Callicorixa scudderi	x		x			x				
Callicorixa vulnerata	x		x		x	x				
Genus - *Cenocorixa*										Key to species in Lauck, D. R. (1979).
Cenocorixa andersoni	x		x			x				
Cenocorixa blaisdelli	x		x		x					
Cenocorixa kuiterti	x		x		x					
Cenocorixa utahensis	x		x			x	x	x		
Cenocorixa wileyae	x		x		x	x	x	x		

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Corixidae** - Continued										
Genus - *Corisella*										Key to species in Lauck, D. R. (1979).
Corisella decolor	x		x		x	x	x			
Corisella edulis	x		x		x	x	x	x		
Corisella inscripta	x		x		x	x		x	x	
Corisella tarsalis	x		x		x			x		
Genus - *Graptocorixa*										Key to species in Lauck, D. R. (1979).
Graptocorixa abdominalis	x	x			x		x	x		
Graptocorixa californica	x		x		x	x				
Graptocorixa gerhardi	x	x						x		
Graptocorixa serrulata	x	x				x	x	x		
Graptocorixa uhleri	x	x			x		x			
Graptocorixa uhleroidea	x	x			x					
Genus - *Hesperocorixa*										Key to species in Lauck, D. R. (1979).
Hesperocorixa atopodonta	x	x	x			x				
Hesperocorixa laevigata	x	x	x		x	x	x	x		
Hesperocorixa obliqua[*]	x	x	x		x					California record is suspect.
Hesperocorixa vulgaris	x	x	x		x	x				
Genus - *Morphocorixa*										Key to species in Lauck, D. R. (1979).
Morphocorixa beameri[**]	x							x		Formerly listed under the genus *Pseudocorixa*.
Morphocorixa lundbladi	x		x					x		
Genus - *Neocorixa*										Key to species in Lauck, D. R. (1979).
Neocorixa snowi	x	x	x					x		
Genus - *Palmacorixa*										Key to species in Lauck, D. R. (1979).
Palmacorixa buenoi	x	x								Unpublished record for California.
Genus - *Ramphocorixa*										Key to species in Lauck, D. R. (1979).
Ramphocorixa rotundocephala	x	x	x					x		
Genus - *Sigara*										Key to species in Lauck, D. R. (1979) with additional notes for *S. krafti* in Stonedahl (1984).
Sigara alternata	x	x				x		x		
Sigara grossolineata	x	x			x	x				
Sigara krafti	x	x				x				
Sigara mckinstryi	x	x			x	x				
Sigara nevadensis	x	x					x			
Sigara omani	x	x			x	x	x	x		
Sigara vallis	x	x			x					
Sigara vandykei	x	x			x					
Sigara washingtonensis	x	x			x	x	x	x		
Genus - *Trichocorixa*										Key to species in Lauck, D. R. (1979).
Trichocorixa arizonensis	x	x	x					x		
Trichocorixa calva	x	x	x	x	x			x		
Trichocorixa reticulata	x	x	x	x	x		x		x	
Trichocorixa uhleri	x	x			x			x		
Trichocorixa verticalis	x		x	x	x			x		
Family - **Gelastocoridae**										Shore dwellers. Excluded from benthic datasets.
Family - **Gerridae**										Surface dwellers. Excluded from benthic datasets.
Family - **Hebridae**										Surface dwellers. Excluded from benthic datasets.
Family - **Hydrometridae**										Surface dwellers. Excluded from benthic datasets.
Family - **Leptopodidae**										Shore dwellers. Excluded from benthic datasets.
Family - **Macroveliidae**										Surface dwellers. Excluded from benthic datasets.
Family - **Mesoveliidae**										Surface dwellers. Excluded from benthic datasets.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Naucoridae**										Family and generic keys in Polhemus (2019).
Genus - *Ambrysus*										Species key in Polhemus (1979). Description of *A. relictus* in Polhemus and Polhemus (1979).
Ambrysus amargosus	x	x					x			
Ambrysus arizonus	x	x						x		
Ambrysus californicus	x	x			x					
Ambrysus circumcinctus	x	x						x		
Ambrysus funebris	x	x			x					
Ambrysus hungerfordi[*]	x	x							x	
Ambrysus hybridus[*]	x	x					x	x		
Ambrysus melanopterus	x	x						x		
Ambrysus mormon	x	x	x		x	x	x	x		
Ambrysus occidentalis	x	x	x		x			x	x	
Ambrysus pudicus[*]	x	x			x				x	
Ambrysus pulchellus	x	x						x		
Ambrysus puncticollis	x	x			x			x		
Ambrysus relictus	x	x					x			
Ambrysus thermarum	x	x					x	x		
Ambrysus triunfo[*]	x	x							x	
Ambrysus vanduzeei[*]	x	x							x	
Ambrysus woodburyi	x	x					x	x		
Genus - *Limnocoris*										Species key in Polhemus (1979).
Limnocoris moapensis	x	x					x			
Genus - *Pelocoris*										Species key in Polhemus (1979).
Pelocoris biimpressus	x	x			x		x	x		Species description in Polhemus and Sites (1995).
Family - **Nepidae**										Family and generic keys in Polhemus (2019). Species key in Sites and Polhemus (1994).
Genus - *Curicta*										
Curicta pronotata	x		x					x		
Genus - *Ranatra*										
Ranatra brevicollis	x	x	x		x				x	
Ranatra fusca	x	x	x		x	x				
Ranatra montezuma	x	x	x					x		
Ranatra quadridentata	x	x			x			x	x	
Family - **Notonectidae**										Not benthic. Excluded from benthic datasets.
Family - **Ochteridae**										Shore dwellers. Excluded from benthic datasets.
Family - **Pleidae**										Not benthic. Excluded from benthic datasets.
Family - **Saldidae**										Shore dwellers. Excluded from benthic datasets.
Family - **Veliidae**										Surface dwellers. Excluded from benthic datasets.

Footnotes
[*] - Denotes a new name added after the previous STE.
[**] - Denotes a name change from previous STE.

Literature

Goodwyn, P. J. P. 2006. Taxonomic revision of the subfamily Lethocerinae Lauck & Menke (Heteroptera: Belostomatidae). Stuttgarter Beitrage zur Naturkunde Serie A (Biologie)(695): 1-71.

Hungerford, H. B. 1948. The Corixidae of the Western Hemisphere (Hemiptera), University of Kansas Science Bulletin.

Lauck, D. R. 1979. Family Corixidae/water boatmen. [pp. 87-123]. In: A. S. Menke (editor), The semiaquatic and aquatic Hemiptera of California (Heteroptera: Hemiptera).

Menke, A. S. 1979. Family Belostomatidae/giant water bugs, electric light bugs, toe biters. [pp. 76-86]. In: Menke, A. S. (editor), The semiaquatic and aquatic Hemiptera of California (Heteroptera: Hemiptera).

Menke, A. S., Ed. 1979. The semiaquatic and aquatic Hemiptera of California. Berkeley, University of California Press.

Polhemus, D. A., and J. T. Polhemus. 2002. Basins and ranges: the biogeography of aquatic true bugs (Insecta: Heteroptera) in the Great Basin, iii + 405 pp. [pp. 235-254]. In: R. Hershler, D. B. Madsen and D. R. Currey (editors), Great Basins Aquatic Systems History. Smithsonian Institution Press, Washington, D.C.

Polhemus, J. T. 1979. Family Naucoridae/creeping water bugs, saucer bugs. [pp. 131-138]. In: A. S. Menke (editor), The semiaquatic and aquatic Hemiptera of California (Heteroptera: Hemiptera).

Polhemus, J. T. 2019. Chapter 17: Aquatic and Semiaquatic Hemiptera. pp. 521-567. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Polhemus, J. T. and D. A. Polhemus. 1994. A new species of *Ambrysus* Stål from Ash Meadows, Nevada (Heteroptera: Naucoridae). Journal of the New York Entomological Society 102(2): 261-265.

Polhemus, J. T. and R. W. Sites. 1995. The identity of *Pelocoris biimpressus* Montandon and synonymy of Pelocoris species in the southwestern United States (Heteroptera: Naucoridae). Proceedings of the Entomological Society of Washington 97(3): 654-658.

Sites, R. W. and J. T. Polhemus. 1994. Nepidae (Hemiptera) of the United States and Canada. Annals of the Entomological Society of America 87: 27-42.

Stonedahl, G. M. 1984. A new species of *Sigara* from western Oregon and Washington (Hemiptera: Corixidae). Journal of the New York Entomological Society 92(1): 42-47.

Stonedahl, G. M. and J. D. Lattin. 1986. The Corixidae of Oregon and Washington (Hemiptera: Heteroptera). Agricultural Experiment Station, Oregon State University, Technical Bulletin(150): 1-84.

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Lepidoptera - Moths and Butterflies**
Standard Effort Level I: Genus
Standard Effort Level II: Genus
Standard Taxonomic Reference(s): Solis (2019).

Larvae of *Parapoynx* and *Petrophila* may be identified to genus using the key in Merritt, Cummins and Berg (Solis, 2019). This key and others for aquatic Lepidoptera should be used with caution for specimens collected in bioassessment samples. Careful collecting of Lepidoptera larvae to preserve case integrity and to record host-plant association is required to eliminate accidentals (e.g., terrestrial or riparian taxa). *Parapoynx* and *Petrophila* are the only two genera that are considered benthic and should be included in bioassessment samples. Other genera are either miners of surface vegetation or are semiaquatic at best. The key presented in Stehr and Martinat (1987) is a more complete guide to the families of North American Lepidoptera.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Lepidoptera**										
Family - **Crambidae**[*]										Generic key in Solis (2019).
Genus - *Parapoynx*	x		x							There are no records for *Parapoynx* in California. Specimens have been found that keyed out as *Parapoynx*, in older versions of Merritt & Cummins. Does not key out in current version.
Genus - *Petrophila*	x	x	x		x	x	x	x		

Footnotes
[*] - Denotes a new name added after the previous STE.
[**] - Denotes a name change from previous STE.

Literature

Solis, M. A. 2019. Chapter 20: Aquatic and Semiaquatic Lepidoptera. pp. 765-789. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Stehr, F. W., and P. J. Martinat. 1987. Lepidoptera. Key to families of larvae. [pp. 306-340]. In: F. W. Stehr (editor), Immature Insects, Volume 1. Kendall/Hunt, Dubuque, Iowa.

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Megaloptera - Dobsonflies and Alderflies**
Standard Effort Level I: Genus
Standard Effort Level II: Genus
Standard Taxonomic Reference(s): Bowles and Contreras-Ramos (2019).

Larvae may be identified to genus using the key in Merritt, Cummins and Berg (Bowles and Contreras-Ramos, 2019). Early instar corydalids should be left at family since head color patterns generally do not develop until later instars. Evans's (1972) unpublished dissertation provides a species key to western megalopteran larvae, although the key does not include one species of *Sialis* and three species of *Protochauliodes*.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Megaloptera**										Family and generic keys in Bowles and Contreras-Ramos (2019). Adults are required for species id.
Family - **Corydalidae**										
Genus - *Corydalus*										
Corydalus bidenticulatus	x	x						x		A single record from Huachuca Mts., Miller Canyon.
Corydalus texanus	x	x			x		x	x	x	
Genus - *Dysmicohermes*	x	x			x	x				
Genus - *Neohermes*	x	x			x	x	x	x		
Genus - *Orohermes*										
Orohermes crepusculus	x	x			x	x				Monotypic.
Genus - *Protochauliodes*	x	x			x	x				
Family - **Sialidae**										
Genus - *Sialis*	x	x	x		x	x	x			Only one western genus.

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Bowles, D. E. and A. Contreras-Ramos. 2019. Chapter 18: Megaloptera and Aquatic Neuroptera. pp. 569-584. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Evans, E. D. 1972. A study of the Megaloptera of the Pacific coastal region of the United States. Ph.D. Dissertation, Corvallis, Oregon, Oregon State University, 210 pp.

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Neuroptera - Spongillaflies**
Standard Effort Level I: Genus
Standard Effort Level II: Genus
Standard Taxonomic Reference(s): Bowles and Contreras-Ramos (2019).

Larvae may be identified to genus using the key in Merritt, Cummins and Berg (Bowles and Contreras-Ramos, 2019). Bowles (2006) provides a species key to larvae, although there is only one species in each genus found in the SAFIT region. Larvae feed on and live in conjunction with freshwater sponges. Tauber (1991) provides a key to North American Neuroptera larvae.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Neuroptera**										
Family - **Sisyridae**										Generic key in Bowles and Contreras-Ramos (2019).
Genus - *Climacia*										
Climacia californica	x	x	x		x	x				Only one species in the region.
Genus - *Sisyra*										
Sisyra vicaria	x	x	x		x	x		x		Only one species in the region.

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Bowles, D. E. 2006. Spongillaflies (Neuroptera: Sisyridae) of North America with a key to the larvae and adults. Zootaxa (1357): 1-19.

Bowles, D. E. and A. Contreras-Ramos. 2019. Chapter 18: Megaloptera and Aquatic Neuroptera. pp. 569-584. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Tauber, C. A. 1991. Order Neuroptera. [pp. 126-143]. In: F. W. Stehr (editor), Immature Insects, Volume 2. Kendall/Hunt, Dubuque, Iowa.

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Odonata - Damselflies and Dragonflies**
Standard Effort Level I: Genus
Standard Effort Level II: Species (where possible)
Standard Taxonomic Reference(s): Tennessen (2019a), Tennessen (2019b), Westfall and May (2006), Needham et al. (2014).

Keys to all North American families and genera of Odonata are provided for both adults and nymphs by Tennessen (2019a). Generic and species keys for adults and nymphs are given for damselflies (Zygoptera) in Westfall and May (2006) and dragonflies (Anisoptera) in Needham et al. (2014), although previous editions of both works (from 1996 and 2000, respectively) remain suitable for bioassessment in California. Tennessen (2019b) provides improved, fully illustrated keys to species of North American dragonfly nymphs (Anisoptera) that address many errors in previous keys and include several species with nymphal stages unknown by Needham et al. (2014), but identification to species can still be impossible for early instar and/or damaged specimens common in bioassessment samples. Tennessen and Paulson (2007) and Rehn (2000) provided more detailed ecological and distributional information on odonates of California and the Pacific Coast. Kennedy (1917) and Paulson and Garrison (1977) provided considerable distributional information for the Pacific Coast region.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Odonata**										
Suborder - **Anisoptera**										Generic keys in Tennessen (2019a); species keys for nymphs in Needham et al. (2014) or Tennessen (2019b).
Family - **Aeshnidae**										Species keys in Needham et al. (2014) or Tennessen (2019b).
Genus - *Aeshna*										Early instar nymphs of *Aeshna* and *Rhionaeshna* are difficult to separate and should be left at slash id.
Aeshna canadensis[*]	x		x		x	x				
Aeshna constricta[*]	x		x			x	x			
Aeshna interrupta[*]	x		x		x	x	x	x		
Aeshna juncea[*]	x		x			x				
Aeshna palmata[*]	x	x	x		x	x	x	x		
Aeshna persephone[*]	x	x						x		
Aeshna sitchensis[*]	x		x			x				
Aeshna subarctica[*]	x		x			x				
Aeshna tuberculifera[*]	x		x			x				
Aeshna umbrosa[*]	x	x	x		x	x	x			
Aeshna walkeri[*]	x	x			x	x			x	
Genus - *Aeshna/ Rhionaeshna*	x	x	x		x	x	x	x	x	
Genus - *Anax*										
Anax junius	x	x	x		x	x	x	x	x	
Anax walsinghami	x	x			x		x	x	x	
Genus - *Oplonaeschna*										
Oplonaeschna armata	x	x			x			x		Only one species known from the U.S.
Genus - *Remartinia*										
Remartinia luteipennis	x		x					x	x	Only one species known from the U.S.
Genus - *Rhionaeschna*										Early instar nymphs of *Aeshna* and *Rhionaeshna* are difficult to separate and should be left at slash id.
Rhionaeschna californica[*]	x	x	x		x	x	x		x	
Rhionaeschna dugesi[*]	x	x	x					x	x	
Rhionaeschna manni[*]	x	x	x						x	
Rhionaeschna multicolor[*]	x	x	x		x	x	x	x	x	
Rhionaeschna psilus[*]	x	x	x					x	x	Vagrant in California, nymphs unlikely.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Cordulegastridae**										Species keys in Needham et al. (2014) or Tennessen (2019b).
Genus - *Cordulegaster*										
Cordulegaster diadema	x	x						x		
Cordulegaster dorsalis	x	x			x	x	x	x	x	
Family - **Corduliidae**										Species keys in Needham et al. (2014) or Tennessen (2019b). Uncommon in stream bioassessment samples.
Genus - *Cordulia*										
Cordulia shurtleffii	x		x		x	x	x			Only one species known from North America. High elevation lakes and ponds.
Genus - *Epitheca*										
Epitheca canis	x	x	x		x	x				
Epitheca spinigera	x	x	x		x	x				
Genus - *Somatochlora*										Boggy marshes and lakes typically at higher elevations.
Somatochlora albicincta	x		x		x	x				
Somatochlora minor	x	x				x				
Somatochlora semicircularis	x		x		x	x	x			
Somatochlora walshii[*]	x	x	x			x				
Family - **Gomphidae**										Species keys in Needham et al. (2014) or Tennessen (2019b).
Genus – *Aphylla*[*]										
Aphylla protracta[*]	x		x					x		
Genus - *Erpetogomphus*										Keys to species in Tennessen (2019b)
Erpetogomphus compositus	x	x			x	x	x	x	x	
Erpetogomphus crotalinus	x	x						x		
Erpetogomphus designatus	x	x	x				x			
Erpetogomphus elaps[*]	x	x						x		
Erpetogomphus lampropeltis	x	x			x			x	x	
Genus – *Gomphurus*[*]										Formerly in the Genus *Gomphus.*
Gomphurus lynnae [**]	x	x				x	x			
Genus - *Octogomphus*										
Octogomphus specularis	x	x			x	x	x		x	Monotypic.
Genus - *Ophiogomphus*										
Ophiogomphus arizonicus	x	x						x		
Ophiogomphus bison	x	x			x	x	x			
Ophiogomphus morrisoni	x	x	x		x	x	x			
Ophiogomphus occidentis	x	x			x	x	x			
Ophiogomphus severus	x	x			x	x	x	x		
Genus – *Phanogomphus*[*]										Formerly in the Genus *Gomphus.*
Phanogomphus kurilis[**]	x	x	x		x	x	x			
Genus - *Progomphus*										
Progomphus borealis	x	x			x	x		x	x	Only one species known from California.
Genus - *Stylurus*										
Stylurus intricatus	x	x			x		x	x		
Stylurus olivaceus	x	x			x	x	x	x		
Stylurus plagiatus	x	x			x			x		
Family - **Libellulidae**										Species keys in Needham et al. (2014) or Tennessen (2019b).
Genus - *Brachymesia*										
Brachymesia furcata	x		x		x		x	x	x	Common on coasts in eastern part of range.
Brachymesia gravida	x		x					x		Common on coasts in eastern part of range.
Genus - *Brechmorhoga*										Often mistaken for Corduliidae due to deep crenulations in labial palps.
Brechmorhoga mendax	x	x			x			x	x	
Brechmorhoga pertinax	x	x						x		
Brechmorhoga praecox[*]	x	x						x		
Genus - *Dythemis*										
Dythemis fugax	x	x	x					x		
Dythemis maya[*]	x	x						x		
Dythemis nigrescens	x	x	x					x	x	
Dythemis sterilis[*]	x	x							x	
Dythemis velox	x	x						x		

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family – **Libellulidae-** Continued										
Genus - *Erythemis*										
Erythemis collacata	x		x		x	x	x	x	x	
Erythemis plebeja[*]	x		x					x	x	
Erythemis simplicicollis	x		x					x		
Erythemis vesiculosa	x		x					x	x	
Genus - *Erythrodiplax*										
Erythrodiplax basifusca	x		x					x	x	
Erythrodiplax berenice[*]	x		x						x	Salt marshes in the western U.S.; estuaries in the eastern U.S.
Erythrodiplax funerea	x		x		x			x		
Genus - *Ladona*										
Ladona julia	x		x		x	x				Only one species in western North America
Genus - *Leucorrhinia*										
Leucorrhinia glacialis	x		x		x	x	x			
Leucorrhinia hudsonica	x		x		x	x	x			
Leucorrhinia intacta	x		x		x	x	x			
Leucorrhinia proxima	x		x		x	x				
Genus - *Libellula*										
Libellula comanche	x	x			x	x	x	x		Restricted to seeps and springs.
Libellula composita	x	x	x		x	x	x	x		Restricted to seeps and springs.
Libellula croceipennis	x	x			x			x	x	Restricted to seeps and springs.
Libellula forensis	x	x	x		x	x	x	x		
Libellula luctuosa	x		x		x	x	x	x	x	
Libellula nodisticta	x	x	x		x	x	x	x		Prefers seeps and springs.
Libellula pulchella	x		x		x	x	x	x		
Libellula quadrimaculata	x		x		x	x	x	x		
Libellula saturata	x	x	x		x	x	x	x	x	
Genus - *Macrodiplax*										
Macrodiplax balteata	x		x		x			x	x	Only one species in North America. Spring-fed marshes in the desert.
Genus - *Macrothemis*										
Macrothemis inacuta	x	x						x	x	
Macrothemis inequiunguis[*]	x	x							x	
Macrothemis pseudimitans[*]	x	x						x	x	
Genus – *Micrathyria*[*]										
Micrathyria aequalis[*]	x		x					x	x	
Micrathyria didyma[*]	x		x					x	x	
Micrathyria hageni[*]	x		x					x	x	
Genus - *Orthemis*										
Orthemis discolor	x		x					x	x	
Orthemis ferruginea	x		x		x		x	x	x	
Genus - *Pachydiplax*										
Pachydiplax longipennis	x	x	x		x	x	x	x	x	Monotypic.
Genus - *Paltothemis*										
Paltothemis lineatipes	x	x			x	x		x	x	Only one species known from the U.S. Often mistaken for Corduliidae due to deep crenulations in labial palps.
Genus - *Pantala*										
Pantala flavescens	x		x		x	x	x	x	x	
Pantala hymenaea	x		x		x	x	x	x	x	
Genus - *Perithemis*										
Perithemis domitia	x	x	x					x		
Perithemis intensa	x	x	x		x		x	x	x	
Perithemis tenera	x		x					x		
Genus - *Planiplax*										
Planiplax sanguiniventris	x		x						x	
Genus - *Plathemis*										
Plathemis lydia	x	x	x		x	x	x	x		
Plathemis subornata	x	x	x		x	x	x	x		
Genus - *Pseudoleon*										
Pseudoleon superbus	x	x						x	x	Monotypic.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family – **Libellulidae-** Continued										
Genus - *Sympetrum*										Keys to species in Tennessen (2019b)
Sympetrum corruptum	x	x	x		x	x	x	x	x	
Sympetrum costiferum	x		x		x	x	x			
Sympetrum danae	x		x		x	x	x	x		
Sympetrum illotum	x	x	x		x	x	x	x	x	
Sympetrum internum	x		x		x	x	x			
Sympetrum madidum	x		x		x	x	x			
Sympetrum obtrusum	x		x		x	x	x			
Sympetrum pallipes	x	x	x		x	x	x	x		
*Sympetrum semicinctum***	x		x		x	x	x	x		Western populations previously considered to be *S. occidentale*
Sympetrum signiferum	x	x						x		
Sympetrum vicinum	x		x		x	x				
Genus - *Tramea*										
*Tramea binotata**	x		x					x		
*Tramea darwini***	x		x		x			x	x	Previously *T. calverti*
*Tramea insularis**	x		x					x		
Tramea lacerata	x		x		x	x	x	x	x	
Tramea onusta	x	x	x		x		x	x	x	
Family - **Macromiidae**										Species keys in Needham et al. (2014) or Tennessen (2019b).
Genus - *Macromia*										
Macromia magnifica	x	x			x	x	x	x		Only species in CA and surrounding states.
Family - **Petaluridae**										Species keys in Needham et al. (2014) or Tennessen (2019b).
Genus - *Tanypteryx*										
Tanypteryx hageni	x	x			x	x	x			Only one species in North America. Known only from boggy seeps.
Suborder - **Zygoptera**										Generic key in Tennessen (2019a).
Family - **Calopterygidae**										Keys to species in Westfall and May (2006).
Genus - *Calopteryx*										
Calopteryx aequabilis	x	x			x	x	x			Only species in western U.S.
Genus - *Hetaerina*										
Hetaerina americana	x	x			x	x	x	x	x	
Hetaerina vulnerata	x	x						x		
Family - **Coenagrionidae**										Keys to species in Westfall and May (2006).
Genus - *Amphiagrion*										
Amphiagrion abbreviatum	x	x	x		x	x	x	x	x	Only one species known from western US.
Genus - *Apanisagrion*										
Apanisagrion lais	x	x						x		Monotypic.
Genus - *Argia*	x	x	x		x	x	x	x	x	Not all species included in key. Leave at genus.
Genus - *Coenagrion*										Use slash id. for samples collected in the Sierra Nevada mountain range.
Coenagrion resolutum	x		x		x	x	x	x		Northern Sierra lakes and bogs; larvae hard to distinguish from *Enallagma* species.
Genera - *Coenagrion/ Enallagma*	x	x	x		x	x	x	x	x	Some species incompletely separable.
Genus - *Enallagma*										Key to all species of nymphs except *E. eiseni* in Westfall & May (2006)
Enallagma anna	x	x			x	x	x	x		
*Enallagma annexum***	x	x	x		x	x	x	x	x	N.A. populations previously considered to be *E. cyathigerum*
Enallagma basidens	x	x	x		x			x	x	
Enallagma boreale	x		x		x	x	x	x		
Enallagma carunculatum	x		x		x	x	x	x	x	
Enallagma civile	x	x	x		x	x	x	x	x	
Enallagma clausum	x	x	x		x	x	x			
Enallagma eiseni	x	x	x					x	x	Nymph unknown. Baja and AZ desert oases. One photo record in SoCal.
Enallagma novaehispaniae	x	x						x	x	
Enallagma praevarum	x	x	x		x		x	x	x	
Enallagma semicirculare	x	x	x					x		
Genus - *Hesperagrion*										
Hesperagrion heterodoxum	x	x						x		Monotypic.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family – **Coenagrionidae-**Continued										
Genus - *Ischnura*										
Ischnura barberi	x	x	x	x	x	x		x	x	Occurs in some tidal marshes in SoCal.
Ischnura cervula	x	x	x		x	x	x	x	x	
Ischnura damula	x	x	x					x		
Ischnura demorsa	x	x					x	x		
Ischnura denticollis	x	x	x		x	x	x	x	x	
Ischnura erratica	x		x		x	x				
Ischnura gemina	x		x		x					
Ischnura hastata	x		x		x			x	x	
Ischnura perparva	x	x	x		x	x	x	x		
Ischnura ramburii	x		x		x			x	x	
Genus - *Nehalennia*										
Nehalennia irene	x		x		x	x				Only species in western North America
Genus - *Telebasis*										
Telebasis incolumis	x	x	x						x	Nymph unknown. Specimens from SoCal deserts should be left at genus.
Telebasis salva	x	x	x		x		x	x	x	Widespread but uncommon at low to middle elevations.
Genus - *Zoniagrion*										
Zoniagrion exclamationis	x	x			x					Monotypic.
Family - **Lestidae**										Keys to species in Westfall and May (2006).
Genus - *Archilestes*										
Archilestes californica	x	x			x	x		x	x	
Archilestes grandis	x	x			x			x	x	
Genus - *Lestes*										
Lestes alacer	x	x	x					x		
Lestes congener	x	x	x		x	x	x	x		
Lestes disjunctus	x		x		x	x	x	x		
Lestes dryas	x		x		x	x	x	x		
Lestes forcipatus[*]	x		x			x				
Lestes sigma[*]	x		x					x		
Lestes stultus	x		x		x	x				
Lestes unguiculatus	x		x		x	x	x			
Family - **Platystictidae**										
Genus - *Palaemnema*										
Palaemnema domina	x	x						x		Only one species recorded from western North America.
Family – **Protoneuridae**[*]										
Genus – *Protoneura*[*]										
Protoneura cara[*]	x		x					x		Only one species recorded from western North America.

Footnotes

[*] - Denotes a new name added after the previous STE.

[**] - Denotes a name change from previous STE.

Literature

Needham, J. G., M. J. Westfall, Jr., and M.L. May. 2000. *Dragonflies of North America, Revised Edition*. xv + 939 pp. Scientific Publishers, Gainesville, FL.

Needham, J. G., M. J. Westfall, Jr., and M.L. May. 2014. *Dragonflies of North America, 3rd edition*. xiv + 657 pp. Scientific Publishers, Gainesville, FL.

Kennedy, C. H. 1917. Notes on the life history and ecology of the dragonflies (Odonata) of central California and Nevada. Proceedings of the United States National Museum 52(2192):483-635.

Paulson, D. R., and Garrison, R. W. 1977. A list and new distributional records of Pacific Coast Odonata. Pan-Pacific Entomologist 53:147-160.

Rehn, A.C. 2000. Proceedings of the California Aquatic Macroinvertebrate Laboratory Network (CAMLNet) Odonata Workshop, September 2000.

Tennessen, K. J. and D.R. Paulson. 2007. Odonata larvae of the Pacific Northwest, workshop manual. Xerces Society for Invertebrate Conservation, March 16-18, 2007. The Evergreen State College, Olympia, Washington.
Tennessen, K. J. 2019a. Chapter 14: Odonata. pp. 341-409. *In*: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), *An Introduction to the Aquatic Insects of North America*, 5th edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, IA.

Tennessen, K. J. 2019b. *Dragonfly Nymphs of North America*, xiv + 620 pp. Springer Nature, Switzerland.

Westfall, M. J. and M. L. May. 1996. *Damselflies of North America.* vii + 649 pp. Scientific Publishers, Gainesville, FL.

Westfall, M. J. and M. L. May. 2006. *Damselflies of North America, Revised Edition*. xii + 502 pp. Scientific Publishers, Gainesville, FL.

Websites:

Arizona Dragonflies: Accessed 28 August 2023 at URL: http://azdragonflies.org

North American Odonata. Hosted by the University of Puget Sound. Accessed 28 August 2023 at URL: https://www.pugetsound.edu/puget-sound-museum-natural-history/biodiversity-resources/insects/dragonflies/world-odonata-list/north-american-odonata

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Plecoptera - Stoneflies**
Standard Effort Level I: Genus
Standard Effort Level II: Species (where possible)
Standard Taxonomic Reference(s): DeWalt and Kondratieff (2019) and Stewart and Stark (2002).

Nymphs may be identified to family and genus using the chapter in Merritt, Cummins and Berg (DeWalt and Kondratieff, 2019), which also provides keys to adults, or Stewart and Stark (2002), except for Capniidae (the key is out dated and should not be used). Though the keys in DeWalt and Kondratieff, 2019 are more current, there is still a lot of valuable information and figures in the Stewart and Stark book, and should not be overlooked as a resource. Although species keys exist for the adults of many families and genera in the West, many nymphs remain undescribed. Early instar nymphs of Capniidae can be very difficult to identify to genus; it is recommended that only mature nymphs be identified beyond Capniidae. Many genera and species of Capniidae, Leuctridae, Nemouridae and Taeniopterygidae are underrepresented in benthic samples because they emerge during the winter months or they prefer ephemeral habitats. A current species list and distribution for stoneflies, Plecoptera Species File (DeWalt, et al.), is maintained on the Illinois Natural History Survey website.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Plecoptera**										
Family - **Capniidae**										Generic key in DeWalt and Kondratieff, 2019. Only last instar identifiable, at best. *Arsapnia, Capnia* and *Sierracapnia* not separable, leave at Capniidae. Species id. is not possible for nymphs.
Genus - *Arsapnia* *	x	x			x	x	x	x	x	Leave at Capniidae.
Genus - *Capnia*	x	x			x	x	x	x	x	Leave at Capniidae.
Genus - *Capnura*	x	x			x	x	x	x		
Genus - *Eucapnopsis*										
Eucapnopsis brevicauda	x	x			x	x	x	x		Only North American species.
Genus - *Eurekapnia* *										
Eurekapnia maculata **	x	x			x					Monotypic. Known only from California. Formerly *Bolshecapnia maculata*.
Genus - *Isocapnia*	x	x			x	x	x			
Genus - *Mesocapnia*	x	x			x	x	x	x	x	Leave at Capniidae.
Genus - *Paracapnia*	x	x			x	x				
Genus - *Sierracapnia* *	x	x			x		x			Leave at Capniidae.
Genus - *Utacapnia*	x	x			x	x	x			Leave at Capniidae.
Family - **Chloroperlidae**										Generic key in DeWalt and Kondratieff, 2019. Species id. is not possible for nymphs.
Genus - *Alloperla*	x	x			x	x	x			
Genus - *Bisancora*	x	x			x	x			x	
Genus - *Gaufinia**	x	x				x	x	x		Formerly listed under the Genus *Sweltsa*. Larvae of *Gaufinia* and *Sweltsa* not separable, use *Gaufinia/ Sweltsa* outside of California.
Genus - *Haploperla*										
Haploperla chilnualna	x	x			x	x	x		x	Only one species listed for California and surrounding states.
Genus - ~~*Kathroperla*~~	-	-	-	-	-	-	-	-	-	Moved to family Kathroperlidae.
Genus - *Paraperla*	x	x			x	x	x			
Genus - *Plumiperla*	x	x			x	x	x			
Genus - *Sasquaperla*										
Sasquaperla hoopa	x	x			x					Monotypic.
Genus - *Suwallia*	x	x			x	x	x	x		
Genus - *Sweltsa*	x	x			x	x	x	x		Larvae of *Gaufinia* and *Sweltsa* not separable, use *Gaufinia/ Sweltsa* outside of California.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Chloroperlidae** - Continued										
Genus - *Triznaka*	x	x			x	x	x	x		
Genus - *Utaperla*										
Utaperla sopladora	x	x					x			Only one species in western North America.
Family - **Kathroperlidae**[*]										Will key out to Chloroperlidae in generic key in DeWalt and Kondratieff, 2019. Species id. is not possible for nymphs.
Genus - *Kathroperla*	x	x			x	x	x			
Family - **Leuctridae**										Generic key in DeWalt and Kondratieff, 2019. Species id. is not possible for nymphs.
Genus - *Calileuctra*	x	x			x					Found in intermittent streams.
Genus - *Despaxia*										Monotypic.
Despaxia augusta	x	x			x	x	x			
Genus - *Dracoleuctra*										Monotypic.
Dracoleuctra siskiyou	x	x				x				Larvae unknown.
Genus - *Megaleuctra*	x	x			x	x				
Genus - *Moselia*	x	x			x	x	x			Two species in western states.
Genus - *Paraleuctra*	x	x			x	x	x			
Genus - *Perlomyia*	x	x			x	x	x			
Genus - *Pomoleuctra*	x	x			x	x				
Family - **Nemouridae**										Generic key in DeWalt and Kondratieff, 2019. With the exception of *Zapada*, species id. is not possible for nymphs.
Genus - *Amphinemura*	x	x						x		
Genus - *Lednia*										
Lednia sierra	x	x			x					Only one species known from California.
Genus - *Malenka*	x	x			x	x	x	x	x	
Genus - *Nanonemoura*										
Nanonemoura wahkeena	x	x				x				Monotypic. Only known from type locality.
Genus - *Nemoura*										
Nemoura spiniloba	x	x			x					Only one species known from California.
Genus - *Ostrocerca*	x	x			x	x				
Genus - *Podmosta*	x	x			x	x	x			
Genus - *Prostoia*										
Prostoia besametsa	x	x			x	x	x	x		Only one species known from western North America.
Genus - *Soyedina*	x	x			x	x	x			
Genus - *Visoka*										
Visoka cataractae	x	x			x	x	x			Monotypic.
Genus - *Zapada*										Species key in Baumann et al. (1977).
Zapada cinctipes	x	x			x	x	x			
Zapada columbiana	x	x			x	x	x			
Zapada frigida	x	x			x	x	x			
Species Complex - *Zapada oregonensis* group	x	x			x	x	x			Species complex contains the following species: *Z. cordillera, Z. haysi and Z. oregonensis.*
Family - **Peltoperlidae**										Generic key in DeWalt and Kondratieff, 2019. With the exception of *Yoraperla*, species id. is not possible for nymphs.
Genus - *Sierraperla*	x	x			x	x	x			Two species in California. Larvae not separable.
Genus - *Soliperla*										Key to the three California species in Stark et al. 2017.
Soliperla campanula	x	x				x				
Soliperla quadrispinula	x	x			x	x				
Soliperla sierra	x	x			x					
Soliperla thyra	x	x			x		x			
Soliperla tillamook	x	x				x				
Genus - *Yoraperla*										Species key in Stark and Nelson (1994).
Yoraperla brevis	x	x			x	x	x			
Yoraperla mariana	x	x			x	x				
Yoraperla nigrisoma	x	x			x	x	x			Difficult to separate from *Y. nigrisoma* and *Y. siletz*, leave at genus.
Yoraperla siletz	x	x			x	x				Difficult to separate from *Y. nigrisoma* and *Y. siletz*, leave at genus.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Perlidae**										Generic key in DeWalt and Kondratieff, 2019. Species keys in Baumann, Gaufin and Surdick (1977).
Genus - *Acroneuria*										
Acroneuria abnormis	x	x					x			Only one species known from western North America.
Genus - *Anacroneuria*										
Anacroneuria wipukupa	x	x						x		Only one species known from North America.
Genus - *Calineuria*										
Calineuria californica	x	x			x	x	x			Only one species known from North America.
Genus - *Claassenia*										
Claassenia sabulosa	x	x			x	x	x	x		Only one species known from North America.
Genus - *Doroneuria*										
Doroneuria baumanni	x	x			x	x	x			Only species reported from California. Records of *D. theodora* in NE Oregon are suspect.
Genus - *Hesperoperla*										Species can be separated using description in Baumann and Stark (1980), however see Bauman et al. 2017. *H. pacifica* can be variable, see variant page 70.
Hesperoperla hoguei	x	x			x					
Hesperoperla pacifica	x	x			x	x	x	x		
Genus - *Neoperla*[*]										
Neoperla clymene[*]	x	x						x		Only one species known from western North America.
Genus - Perlesta [*]	x	x						x		Species id. is not possible for the nymphs.
Family - **Perlodidae**										Generic key in DeWalt and Kondratieff, 2019. Species id. on the nymphs is not possible for most genera.
Genus - *Baumannella*										
Baumannella alameda	x	x			x					Monotypic.
Genus - *Calliperla*										
Calliperla luctuosa	x	x			x	x				Monotypic.
Genus - *Cascadoperla*										
Cascadoperla trictura	x	x			x	x	x			Monotypic.
Genus - *Chernokrilus*										
Chernokrilus misnomus	x	x			x	x				Monotypic.
Genus - *Cosumnoperla*										Species can be separated using description in Bottorff (2007).
Cosumnoperla hypocrena	x	x			x					
Cosumnoperla sequoia	x	x			x					
Genus - *Cultus*	x	x			x	x	x	x		Species id. is not possible for nymphs.
Genus - *Diura*										
Diura knowltoni	x	x			x	x	x			Only one species known from western North America.
Genus - *Frisonia*										
Frisonia picticeps	x	x			x	x	x			Monotypic.
Genus - *Isogenoides*	x	x			x	x	x	x		Species id. is not possible for nymphs.
Genus - *Isoperla*	x	x			x	x	x	x	x	Species key in Sandberg, 2011. For late instars only, may not work outside California. Requires slide mounting of lacinia.
Genus - *Kogotus*										Immature specimens have secondary lacinial tooth which makes ID to genus difficult.
Kogotus modestus	x	x					x			In Nevada, only known from eastern part of state.
Kogotus nonus	x	x			x	x	x			Only one species reported from California. Immature *Kogotus* and *Rickera* very difficult to separate.
Genus Complex - *Kogotus/Rickera*	x	x			x	x	x			Many specimens of these genera, especially early instars inseparable.
Genus - *Megarcys*	x	x			x	x	x			Species id. not possible for nymphs.
Genus - *Oroperla*										
Oroperla barbara	x	x			x		x			Monotypic.
Genus - *Osobenus*										
Osobenus yakimae	x	x			x	x				Monotypic.
Genus - *Perlinodes*										
Perlinodes aureus	x	x			x	x	x			Monotypic.
Genus - *Rickera*										
Rickera sorpta	x	x			x	x	x			Monotypic. Immature *Kogotus* and *Rickera* very difficult to separate.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Perlodidae** - Continued										
Genus - *Salmoperla*										
Salmoperla sylvanica	x	x			x					Monotypic.
Genus - *Setvena*										Species key in Stewart and Stanger (1985).
Setvena tibialis	x	x				x				
Setvena wahkeena	x	x				x				
Genus - *Skwala*	x	x			x	x	x	x		Species id. not possible for nymphs.
Genus - *Susulus*										
Susulus venustus	x	x			x					Monotypic.
Family - **Pteronarcyidae**										Generic key in DeWalt and Kondratieff, 2019.
Genus - *Pteronarcella*	x	x			x	x	x	x		Stewart and Stark (2002) p459, suggested that the species cannot be separated as nymphs.
Genus - *Pteronarcys*										Species key in Baumann et al. (1977).
Pteronarcys californica	x	x			x	x	x	x		
Pteronarcys princeps	x	x			x	x	x			
Family - **Taeniopterygidae**										Generic key in DeWalt and Kondratieff, 2019.
Genus - *Doddsia*										
Doddsia occidentalis	x	x			x	x	x			Monotypic.
Genus -*Oemopteryx*	x	x			x	x				*Taenionema* and *Omiopterix* difficult to separate. Leave at family.
Genus - *Taenionema*	x	x			x	x	x	x		*Taenionema* and *Omiopterix* difficult to separate. Leave at family.
Genus - *Taeniopteryx*										
Taeniopteryx nivalis	x	x			x	x	x			Only species reported from California.

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Baumann, R. W. and B. P. Stark. 1980. *Hesperoperla hoguei*, a new species of stonefly from California (Plecoptera: Perlidae). Great Basin Naturalist 40(1): 63-67.

Baumann, R. W., A. L. Sheldon and R. L. Bottorff. 2017. Stoneflies (Plecoptera) of Nevada. Monographs of the Western North American Naturalist 10: 1–138.

Baumann, R. W., A. R. Gaufin and R. F. Surdick. 1977. The stoneflies (Plecoptera) of the Rocky Mountains. Philadelphia, American Entomological society at the Academy of Natural Sciences. Baumann, R. W., and B. C. Kondratieff. 2010. The stonefly genus Lednia in North America (Plecoptera: Nemouridae). Illiesia 6(25):315-327.

Bottorff, R. L. 2007. Cosumnoperla sequoia, a new species of stonefly from the Sierra Nevada, California (Plecoptera: Perlodidae: Isoperlinae). Illiesia 3(6):46-52.

Sandberg, J. B., 2011. The *Isoperla* of California (Plecoptera: Perlodidae); larval descriptions and a key to 17 western Nearctic species. Illiesia, 7(22):202-258.

Stark, B. P. and C. R. Nelson. 1994. Systematics, phylogeny and zoogeography of genus *Yoraperla* (Plecoptera: Peltoperlidae). Entomologica Scandinavica 25: 241-273.

Stark, B. P., J. B. Sandberg and J.J. Lee. 2017. California *Soliperla* Ricker, 1952 (Plecoptera: Peltoperlidae), distribution and taxonomic characters. Illiesia, 13(7): 82-93.

Stewart, K. W. and J. A. Stanger. 1985. The nymphs, and a new species of North American *Setvena* Illies (Plecoptera: Perlodidae). Pan-Pacific Entomologist 61: 237-244.

Stewart, K. W. and B. P. Stark. 2002. Nymphs of North American stonefly genera (Plecoptera). Columbus, Ohio, The Caddis Press, ix + 510 pp.

DeWalt, R. E. and B. C. Kondratieff. 2019. Chapter 16: Plecoptera. pp. 429-520. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Useful Websites:

DeWalt, R. E. et al. Plecoptera Species File Online.
http://plecoptera.speciesfile.org/HomePage/Plecoptera/HomePage.aspx

Phylum: **Arthropoda**
Subphylum: **Hexapoda**
Class: **Insecta**
Order: **Trichoptera - Caddisflies**
Standard Effort Level I: Genus
Standard Effort Level II: Species (where possible)
Standard Taxonomic Reference(s): Morse, et al. (2019) or Wiggins (1996).

Larvae and pupae may be identified to genus using the keys in Merritt, Cummins and Berg (Morse, et al. 2019) or larvae may be keyed to genus using Wiggins (1996). Wiggins (2004) also provides a wealth of behavioral and ecological information. Distributional information comes from original sources. Rasmussen and Morse (2023) provide a distributional checklist of Nearctic Trichoptera.

Larvae for many genera are not identifiable to species because some remain undescribed. Larvae and pupae can sometimes be reared to adults and thus identified to species. For preserved specimens, well-developed, pharate pupae can sometimes be identified to species by using the metamorphotype method (Milne, 1938). In this case, the genitalia of a pharate pupa can be observed through the pupal cuticle and the specimen identified using keys and descriptions of the adult. Likewise the larval sclerites are retained within the pupal cocoon and can be used to associate the larvae.

There are 19 recognized species groups of *Rhyacophila* known from the SAFIT region covered by this list. Of these, 14 species groups have at least one representative species described as larvae in the peer-reviewed literature. Ross (1956) and Schmid (1970) assigned most of the known *Rhyacophila* species to species groups based on adult characteristics. Three as yet unpublished but disseminated works (Wold, 1973; Smith (unpublished), draft key and Giersch & Wisseman 2012, draft key) have further dealt with *Rhyacophila*, illustrating or describing larvae for most of the species groups. The larvae of the Rhyacophila viquaea group are still undescribed and unassociated.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Insecta**										
Order - **Trichoptera**										
Family - **Apataniidae**										Generic key in Morse, et al. (2019).
Genus - *Allomyia*	x	x			x	x	x			
Genus - *Apatania*	x	x			x	x	x	x		
Genus - *Moselyana*										
Moselyana comosa	x	x				x				Monotypic.
Genus - *Pedomoecus*										
Pedomoecus sierra	x	x			x	x				Monotypic.
Family - **Brachycentridae**										Generic key in Morse, et al. (2019).
Genus - *Amiocentrus*										
Amiocentrus aspilus	x	x			x	x	x			Monotypic.
Genus - *Brachycentrus*										Key to species in Flint (1984).
Brachycentrus americanus	x	x			x	x	x	x		
Brachycentrus echo	x	x			x		x			
Brachycentrus occidentalis	x	x			x	x	x	x		
Genus - *Eobrachycentrus*										
Eobrachycentrus gelidae	x	x				x				Only one species listed for North America.
Genus - *Micrasema*	x	x			x	x	x	x		

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Calamoceratidae**										Generic key in Morse, et al. (2019).
Genus - *Heteroplectron*										
Heteroplectron californicum	x	x			x	x				Only one species listed for Western North America.
Genus - *Phylloicus*	x	x						x		
Family - **Glossosomatidae**										Generic key in Morse, et al. (2019).
Genus - *Agapetus*	x	x			x	x	x	x		
Genus - *Anagapetus*	x	x			x	x	x			
Genus - *Culoptila*	x	x					x	x		
Genus - *Glossosoma*	x	x			x	x	x	x		
Genus - *Protoptila*	x	x			x	x	x	x		
Family - **Goeridae**										Generic key in Morse, et al. (2019).
Genus - *Goera*										
Goera archaon	x	x			x	x				Only one species listed for Western North America.
Genus - *Goeracea*										Key to species in Wiggins (1973).
Goeracea genota	x	x				x				
Goeracea oregona	x	x			x	x				
Genus - *Lepania*										Monotypic.
Lepania cascada	x	x				x				Jon Lee has found specimens that key out to *Lepania* from spring creeks in northern California.
Family - **Helicopsychidae**										Only one North American genus.
Genus - *Helicopsyche*	x	x			x	x	x	x		
Family - **Hydrobiosidae**										Only one North American genus.
Genus - *Atopsyche*	x	x						x		
Family - **Hydropsychidae**										Generic key in Morse, et al. (2019).
Genus - *Arctopsyche*										Key to species in Givens and Smith (1980).
Arctopsyche californica	x	x			x					
Arctopsyche grandis	x	x			x	x	x			Larvae of *A. grandis* and *A. inermis* cannot be separated, use *A. grandis*/*A. inermis*.
Arctopsyche inermis[*]	x	x			x	x				Larvae of *A. grandis* and *A. inermis* cannot be separated, use *A. grandis*/*A. inermis*.
Genus - *Cheumatopsyche*	x	x			x	x	x	x		
Genus - *Diplectrona*										
Diplectrona californica	x	x			x					Only one species listed for Western North America. Known from only a couple sites in Southern CA.
Genus - *Homoplectra*	x	x			x	x				
Genus - *Hydropsyche*	x	x			x	x	x	x	x	
Genus - *Parapsyche*										Key to species in Givens (2015). Intended only for last instars, *P. spinata* and *P. turbinate* difficult to separate.
Parapsyche almota[*]	x	x			x	x	x			
Parapsyche elsis[*]	x	x			x	x	x			
Parapsyche extensa[*]	x	x			x					
Parapsyche spinata[*]	x	x			x	x				
Parapsyche turbinata[*]	x	x			x	x				
Genus - *Smicridea*	x	x			x		x	x		
Family - **Hydroptilidae**										Generic key in Morse, et al. (2019).
Genus - *Agraylea*	x	x	x		x	x				
Genus - *Alisotrichia*										
Alisotrichia arizonica	x	x					x	x		Only one species listed for North America.
Genus - *Hydroptila*	x	x	x		x	x	x	x		
Genus - *Ithytrichia*	x	x	x		x		x	x		
Genus - *Leucotrichia*	x	x			x	x	x	x		
Genus - *Mayatrichia*	x	x					x	x		
Genus - *Metrichia*	x	x						x		
Genus - *Neotrichia*	x	x			x	x	x	x		
Genus - *Nothotrichia*										
Nothotrichia shasta	x	x			x					Only one species listed for North America.
Genus - *Ochrotrichia*	x	x			x	x	x	x		
Genus - *Oxyethira*	x	x	x		x	x	x	x		
Genus - *Palaeagapetus*										Moved to Family Ptilocolepidae, see Thomson et al. (2022).

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Hydroptilidae** - Continued										
Genus - *Stactobiella*	x	x			x	x		x		
Genus - *Zumatrichia*										
Zumatrichia notosa	x	x						x		Only one species listed for North America.
Family - **Lepidostomatidae**										Only one genus listed for Western North America.
Genus - *Lepidostoma*	x	x			x	x	x	x		
Family - **Leptoceridae**										Generic key in Morse, et al. (2019).
Genus - *Ceraclea*	x	x	x		x	x	x			
Genus - *Mystacides*										Key to species in Yamamoto and Wiggins (1964).
Mystacides alafimbriatus	x	x	x		x	x			x	
Mystacides interjectus	x	x								Unverified record from California.
Mystacides sepulchralis	x	x			x					
Genus - *Nectopsyche*	x	x	x		x	x	x	x		
Genus - *Oecetis*	x	x	x		x	x	x	x		
Genus - *Triaenodes*	x	x	x		x	x	x	x		
Family - **Limnephilidae**										Generic key in Morse, et al. (2019).
Genus - *Allocosmoecus*										
Allocosmoecus partitus	x	x			x	x				Monotypic.
Genus - *Amphicosmoecus*										
Amphicosmoecus canax	x	x			x	x		x		Monotypic.
Genus - *Anabolia*										
Anabolia bimaculata	x	x					x	x		
Genus - *Asynarchus*	x	x	x			x				
Genus - *Chyranda*										
Chyranda centralis	x	x			x	x	x			Monotypic.
Genus - *Clistoronia*	x		x		x	x	x	x		
Genus - *Clostoeca*	x		x		x	x				
Genus - *Crenophylax*										
Crenophylax sperryi	x	x						x		Monotypic.
Genus - *Cryptochia*	x	x			x	x	x			
Genus - *Desmona*	x	x	x		x					
Genus - *Dicosmoecus*										Key to species in Wiggins and Richardson (1982).
Dicosmoecus atripes	x	x	x		x	x	x			
Dicosmoecus gilvipes	x	x	x		x	x	x			
Dicosmoecus pallicornis	x	x	x		x		x			
Genus - *Ecclisocosmoecus*										
Ecclisocosmoecus scylla	x	x				x				Only one species listed for North America.
Genus - *Ecclisomyia*	x	x			x	x	x			
Genus - *Eocosmoecus*										Key to species in Wiggins and Richardson (1989)
Eocosmoecus frontalis	x	x				x				
Genus - *Glyphopsyche*										
Glyphopsyche irrorata	x	x	x		x	x				Only one species listed for western North America.
Genus - *Grammotaulius*	x	x	x			x	x			
Genus - *Halesochila*										
Halesochila taylori	x		x			x				Monotypic. Jon Lee has found them in Northwestern California.
Genus - *Hesperophylax*	x	x	x		x	x	x	x		
Genus - *Homophylax*	x	x			x	x	x			
Genus - *Hydatophylax*										
Hydatophylax hesperus	x	x			x	x				Only one species listed for California and surrounding states.
Genus - *Lenarchus*	x		x		x	x	x			
Genus - *Limnephilus*	x	x	x		x	x	x	x	x	
Genus - *Monophylax*[*]										
Monophylax mono[*]	x	x			x	x				Formerly in the Genus *Desmona*.
Genus - *Nemotaulius*										
Nemotaulius hostilis	x		x			x				Only one species listed for North America.
Genus - *Onocosmoecus*	x	x	x		x	x	x	x		
Genus - *Philarctus*										
Philarctus bergrothi	x	x	x			x				Only one species listed for North America.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Limnephilidae** - Continued										
Genus - *Philocasca*	x	x			x	x				
Genus - *Pseudostenophylax*										
Pseudostenophylax edwardsi	x	x			x	x				Only one species listed for western North America.
Genus - *Psychoglypha*	x	x			x	x	x	x		
Family - **Odontoceridae**										Generic key in Morse, et al. (2019).
Genus - *Marilia*	x	x			x		x	x		
Genus - *Namamyia*										
Namamyia plutonis	x	x			x	x				Monotypic.
Genus - *Nerophilus*										
Nerophilus californicus	x	x			x	x				Monotypic.
Genus - *Parthina*	x	x			x	x		x		
Family - **Philopotamidae**										Generic key in Morse, et al. (2019). Larvae of *Dolophilodes* and *Sisko* can be separated using key in Lee (2024)
Genus - *Chimarra*	x	x			x	x	x	x		
Genus - *Dolophilodes*	x	x			x	x	x	x		
Genus - *Sisko*	x	x			x	x				
Genus - *Wormaldia*	x	x			x	x	x	x		
Family - **Phryganeidae**										Generic key in Morse, et al. (2019).
Genus - *Agrypnia*	x	x	x		x	x	x			
Genus - *Banksiola*										
Banksiola crotchi	x	x	x		x	x				Only one species listed for Western North America.
Genus - *Phryganea*										
Phryganea cinerea	x		x		x	x				Only one species listed for Western North America.
Genus - *Ptilostomis*										
Ptilostomis ocellifera	x	x	x		x	x				Only one species reported from California.
Genus - *Yphria*										
Yphria californica	x	x			x	x				Monotypic.
Family - **Polycentropodidae**										Generic key in Morse, et al. (2019). Comment at bottom of page 652 suggests caution in separating several genera. Leave at Family.
Family - **Psychomyiidae**										Generic key in Morse, et al. (2019).
Genus - *Psychomyia*	x	x			x	x		x		
Genus - *Tinodes*	x	x			x	x	x	x		
Family - **Ptilocolepidae**[*]										
Genus - Palaeagapetus										
Palaeagapetus nearcticus	x	x			x	x				Only one species listed for Western North America.
Family - **Rhyacophilidae**										Generic key in Morse, et al. (2019).
Genus - *Himalopsyche*										
Himalopsyche phryganea	x	x			x	x				Only one species listed for North America.
Genus - *Rhyacophila*										Species complex key in Giersch & Wisseman (2012), draft key.
Species Complex - *Rhyacophila alberta* group	x	x			x	x				
Species Complex - *Rhyacophila angelita* group	x	x			x	x	x	x		
Species Complex - *Rhyacophila betteni* group	x	x			x	x	x			
Species Complex - *Rhyacophila brunnea* group	x	x			x	x	x			*Rhyacophila brunnea* and *R. vemna* groups are not separable, use slash id. on samples collected in northern states. R. vemna grp. in not known from California.
Species Complex - *Rhyacophila coloradensis* group	x	x			x	x	x	x		
Species Complex - *Rhyacophila ecosa* group	x	x			x	x				
Species Complex - *Rhyacophila grandis* group	x	x			x	x				
Species Complex - *Rhyacophila hyalinata* group	x	x			x	x	x			

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Rhyacophilidae** - Continued										
Species Complex - *Rhyacophila lieftincki* group										
Rhyacophila arnaudi	x	x			x	x	x			Only one species of *lieftincki* group in SAFIT region.
Species Complex - *Rhyacophila mosana* group*										
*Rhyacophila mosana**	x	x			x					Only one species of *mosana* group in SAFIT region.
Species Complex - *Rhyacophila nevadensis* group	x	x			x	x	x			
Species Complex - *Rhyacophila oreta* group	x	x			x	x	x			
Species Complex - *Rhyacophila rayneri* group										
Rhyacophila rayneri	x	x			x				x	Only one species in this species group.
Species Complex - *Rhyacophila rotunda* group	x	x			x	x	x	x		
Species Complex - *Rhyacophila sibirica* group	x	x			x	x	x			
Species Complex - *Rhyacophila vagrita* group										
Rhyacophila vagrita	x	x			x	x	x			Only one species of *vagrita* group in California.
Species Complex - *Rhyacophila vemna* group	x	x				x				
Species Complex - *Rhyacophila verrula* group	x	x			x	x	x			
Species Complex - *Rhyacophila viquaea* group	x	x			x	x				Larvae of the *Rhyacophila viquaea* group are still undescribed. Specimens keyed to this group should be left at *Rhyacophila*.
Species Complex - *Rhyacophila visor* group*	x	x			x	x				
Species Complex - *Rhyacophila vofixa* group	x	x			x	x	x			
Family - **Sericostomatidae**										Only one genus listed for Western North America.
Genus - *Gumaga*	x	x			x	x		x		
Family - **Thremmatidae***										Generic key in Morse, et al. (2019).
Genus - *Neophylax*										Formerly in the Family Uenoidae. Key to species in Vineyard et al. (2005).
Neophylax occidentis	x	x			x	x	x			
Neophylax rickeri	x	x			x	x				
Neophylax splendens	x	x			x	x	x			
Genus - *Oligophlebodes*	x	x			x	x	x	x		Formerly in the Family Uenoidae.
Family - **Uenoidae**										Generic key in Morse, et al. (2019).
Genus - *Farula*	x	x			x	x				
Genus - *Neothremma*	x	x			x	x				
Family - **Xiphocentronidae**										Generic key in Morse, et al. (2019).
Genus - *Cnodocentron*										
Cnodocentron yavapai	x	x						x		Only one species listed for North America.

Footnotes

* - Denotes a new name added after the previous STE.

** - Denotes a name change from previous STE.

Literature

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: 1-58.

Giersch, J. and R. Wisseman. 2012. Annotated list of *Rhyacophila* of North America with larval key and descriptions. Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT), Workshop 2012, The Trichoptera of North America.

Givens, D. R. 2015. Parapsyche species (Trichoptera: Hydropsychidae: Arctopsychinae) of western North America. Zootaxa, 4057 (4): 451–489.

Givens, D. R. and S. D. Smith. 1980. A synopsis of the western Arctopsychinae (Trichoptera: Hydropsychidae). Melanderia 35: 1-24.

Lee, J. 2024. Descriptions of the larvae and pupae of Sisko Ross with notes on western Dolophilodes Ulmer larvae (Trichoptera: Philopotamidae). Zootaxa 5428 (1): 124–134.

Milne, M. J. 1938. The "metamorphotype method" in Trichoptera. Journal of the New York Entomological Society 46: 435-437.

Morse, J. C. et al. 2019. Chapter 19: Trichoptera. pp. 585-764. In: R. W. Merritt, K. W. Cummins and M. B. Berg (editors), An introduction to the aquatic insects of North America, fifth edition, xviii + 1480 pp. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Rasmussen, A.K., & Morse, J.C. 2023. Distributional Checklist of Nearctic Trichoptera (January 2022 Revision). Unpublished, Florida A&M University, Tallahassee. 541 pp. [Available at http://www.trichoptera.org/].

Ross, H. H. 1956. Evolution and classification of the mountain caddisflies. Univ. Ill. Press, Urbana. 213pp.

Schmid, F. 1970. Le Genre Rhyacophila et La Famille des Rhyacophilidae (Trichoptera). Memoires de la Societe Entomologique du Canada(66): 1- 229 + 52 plates. Smith, S.D. (unpublished). Key to Western *Rhyacophila* Larvae (Draft). Central Washington University: 125-229.

Smith, S.D. (unpublished). Key to Western *Rhyacophila* Larvae (Draft). Central Washington University: 125-229.

Thomson, R. E., P. B. Frandsen and R. W. Holzenthal. 2022. A preliminary molecular phylogeny of the family Hydroptilidae (Trichoptera): an exploration of combined targeted enrichment data and legacy sequence data. ZooKeys 1111: 467–488.

Vineyard, R. N., G. B. Wiggins, H. E. Frania, and P. W Schefter. 2005. The caddisfly genus *Neophylax* (Trichoptera: Uenoidae). Royal Ontario Museum Contributions in Science(2): vi + 141.

Wiggins, G. B. 1973. New systematic data for the North American caddisfly genera Lepania, Goeracea and Goerita (Trichoptera: Limnephilidae). Life Sciences Contribution of the Royal Ontario Museum 91: 1-32.

Wiggins, G. B. 1996. Larvae of the North American caddisfly genera (Trichoptera). Toronto, University of Toronto Press, xiii + 457 pp.

Wiggins, G. B. 2004. Caddisflies: the Underwater Architects. Toronto, University of Toronto Press, xi + 292 pp.

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.

Wiggins, G. B. and J. S. Richardson. 1989. Biosystematics of *Eocosmoecus* a new Nearctic caddisfly genus (Trichoptera:Limnephilidae, Dicosmoecinae). Journal of the North American Benthological Society 8(4): 355-369.

Wold, J. L. 1973. Systematics of the genus *Rhyacophila* (Trichoptera: Rhyacophilidae) in western North America with special reference to the immature stages. Dept. of Entomology: 229.

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 42:1105-1126.

Phylum: **Annelida**

Standard Effort Level I: Class

Standard Effort Level II: Branchiobdella excluded from bioassessment samples.
Hirudinea to genus.
Oligochaeta to subclass.
Polychaeta to species.

Standard Taxonomic Reference(s): Kathman and Brinkhurst (1998), Klemm (1972), Foster (1972). Thorp and Lovell (2016).

Annelids are generally identified using Kathman and Brinkhurst (1998) or Thorp and Lovell (2016). Hirudinea can be identified using Thorp and Lovell (2016), Klemm (1972) and Klemm (1985). Polychaetes can be identified using Foster (1972) and Klemm (1985). The keys in Thorp and Lovell (2016) should be used with caution when trying to identify Polychaetes. Not all freshwater species known from California are included in the key and the key is intended for freshwater species only, so estuarine species are not included. Branchiobdella are typically excluded from bioassessment samples as they are commensals on crayfish (see STE Rules section 3.4.3).

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Clitellata**										
Subclass - **Branchiobdellidea**										Excluded from bioassessment samples as they are commensals on crayfish.
Subclass - **Hirudinea**										Former class moved to subclass. Generic and species keys in Thorp and Lovell (2016).
Order - **Arhynchobdellida**										
Family - **Erpobdellidae**										
Genus - *Erpobdella*	x	x	x		x	x	x	x		Many names previously listed under *Dina*, *Mooreobdella* and *Nephelopsis* are now listed under this genus.
Genus - *Motobdella*[*]	x	x	x					x		
Family - **Haemopidae**										
Genus - *Haemopis*[*]	x	x	x		x	x	x	x		
Order - **Rhynchobdellida**										
Family - **Glossiphoniidae**										
Genus - *Glossiphonia*[*]	x	x	x		x	x	x			
Genus - *Helobdella*	x	x	x		x	x	x	x		
Genus - *Placobdella*	x	x	x			x	x	x		
Genus - *Theromyzon*[*]	x	x	x		x	x	x			
Family - **Piscicolidae**										
Genus - *Myzobdella*[*]										
Myzobdella lugubris[*]	x	x	x	x	x			x		Invasive Species, only one species reported from region.
Genus - *Piscicola*[*]	x	x	x		x	x				
Subclass - **Oligochaeta**	x	x	x	x	x	x	x	x		
Class - **Polychaeta**										Generic and species keys in Foster (1972), Klemm (1985) and Thorp and Lovell (2016).
Subclass - **Errantia**[**]										
Order - **Phyllodocida**										
Family - **Nereididae**										
Genus - *Alitta*[*]										
Alitta succinea[**]	x	x	x	x						Cosmopolitan east and west coasts brackish to fresh water. Formerly listed under the genus *Nereis*.
Genus - *Hediste*[*]										
Hediste diadroma	x			x	x	x				Estuarine, not included in Thorp and Lovell (2016) key.
Hediste limnicola[**]	x	x	x	x	x	x				Formerly listed under the genus *Neanthes*.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Nereididae** - Continued										
Genus - *Lycastoides*										
Lycastoides alticola	x	x			x					Not included in Thorp and Lovell (2016) key.
Genus - *Namalycastis*										
*Namalycastis hawaiiensis***	x		x		x					Not included in Thorp and Lovell (2016) key. Formerly listed under the genus *Namanereis*.
Subclass - **Sedentaria****										
Order - **Sabellida****										
Family - **Fabriciidae****										
Genus - *Manayunkia*										Thorp and Lovell (2016) still list under family Serpulidae.
Manayunkia speciosa	x	x	x		x	x				
Family - **Serpulidae****										
Genus - *Ficopomatus*										
Ficopomatus enigmaticus	x	x	x	x	x					
Order - **Spionida***										
Family - **Spionidae***										
Genus - *Marenzelleria**										
*Marenzelleria neglecta**	x	x		x	x					
*Marenzelleria viridis**	x	x		x	x					
Order - **Terebellida***										
Family - **Ampharetidae***										
Genus - *Hobsonia**										
*Hobsonia florida**	x			x		x				Estuarine, not included in Thorp and Lovell (2016) key.

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Carlton, J. T. (ed). 2007. The Light and Smith Manual: Intertidal Invertebrates from Central California to Oregon. Fourth Edition, Completely Revised and Expanded. University of California Press. Berkeley. xvii + 1002pp.

Foster, N. 1972. Biota of Freshwater Ecosystems. Identification Manual No. 4. Freshwater Polychaetes (Annelida) of North America. US Government Printing Office, Washington DC.

Kathman, R. D. and R. O. Brinkhurst. 1998. Guide to the freshwater oligochaetes of North America. College Grove, Tennessee, Aquatic Resources Center.

Klemm, D. 1972. Biota of Freshwater Ecosystems. Identification Manual No. 8. Freshwater Leeches (Annelida: Hirudinea) of North America. US Government Printing Office, Washington DC.

Klemm, D. 1985. A Guide to the Freshwater Annelida (Polychaeta, Naidid and Tubificid Oligochaeta, and Hirudinea) of North America. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Thorp, J. H. and L. L. Lovell. 2016. Chapter 12 - Phylum Annelida. pp. 223-263. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Phylum: **Arthropoda**
Subphylum: **Chelicerata**
Class: **Arachnida**
Subclass: **Acari - Mites**
Standard Effort Level I: Genus
Standard Effort Level II: Genus
Standard Taxonomic Reference(s): Smith (2016).

This section has been greatly expanded from the previous revision of the STE list. The newer keys, in the 2016 Thorp and Rogers, and the SAFIT workshop of 2016, have shown us that there is a lot more diversity out there, than what was previously thought by people doing bioassessment work. The standard text is the chapter in Thorp and Rogers, Chapter 16, Subclass Acari, p293 (Smith, 2016), which provides keys to mature and immature specimens. Larval water mites are typically parasites and thus excluded from bioassessment samples. Deutonymphs, on the other hand, are free living and should be included. Cook (1974) is an excellent source for detailed illustrations to supplement the newer key. For people doing survey work, there are really good species keys for a lot of the genera and most species descriptions are very good. The majority of studies done on aquatic mites have been done in Canada or in the eastern part of the U.S., so it is quite possible that additional taxa will be found, in the west, that are not listed below.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Class - **Arachnida**										
Subclass - **Acari**										Not included in Smith (2016).
Order - **Mesostigmata***										
Family - **Ascidae***										
Genus - *Platyseius* *										
*Platyseius cooki**	x		x	x		x				Aquatic/Semi-Aquatic?
Order - **Sarcoptiformes**										Family and generic keys in Smith (2016).
Suborder - **Oribatida**										Oribatid mites are typically excluded from bioassessment samples. Most Oribatida mites are surface or shore dwellers, very few are actually benthic aquatic.
Family - **Ameronothridae***										Not included in Smith (2016).
Genus - *Paraquanothrus**										
*Paraquanothrus grahami**	x		x		x			x		Mites occur in shallow weathering depressions, or pans, that temporarily hold rainwater.
Family - **Hydrozetidae***										Species in the Hydrozetidae are subaquatic in ponds, lakes and streams, generally in association with plants. Can be very abundant in samples with lots of vegetation.
Genus - *Hydrozetes**		x	x		x					
Family - **Trhypochthoniidae***										
Genus - *Mucronothrus**	x	x	x		x	x				
Genus - *Trhypochthoniellus**	x	x			x					
Family - **Zetomimidae***										
Genus - *Heterozetes**										Associated with shallow, eutrophic bodies of water, marshes, wet meadows and areas of wet moss, anecdotal literature suggests that they may live on the water's surface rather than beneath it.
*Heterozetes aquaticus**	x	x	x		x					Only one species known from western North America.
Order - **Trombidiformes**										Family and generic keys in Smith (2016).
Family - **Acalyptonotidae**										
Genus - *Acalyptonotus*	x	x	x			x				
Family - **Anisitsiellidae**										
Genus - *Bandakia*	x	x	x			x				
Genus - *Cookacarus**	x	x			x					
Genus - *Oregonacarus**	x	x			x	x				
Genus - *Utaxatax*	x	x			x	x				

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Order - **Trombidiformes** - Continued										
Family - **Aphevideruliciidae***										
Genus - *Aphevideruliix**	x	x			x					
Family - **Arrenuridae**										
Genus - *Arrenurus*	x	x	x		x	x	x	x		
Family - **Athienemanniidae**										
Genus - *Chelohydracarus**	x	x			x					
Genus - *Chelomideopsis*	x	x	x		x	x				
Genus - *Platyhydracarus*	x	x	x		x	x				
Family - **Aturidae**										
Genus - *Aturus*	x	x			x			x		
Genus - *Axonopsis*	x	x	x		x	x				
Genus - *Bharatalbia**	x	x			x	x				
Genus - *Brachypoda*	x	x	x		x	x		x		
Genus - *Erebaxonopsis*	x	x			x					
Genus - *Estellacarus*	x	x	x		x					
Genus - *Kongsbergia**	x	x			x	x		x		
Genus - *Lethaxona*	x	x				x				
Genus - *Phreatobrachypoda*	x	x			x	x				
Genus - *Stygalbiella*	x	x			x			x		
Genus - *Submiraxona**	x	x						x		
Genus - *Woolastookia*	x	x	x		x	x				
Family - **Chappuisididae**										
Genus - *Chappuisides*	x	x	x		x	x	x			
Genus - *Uchidastygacarus*	x	x	x		x	x				Previously in the Family Uchidastygacaridae.
Genus - *Yachatsia*	x	x	x		x	x	x	x		Previously in the Family Uchidastygacaridae.
Family - **Eylaidae**										
Genus - *Eylais*	x	x	x							No published records for California, but occasionally found in bioassessment samples. Common in vernal pools
Family - **Feltriidae**										
Genus - *Feltria*	x	x	x		x	x		x		
Family - **Frontipodopsidae**										
Genus - *Frontipodopsis*	x	x	x		x					
Family - **Halacaridae***										
Genus - *Lobohalacarus**	x	x			x			x		
Genus - *Soldanellonyx**	x	x	x		x	x		x		
Family - **Hydrachnidae***										
Genus - *Hydrachna**	x	x	x		x					
Family - **Hydrodromidae**										
Genus - *Hydrodroma*	x	x	x							Previously in the Family Hydrodromidae. No published records for California, but occasionally found in bioassessment samples.
Family - **Hydrovolziidae**										
Genus - *Hydrovolzia*	x	x			x					
Family - **Hydryphantidae**										
Genus - *Albertathyas**	x	x				x				
Genus - *Columbiathyas**	x	x				x				
Genus - *Cowichania**	x	x			x					
Genus - *Cyclothyas*	x	x			x	x				
Genus - *Euthyas**	x		x		x					
Genus - *Notopanisus**	x	x				x				
Genus - *Panisopsis**	x	x			x	x				
Genus - *Protzia*	x	x			x					
Genus - *Siskiyouthyas**	x	x			x	x				
Genus - *Tartarothyas**	x	x				x				
Genus - *Thyopsella**	x	x			x	x				
Genus - *Thyopsis*	x	x	x		x					
Genus - *Thyopsoides*	x	x			x					
Genus - *Wandesia*	x	x			x	x				

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Order - **Trombidiformes** - Continued										
Family - **Hygrobatidae**										
Genus - *Atractides*	x	x	x		x	x		x		
Genus - *Corticacarus*	x	x						x		
Genus - *Diamphidaxona*[*]	x	x			x	x		x		
Genus - *Hygrobates*	x	x	x		x			x		
Genus - *Mesobates*	x	x								No published records for California, but occasionally found in bioassessment samples.
Family - **Laversiidae**[*]										
Genus - *Laversia*	x	x				x				
Family - **Lebertiidae**										
Genus - *Estelloxus*	x	x			x	x				
Genus - *Lebertia*	x	x	x		x					
Genus - *Scutolebertia*	x	x			x					
Family - **Lethaxonidae**[*]										
Genus - *Lethaxona*[*]	x	x				x				
Family - **Limnesiidae**										
Genus - *Arizonacarus*[*]	x	x						x		
Genus - *Kawamuracarus*	x	x						x		
Genus - *Limnesia*	x	x	x		x					
Genus - *Meramecia*[*]	x	x			x			x		
Genus - *Neomamersa*	x	x			x		x	x		
Genus - *Neotyrrellia*	x	x						x		
Genus - *Protolimnesia*[*]	x	x						x		
Genus - *Tyrrellia*	x	x	x		x	x				
Family - **Limnocharidae**										
Genus - *Limnochares*	x	x	x		x	x		x		
Family - **Mideidae**[*]										
Genus - *Midea*[*]	x	x	x			x				
Family - **Mideopsidae**										
Genus - *Mideopsis*	x	x	x		x	x				
Genus - *Paramideopsis*[*]	x	x			x	x	x			Previously listed in the Family Nudomideopsidae.
Genus - *Xystonotus*[*]	x	x	x							No published records for California, but has found in bioassessment samples.
Family - **Momoniidae**										
Genus - *Cyclomomonia*[*]	x	x				x	x			
Genus - *Momonia*	x	x	x			x	x			
Genus - *Stygomomonia*	x	x			x	x	x	x		
Family - **Neoacaridae**[*]										
Genus - *Neoacarus*[*]	x	x	x		x	x	x	x		
Family - **Nudomideopsidae**										
Genus - *Neomideopsis*	x	x				x				
Family - **Omartacaridae**										
Genus - *Omartacarus*	x	x			x					
Family - **Oxidae**										
Genus - *Frontipoda*	x		x		x					
Genus - *Gnaphiscus*[*]	x		x		x					
Genus - *Oxus*	x	x	x							No published records for California, but occasionally found in bioassessment samples.
Family - **Pionidae**										
Genus - *Forelia*[*]	x		x							No published records for California, but occasionally found in bioassessment samples.
Genus - *Hydrochoreutes*[*]	x	x	x		x					
Genus - *Nautarachna*	x	x	x		x		x			
Genus - *Piona*[*]	x		x		x					
Genus - *Pionopsis*[*]	x		x							No published records for California, but occasionally found in bioassessment samples.
Genus - *Pseudofeltria*[*]	x	x			x					

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Order - **Trombidiformes** - Continued										
Family - **Pontarachnidae**										
Genus - *Pontarachna*	x				x					Marine
Family - **Rhynchohydracaridae***										
Genus - *Clathrosperchon**	x	x			x					
Family - **Sperchontidae**										Heather Procter advised caution - Sperchon and Sperchonopsis are much more diverse than the number of named species would imply, and most of the descriptions of named species are not very detailed. Species id. is not recommended.
Genus - *Sperchon*	x	x	x		x	x				
Genus - *Sperchonopsis*	x	x	x		x	x	x			
Family - **Stygothrombiidae***										
Genus - *Stygothrombium**	x	x			x					
Family - **Thermacaridae**										
Genus - *Thermacarus*	x	x			x	x	x			Hot springs.
Family - **Torrenticolidae**										
Genus - *Debsacarus**										Monotypic. Not included in Smith (2016), see O'Neill, et al., (2016) for separation.
*Debsacarus oribatoides**	x	x			x					Known only from California.
Genus - *Monatractides**	x	x	x		x					
Genus - *Neoatractides*	x	x						x		
Genus - *Pseudotorrenticola*	x	x						x		
Genus - *Testudacarus*	x	x			x	x		x		
Genus - *Torrenticola*	x	x	x		x	x	x	x		
Family - **Unionicolidae**										
Genus - *Koenikea*	x	x			x					
Genus - *Neumania*	x	x	x		x					
Genus - *Unionicola*	x		x		x					
Family - **Wettinidae**										
Genus - *Wettina**	x	x	x		x					

Footnotes
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Literature

Cook, D. R. 1974. Water mite genera and subgenera. Memoirs of the American Entomological Institute (21): 860pp.

O'Neill, J. C., et al., 2016. Systematics of testudacarine torrent mites (Acari, Hydrachnidia, Torrenticolidae) with descriptions of 13 new species from North America. ZooKeys 582: 13–110.

Smith, I. M. 2016. Chapter 16 - Phylum Arthropoda, Subclass Acari. pp. 293-412. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Phylum: **Arthropoda**
Subphylum: **Crustacea**
Standard Effort Level I: Genus
Standard Effort Level II: Genus/Species
Standard Taxonomic Reference(s): Rogers (2016).

The Crustacea are best separated using the keys in Rogers (2016). This text does not include most estuarine species, so if you are working on samples coming from an estuarine or tidally influenced area, other marine oriented texts may be required. The Rogers (2005) workshop manual is still a very usable resource and is much simpler to use, though it is not as inclusive. An attempt was made to include more estuarine taxa in this list, since they do periodically show up in benthic samples collected low in coastal watersheds, but since bioassessment is intended for use on freshwater environments, a thorough review of marine/estuarine literature has not been done for this STE. The Light and Smith Manual (2007) can be useful for identification of estuarine taxa. Additional references which can be useful if working in vernal pool habitats have been included in the literature section.

Crustaceans can be important in bioassessment. Some mysids, amphipods and isopods are sensitive to many pollutants and heavy metals. There are several state and federally protected species. The Freshwater Shrimp (*Syncaris pacifica*) is both a state and federally protected species. There are five federally protected fairy shrimp and one federally protected tadpole shrimp. These animals are protected under the state and federal Endangered Species Acts and the California Environmental Quality Act. Any individual, or agency, found collecting any of these species without proper permits may be subject to substantial fines, imprisonment, or both. Most crayfish and freshwater crabs are invasive species.

Since Ostracods are not identified below class, no effort was made to include all of the species known from the SAFIT region into the database. If you have any interest in the species, the NANODe (North American Non-Marine Ostracode Database) website, maintained by Kent State University, can be a useful resource.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Subphylum - **Crustacea**										
Class - **Branchiopoda**										
Subclass - **Phyllopoda**										
Order - **Diplostraca**										
Suborder - **Cladocera**		x	x							Cladocerans are not benthic and should not be included in bioassessment samples.
Suborder - **Spinicaudata**										Family and generic keys in Rogers (2016).
Family - **Cyzicidae**										Clam shrimp.
Genus - *Cyzicus*			x			x		x	x	Found in temporary wetlands, not included in benthic bioassessment samples.
Genus - *Eocyzicus*										
Eocyzicus digueti			x		x		x	x	x	Found in temporary wetlands, not included in benthic bioassessment samples.
Family - **Leptestheriidae**										Clam shrimp.
Genus - *Leptestheria*										
Leptestheria compleximanus			x		x			x	x	Found in temporary wetlands, not included in benthic bioassessment samples.
Family - **Limnadiidae***										Clam shrimp. Species key available in Rogers (2016).
Genus - *Eulimnadia**			x		x			x	x	Found in temporary wetlands, not included in benthic bioassessment samples.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Subclass - **Phyllopoda** - Continued										
Order - **Laevicaudata**										
Family - **Lynceidae**										Clam shrimp. Species key available in Rogers (2016).
Genus - *Lynceus*			x		x	x		x		Found in temporary wetlands, not included in benthic bioassessment samples.
Order - **Notostraca**										Family and generic keys in Rogers (2016).
Family - **Triopsidae**										Tadpole shrimp.
Genus - *Lepidurus*			x		x	x	x	x	x	Found in temporary wetlands and temporary streams, not included in benthic bioassessment samples. *Lepidurus packardi* is a federally listed Endangered Species. Species key available in Rogers (2016).
Genus - *Triops*			x		x		x	x	x	Found in temporary wetlands, not included in benthic bioassessment samples.
Subclass - **Sarsostraca**										
Order - **Anostraca**										Family and generic keys in Rogers (2016).
Family - **Artemiidae**										Brine shrimp. One genus. Species key available in Rogers (2016).
Genus - *Artemia*			x		x	x	x	x	x	Found in saline lakes, not included in bioassessment samples.
Family - **Branchinectidae**										Fairy shrimp. One genus. Species key available in Rogers (2016).
Genus - *Branchinecta*			x		x	x	x	x	x	Found in temporary wetlands, not included in benthic bioassessment samples. Four federally listed Endangered Species known from California.
Family - **Chirocephalidae**										Fairy shrimp. Species keys available in Rogers (2016).
Genus - *Eubranchipus*			x		x	x	x	x		Found in temporary wetlands, not included in benthic bioassessment samples.
Genus - *Linderiella*			x		x					Found in temporary wetlands, not included in benthic bioassessment samples.
Family - **Streptocephalidae**										Fairy shrimp. One genus. Species key available in Rogers (2016).
Genus - *Streptocephalus*			x		x			x	x	Found in temporary wetlands, not included in benthic bioassessment samples. One federally listed Endangered Species known from California.
Family - **Thamnocephalidae**										Fairy shrimp. Species keys available in Rogers (2016).
Genus - *Thamnocephalus*			x		x		x	x	x	Found in temporary wetlands, not included in benthic bioassessment samples.
Class - **Malacostraca**										
Subclass - **Eumalacostraca**										
Order - **Amphipoda**										Family and generic keys in Rogers (2016) - leave at genus.
Family - **Anisogammaridae**										
Genus - *Anisogammarus*[*]										
Anisogammarus pugettensis[*]	x	x	x	x	x					Pacific Coast estuaries and tidally influenced freshwater.
Genus - *Eogammarus*[*]										
Eogammarus confervicolus[*]	x	x	x	x	x	x			x	
Genus - *Ramellogammarus*	x	x	x	x	x	x				Species key is available for mature specimens in Rogers (2016).
Family - **Corophiidae**										
Genus - *Americorophium*	x	x	x	x	x	x				Species key is available for mature specimens in Rogers (2016).
Genus - *Cheirimedeia*[*]	x			x	x	x				Not included in Rogers (2016).
Genus - *Monocorophium*[*]	x			x	x	x			x	Both native and invasive species. Not included in Rogers (2016).
Genus - *Paracorophium*[*]	x			x	x					Introduced - An undetermined species has appeared in Humboldt Bay and another in Tomales Bay.
Genus - *Sinocorophium*[*]	x	x		x	x					Not included in Rogers (2016).
Family - **Crangonyctidae**										Leave at genus.
Genus - *Crangonyx*	x	x	x	x	x	x	x	x		
Genus - *Stygobromus*	x	x	x		x	x	x	x		
Genus - *Stygonyx*										
Stygonyx courtneyi	x	x				x				Monotypic.
Family - **Gammaridae**										One western genus. Leave at genus
Genus - *Gammarus*	x	x	x	x	x	x	x	x		Numerous described and undescribed species.
Family - **Haustoriidae**										Not included in Rogers (2016).
Genus - *Eohaustorius*[*]	x			x	x					
Family - **Hyalellidae**										
Genus - *Apohyale*[*]	x	x		x	x					Not included in Rogers (2016).
Genus - *Hyalella*	x	x	x		x			x		Many undescribed species.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Order - **Amphipoda** - Continued										
Family - **Maeridae***										Not included in Rogers (2016).
Genus - *Maera**	x			x	x					
Genus - *Melita**	x	x		x	x	x				Introduced.
Family - **Pontogeneiidae***										
Genus - *Paramoera**	x	x	x	x	x	x				Species key is available for mature specimens in Rogers (2016).
Family - **Talitridae**										Amphibious - shore and near shore.
Genus - *Arcitalitrus*										
Arcitalitrus sylvaticus	x	x	x		x					Introduced.
Genus - *Talitroides*	x	x	x		x			x		
Order - **Bathynellacea***										Family and generic keys in Rogers (2016) - leave at genus.
Family - **Bathynellidae***										Found in interstitial waters, uncommon in bioassessment samples.
Genus - *Bathynella**	x	x	x		x					
Genus - *Pacificabathynella**	x	x	x		x					
Family - **Parabathynellidae***										
Genus - *Califobathynella**	x	x			x					Species key is available for mature specimens in Rogers (2016).
Genus - *Californibathynella**										
*Californibathynella californica**	x	x			x					
Genus - *Hexabathynella**	x	x			x					Species key is available for mature specimens in Rogers (2016).
Genus - *Texanobathynella**										
*Texanobathynella sachi**	x	x			x					Only one species know from region.
Order - **Decapoda**										Family and generic keys in Rogers (2016) - leave at genus. Species keys are available for mature specimens of most genera in Rogers (2016).
Infraorder - **Astacidea**										Crayfish - Adult crayfish tend to easily avoid bioassessment sampling methods leaving only immature specimens to be identified. Species or even generic id's may be impractical.
Family - **Astacidae**										Species key is available for mature specimens in Rogers (2016).
Genus - *Pacifastacus*										
Pacifastacus connectens	x	x	x			x				
Pacifastacus fortis	x	x	x		x					Federally listed endangered species.
Pacifastacus gambelii	x	x	x		x	x	x			
Pacifastacus leniusculus	x	x	x		x	x	x			
Pacifastacus nigrescens	x	x	x		x					Generally believed to be extinct.
Family - **Cambaridae**										Species key is available for mature specimens in Rogers (2016).
Genus - *Faxonius**										
*Faxonius causeyi**	x	x	x					x		Previously listed under the name *Orconectes causeyi*.
*Faxonius neglectus***	x	x	x			x				Introduced. Previously listed under the name *Orconectes neglectus.*
*Faxonius rusticus**	x	x	x			x	x			Previously listed under the name *Orconectes rusticus*.
*Faxonius virilis***	x	x	x		x		x	x	x	Introduced. Previously listed under the name *Orconectes virilis*.
Genus - *Procambarus*										No native species, all introduced.
*Procambarus acutus**	x	x	x		x					
*Procambarus alleni**	x	x	x		x					
Procambarus clarkii	x	x	x		x	x	x	x	x	
Infraorder - **Brachyura**										Crabs
Family - **Geothelphusidae**										Family and generic keys in Rogers (2016) - leave at genus.
Genus - *Geothelphusa*										
Geothelphusa dehaani	x	x	x				x			Introduced. Possibly extirpated.
Family - **Ocypodidae**										
Genus - *Leptuca**	x			x	x				x	Not included in Rogers (2016).
Genus - *Uca*	x			x	x				x	Species key is available in Rogers (2016).
Family - **Panopeidae**										
Genus - *Rhithropanopeus*										
Rhithropanopeus harrisii	x	x		x	x	x				Introduced.
Family - **Portunidae***										
Genus - *Callinectes**										Species key is available in Rogers (2016). Both native and introduced species known from California.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Infraorder - **Brachyura** - Continued										
Family - **Sesarmidae***										
Genus - *Sesarma**										
*Sesarma sulcatum**	x	x		x					x	Only one western species.
Family - **Varunidae***										
Genus - *Eriocheir*	x	x		x	x	x				Species key is available in Rogers (2016). Introduced Mitten Crabs.
Infraorder - **Caridea**										Shrimp. Leave at genus.
Family - **Atyidae**										Family and generic keys in Rogers (2016) - leave at genus.
Genus - *Atya**	x	x							x	
Genus - *Syncaris*										
Syncaris pacifica	x	x	x		x					Federally listed Endangered Species.
Syncaris pasadenae	x	x	x		x					Thought to be extinct.
Family - **Palaemonidae**										
Genus - *Macrobrachium**	x	x	x						x	
Genus - *Palaemon*	x	x	x	x	x	x		x	x	Non-native species. Some former species of *Exopalaemon* and *Palaemonetes* have been moved into this genus.
Order - **Isopoda**										Family and generic keys in Rogers (2016) - leave at genus.
Family - **Asellidae**										
Genus - *Asellus*										
Asellus hilgendorfii	x	x	x		x					Introduced.
Genus - *Bowmanasellus*										
Bowmanasellus sequoiae	x	x	x		x					Stygobiont.
Genus - *Caecidotea*	x	x	x		x	x				Both native and introduced species.
Genus - *Calasellus*	x	x	x		x					Species key is available for mature specimens in Rogers (2016).
Genus - *Oregonasellus*										
Oregonasellus elliotti	x	x	x			x				Stygobiont, only known from Malheur Cave.
Genus - *Salmasellus*										
Salmasellus howarthi	x	x	x			x				
Family - **Idoteidae***										
Genus - *Synidotea**										
*Synidotea laticauda**	x	x	x	x	x					Euryhaline. An additional 7 species known from CA with an additional 3 along the north coast. All are considered marine or intertidal.
Family - **Janiridae***										
Genus - *Iais**										
*Iais californica**	x		x	x	x	x			x	Introduced.
Family - **Ligiidae**										
Genus - *Ligidium*	x	x	x		x	x				
Family - **Munnidae**										
Genus - *Uromunna**	x	x	x	x	x					Introduced.
Family - **Paranthuridae***										
Genus - *Paranthura**										
*Paranthura elegans**	x	x	x	x	x					
Family - **Sphaeromatidae**										
Genus - *Gnorimosphaeroma*	x	x	x	x	x	x				Euryhaline. Species key is available for mature specimens in Rogers (2016).
Genus - *Pseudosphaeroma**										
*Pseudosphaeroma campbellense**	x	x	x	x	x	x				Introduced. Euryhaline.
Genus - *Sphaeroma**										
*Sphaeroma quoianum**	x	x	x	x	x					Introduced. Euryhaline.
Order - **Mysida**										Family and generic keys in Rogers (2016) - leave at genus.
Family - **Mysidae**										
Genus - *Alienacanthomysis*										
Alienacanthomysis macropsis	x	x	x	x	x	x				
Genus - *Deltamysis*										
Deltamysis holmquistae	x	x	x	x	x					Introduced.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Family - **Mysidae** - Continued										
Genus - *Hyperacanthomysis*										
Hyperacanthomysis longirostris	x	x	x	x	x					Introduced.
Genus - *Mysis*										
Mysis diluviana	x	x	x		x	x	x			Only species recorded from California.
Genus - *Neomysis*	x	x	x		x	x				Species key is available for mature specimens in Rogers (2016). Both native and introduced species known from California.
Genus - *Orientomysis***	x	x	x	x	x					Species key is available for mature specimens in Rogers (2016). Introduced. Formerly listed under the genus *Acanthomysis*.
Order - **Tanaidacea**										Family and generic keys in Rogers (2016).
Family - **Leptocheliidae**										
Genus - *Sinelobus*										
*Sinelobus stanfordi**	x	x	x	x		x			x	Pacific coastal tidally influenced freshwater habitats. California specimens that key out to this genus have been found by the ABL.
Class - **Maxillopoda**										
Subclass - **Branchiura**										
Order - **Arguloida**										Family and generic keys in Rogers (2016) - leave at genus.
Family - **Argulidae**										
Genus - *Argulus*		x	x	x	x					Fish Parasite - excluded from bioassessment samples.
Subclass - **Copepoda**	x	x	x	x						Copepods are not benthic and should not be included in bioassessment samples.
Class - **Ostracoda**	x	x	x	x	x	x	x	x	x	Leave at Ostracoda.

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Carlton, J. T. (ed.). 2007. The Light and Smith Manual: Intertidal Invertebrates from Central California to Oregon, Fourth Edition, Completely Revised and Expanded. University of California Press, Berkeley. xvii + 1002pp.

Eriksen, C. H. and D. Belk. 1999. Fairy shrimps of California's puddles, pools, and playas. Eureka, CA, Mad River Press, Inc.

Martin, J. W. and D. Belk. 1988. A review of the clam shrimp family Lynceidae Stebbing, 1902 (Branchiopoda: Conchostraca), in the Americas. Journal of Crustacean Biology 8(3): 451-482.

Martin, J. W. and C. E. Cash-Clark. 1993. The spinicaudatan clam shrimp genus *Leptestheria* Sars, 1898 (Crustacea, Branchiopoda) in California. Bulletin of the Southern California Academy of Sciences 92(2): 78-88.

Rogers, D. C. 2001. Revision of the Nearctic *Lepidurus* (Notostraca). Journal of Crustacean Biology 21(4): 991-1006.

Rogers, D. C. 2002. Female-based characters for anostracan (Crustacea: Branchiopoda) identification: a key for species of California and Oregon, USA. Hydrobiologia 486: 125-132.

Rogers, D. C. 2003. Revision of the thamnocephalid genus *Phallocryptus* (Crustacea; Branchiopoda; Anostraca). Zootaxa (257):1-14.

Rogers, D. C. 2005. Identification manual to the freshwater Crustacea of the western United States and adjacent areas encountered during bioassessment. EcoAnalysts, Inc. Technical Publication(1): 1-79.

Rogers, D. C. 2006. Three new species of *Branchinecta* (Crustacea: Branchiopoda: Anostroca) from the Nearctic. Zootaxa(1126): 35-51.

Rogers, D. C. and M. Fugate. 2001. *Branchinecta hiberna*, a new species of fairy shrimp (Crustacea: Anostraca) from Western North America. Western North American Naturalist 61(1): 11-18.

Rogers, D. C. 2016. Chapter 16 - Phylum Arthropoda, Subphylum Crustacea. pp. 412-711. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Useful Websites:

Large Branchiopod Bibliography, updated 6 March 2006.
https://blogs.uakron.edu/weeks/bibliography/

NANODe - North American Non-Marine Ostracode Database Project, Version 1 (https://www.personal.kent.edu/~alisonjs/nanode/index.htm).

NAS - Nonindigenous Aquatic Species. USGS website:
https://nas.er.usgs.gov/default.aspx

Phylum: **Ectoprocta** (Bryozoa)
Standard Effort Level I: Class
Standard Effort Level II: Class
Standard Taxonomic Reference(s): Wood (2016).

Ectoprocta (formerly Bryozoa) are generally identified using Wood (2016). There are a number of freshwater species known to occur within the SAFIT region. Bryozoa are not typically enumerated as a quantitative part of benthic samples, as they are colonial and most taxa are sessile. However, their presence in samples should be noted, as they are indicators of clean, well oxygenated water. Four species are known from California or Oregon. The invasive species *Pectinatella magnifica* is known from California.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Bryozoa****										
Class - Phylactolaemata	x	x	x	x	x	x				

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Wood, T. S. 2016. Chapter 13 - Phylum Ectoprocta (Bryozoa). pp. 265-274. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Useful Websites:

Cal-NEMO - Non-Native Species Website. California Non-native Estuarine and Marine Organisms (Cal-NEMO) (http://invasions.si.edu/nemeisis/calnemo/search)

Phylum: **Cnidaria**
Standard Effort Level I: Genus
Standard Effort Level II: Genus
Standard Taxonomic Reference: R. D. Campbell (2016).

Cnidarians are generally identified using Campbell (2016). Caution should be used when using these keys to identify specimens collected from sites near the coast, as these keys are designed to identify only freshwater species and do not typically include estuarine species that sometimes make their way into the lower portions of the watershed.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Cnidaria**										
Class - **Hydrozoa**										
Order - **Anthoathecata***										
Family - **Cordylophoridae***										
Genus - *Cordylophora*										Previously in the Family Anthomedusae.
*Cordylophora caspia**	x	x	x	x	x	x				*Cordylophora caspia* is an introduced colonial hydroid consists of macroscopic polyps. It can be found in both brackish and freshwater. It is colonial and should not be included in bioassessment samples.
Family - **Hydridae**										Distributional records rare, most authors list the genus *Hydra* as widespread.
Genus - *Hydra*	x	x	x		x	x		x		The genus *Hydra* does not have a medusa stage. It is only found as a polyp. Because it is solitary and not colonial it can be counted in benthic bioassessment samples.
Order - **Leptothecata***										
Family - **Blackfordiidae***										
Genus - *Blackfordia**	x	x		x	x	x				*Blackfordia virginica* is an introduced hydroid with a distinct medusa (jellyfish) stage. This is also a branched colonial organism and should not be included in benthic bioassessment samples.
Family - **Campanulariidae***										
Genus - *Obelia**	x			x	x					*Obelia geniculata* is an introduced colonial hydroid, that consists if stalks if polyps branching off in a ziz-zag pattern. It is colonial and should not be included in bioassessment samples.
Order - **Limnomedusae**										
Family - **Olindiidae**										
Genus - *Craspedacusta*										
Craspedacusta sowerbii		x	x		x	x	x	x		Freshwater jellyfish - is an introduced colonial hydroid that is more commonly found in the medusa stage. It is colonial and should not be included in bioassessment samples.
Genus - *Maeotias**										
*Maeotias marginata**	x			x	x					This is another introduced hydroid that is more commonly found in the medusa stage. The polyp stage is very small and lacks tentacles. The medusa stage is not benthic and should not be included in bioassessment samples.

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Campbell, R. D. 2016. Chapter 4 - Phylum Cnidaria, p 85-89. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Phylum: **Entoprocta**
Standard Effort Level I: Class
Standard Effort Level II: Class
Standard Taxonomic Reference(s): Wood (2016).

Entoprocta are primarily marine, with only two invasive species being found in inland waters within the SAFIT region. Entoprocta are generally identified using Wood (2016). Entoprocts are not typically enumerated as a quantitative part of benthic samples, as they are colonial and sessile. However, their presence in samples should be noted, as they are non-native invasive species in the western US (Eng, 1977), and are tolerant to a variety of organic pollutants, low oxygen, and high TDS (Wood, 2010).

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Entoprocta**										
Class - Not Currently Assigned										
Order - Not Currently Assigned										
Family - **Barentsiidae***										
Genus - *Urnatella*										Previously in the Family Urnatellidae.
Urnatella gracilis	x	x	x	x	x					Invasive Species. Only one freshwater species known from North America.
Genus - *Barentsia**										
*Barentsia benedeni**	x			x	x	x				Invasive Species

Footnotes
* - Denotes a new name added after the previous STE.
** - Denotes a name change from previous STE.

Literature

Wood, T. S. 2016. Chapter 14 - Phylum Entoprocta. pp. 275-276. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Useful Websites:

Cal-NEMO - Non-Native Species Website. California Non-native Estuarine and Marine Organisms (Cal-NEMO) (http://invasions.si.edu/nemeisis/calnemo/search)

Phylum: **Mollusca**
Standard Effort Level I: Genus
Standard Effort Level II: Genus/Species
Standard Taxonomic Reference(s): Thorp and Rogers (2016).

The freshwater mollusks of western North America have a long and convoluted taxonomic history, with much confusion in the literature. Snails should be identified using Thorp and Rogers (2016). In Dillon's review, of the Thorp and Rogers, 2016, Keys to the Nearctic Fauna, he both praised and criticized the work, with his final conclusion being: " I will simply observe that the evolutionary approach taken in the Fourth Edition is not as user-friendly as the ecological approach taken in the third." He actually recommends using the third and fourth editions side by side. This text does not include most estuarine species, so if you are working on samples coming from an estuarine or tidally influenced area, other marine oriented texts may be required.

The workshop manuals Perez et al. (2004) and Dillon (2006) are more condensed and can be very helpful. Burch (1982) is still a very good text for identification, but many of the names are outdated. The Light and Smith Manual (2007) can be useful for identification of estuarine taxa. For the bivalves, the Burch (1972) keys are still very good, though again many of the names are outdated. Another good text for freshwater mussels west of the continental divide is Nedeau et al. (2006). Hershler and Liu (2017) can be helpful for Hydrobiid snails, but it does require the snails to be properly relaxed prior to preservation.

Higher level mollusk taxonomy is kind of a mess, but since Thorp and Roger (2016) is the most current and comprehensive work available, this STE list is following their taxonomy as much as possible. A more current breakdown of gastropod systematics can be found in Bouchet, et al. (2017). Since many gastropod taxonomists use Superfamilies (SPF) instead of Orders as the taxonomic break between Subclass and Family, they are included here, but are not included in the current SWAMP database, so they should not be used as a taxonomic category when doing work that will ultimately go into the SWAMP database.

The freshwater snails, clams and mussels are ecologically significant, and their taxonomic relationships are poorly understood. Immature animals are not identifiable due to the tremendous amount of convergence in juvenile forms. Many groups cannot be identified beyond genus level without having properly relaxed and preserved specimens. Non-native invasive species, particularly the Asian clam, *Corbicula*, and the New Zealand Mudsnail, *Potamopyrgus*, are ecological threats. Montana State University provides a webpage with useful information on the taxonomy and ecology of *Potamopyrgus*.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Mollusca**										
Class - **Bivalvia**										Keys in Thorp and Rogers (2016).
Subclass - **Heterodonta**										
Order - **Cardiida***										
Family - **Tellinidae***										Some sources put this Family in the Order Veneroida.
Genus - *Macoma**										
*Macoma petalum**	x			x	x					Invasive species
Order - **Myida***										
Family - **Corbulidae***										
Genus - *Potamocorbula**										
*Potamocorbula amurensis**	x			x	x					Invasive species
Order - **Veneroida**										
Family - **Cyrenidae***										Still listed under the family Corbiculidae in Thorp and Rogers, 2016.
Genus - *Corbicula*	x	x	x		x	x	x	x	x	Invasive species. Leave at genus.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Order - **Veneroida** - Continued										
Family - **Dreissenidae***										
Genus - *Dreissena**										Species can be keyed out using Thorp and Rogers, 2016.
*Dreissena bugensis**	x	x	x		x		x	x		Invasive Species - Quagga mussel
*Dreissena polymorpha**	x	x	x		x					Invasive Species - Zebra mussel
Family - **Sphaeriidae**										Small specimens below 3mm in length should be left at family.
Genus - *Musculium*	x	x	x		x	x	x			Leave at *Musculium* / *Sphaerium.*
Genera - *Musculium* / *Sphaerium**	x	x	x		x	x	x	x		Thorp and Rogers, 2016 does not separate the genera.
Genus - *Pisidium*	x	x	x		x	x	x	x		Leave at genus. Some sources split group into two genera, *Euglesa* and *Pisidium*.
Genus - *Sphaerium*	x	x	x		x	x	x	x		Leave at *Musculium*/ *Sphaerium.*
Subclass - **Palaeoheterodonta**										
Order - **Unionida**										
Family - **Margaritiferidae**										
Genus - *Margaritifera*										
Margaritifera falcata	x	x			x	x	x			Only one western species.
Family - **Unionidae**										
Genus - *Anodonta*	x	x	x		x	x	x	x	x	
Genus - *Gonidea*										
Gonidea angulata	x	x	x		x	x	x			Only one species in Pacific sub-region.

Footnotes
* - Denotes a new name added after the previous STE.
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Literature

Burch, J. B. 1972. Biota of Freshwater Ecosystems. Identification Manual No. 3. Freshwater Sphaeriacean Clams (Mollusca: Pelecypoda) of North America. US Government Printing Office, Washington DC, 32 pp.

Burch, J. B. 1975. Freshwater Unionacean Clams (Mollusca: Pelecypoda) of North America. 204 pp.

Cummings, K.S. & D.L. Graf. 2010. Chapter 11 - Mollusca: Bivalvia. Pages 309–384 In: Thorp, J. H. & A.P. Covich (eds.), Ecology and Classification of North American Freshwater Invertebrates, Third Edition, Academic Press, Boston, MA.

Nedeau, E., A. K. Smith, and J. Stone. 2006. Freshwater Mussels of the Pacific Northwest. US Fish & Wildlife Service, Vancouver, Washington, USA. 45 pp.

Thorp, J. H. and D. C. Rogers. 2016. Chapter 11 - Phylum Mollusca. pp. 209-221. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Mollusca**										
Class - **Gastropoda**										Keys in Thorp and Rogers (2016). Unless otherwise noted, leave at genus.
Subclass - **Caenogastropda***										
Order - **Architaenioglossa**										
SPF - **Ampullaroidea***										
Family - **Ampullariidae**										
Genus - *Marisa*										
Marisa cornuarietis	x	x	x		x		x			Invasive Species.
Genus - *Pomacea*	x	x	x		x		x	x		Invasive Species. Four species known to be in California.
SPF - **Viviparoidea***										
Family - **Viviparidae**										
Genus - *Bellamya*										Species key in Thorp and Rogers, 2016.
Bellamya chinensis	x	x	x		x	x		x		Invasive Species.
Bellamya japonica	x	x	x		x					Invasive Species.
Order - **Littorinimorpha***										Genera listed under the Family Hydrobiidae in older keys.
SPF - **Truncatelloidea***										Listed as Rissooidea in Thorp and Rogers, 2016.
Family - **Amnicolidae**										
Genus - *Colligyrus*	x	x			x	x				Species can be keyed out using Thorp and Rogers, 2016.
Family - **Assimineidae**										
Genus - *Assiminea*	x		x	x	x	x			x	Amphibious. Species can be keyed out using Thorp and Rogers, 2016.
Family - **Cochliopidae**										Species keys are available for most genera, though species identification may require specimens be properly relaxed prior to preservation. Good generic key in Hershler & Liu (2017).
Genus - *Eremopyrgus*	x	x					x			
Genus - *Ipnobius**										
*Ipnobius robustus**	x	x			x					Monotypic.
Genus - *Littoridinops**										
*Littoridinops monroensis**	x			x	x					Invasive Species.
Genus - *Spurwinkia**										
*Spurwinkia salsa**	x			x	x			x		Invasive Species.
Genus - *Tryonia*	x	x	x	x	x		x	x	x	In California - coastal or east side of Sierra Nevada mountain range.
Family - **Hydrobiidae**										
Genus - *Pyrgulopsis*	x	x			x	x	x	x	x	
Family - **Lithoglyphidae**										
Genus - *Fluminicola*	x	x			x	x	x			
Family - **Pomatiopsidae**										
Genus - *Pomatiopsis*	x	x	x		x	x				Semiaquatic, often found among wet leaf litter and vegetation beside flowing or standing water.
Family - **Tateidae***										
Genus - *Potamopyrgus*										
Potamopyrgus antipodarum	x	x			x	x	x	x		Invasive Species - New Zealand Mudsnail.
Family - (Uncertain)										Hershler & Liu, 2017, lists the family as "uncertain".
Genus - *Taylorconcha**	x	x				x				Not in Thorp and Rogers, 2016. Hershler & Liu, 2017, lists the family as "uncertain".
Genus - *Pristinicola*										Not in Thorp and Rogers, 2016.
Pristinicola hemphilli	x	x				x				Monotypic. Snails that appear to be *Pristinicola* have been found in northern California.
Order - Unassigned**										There is currently no name assigned to this Order.
SPF - **Cerithoidea***										
Family - **Batillariidae***										
Genus - *Batillaria**										
*Batillaria attramentaria**	x			x	x					Invasive Species.
Family - **Potamididae***										
Genus - *Cerithideopsis**	x	x		x	x				x	Brackish Water Species.
Family - **Semisulcospiridae***										
Genus - *Juga*	x	x			x	x	x			Previously in the Family Pleuroceridae

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
SPF - **Cerithoidea** - Continued										
Family - **Thiaridae**										
Genus - *Melanoides*										
Melanoides tuberculata	x	x	x		x	x	x	x		Invasive Species.
Genus - *Tarebia*										
Tarebia granifera	x	x			x					Invasive Species.
Subclass - **Heterobranchia***										
Order - **Ellobiida***										
SPF - **Ellobioidea***										
Family - **Ellobiidae**										
Genus - *Myosotella**										
*Myosotella myosotis***	x			x	x	x				Invasive species.
Order - Unassigned**										There is currently no name assigned to this Order.
SPF - **Lymnaeoidea***										
Family - **Lymnaeidae**										
Genus - *Fisherola*										
Fisherola nuttallii	x	x	x			x				Monotypic.
Genus - *Lanx*										Species key in Thorp and Rogers, 2016.
Lanx alta	x	x	x		x	x				
Lanx patelloides	x	x	x		x					
Genus - *Lymnaea*	x	x	x		x	x	x	x		Leave at genus. One of the species, *Lymnaea* (*Galba*) *cubensis*, is an introduced species in California.
Genus - *Radix**										
*Radix auricularia**	x	x	x		x	x	x	x		
SPF - **Planorbiodea***										Listed as Lymnaeoidea in Bouchet, et al. 2017.
Family - **Physidae**										
Genus - *Physa*	x	x	x		x	x	x	x		
Family - **Planorbidae**										
Genus - *Biomphalaria*	x	x	x		x			x		
Genus - *Drepanotrema*										Species key in Thorp and Rogers, 2016.
Drepanotrema aeruginosum	x	x	x					x		
Genus - *Ferrissia*	x	x	x		x	x		x		Leave at genus.
Genus - *Gyraulus*	x	x	x		x					Leave at genus.
Genus - *Helisoma*	x	x	x		x	x	x	x		
Genus - *Menetus*	x	x	x		x					
Genus - *Promenetus*	x	x	x		x	x	x	x		Leave at genus.
Genus - *Vorticifex*										Species key in Thorp and Rogers, 2016.
Vorticifex effusa	x	x	x		x	x				
Vorticifex solida	x	x	x		x		x			
SPF - **Valvatoidea***										
Family - **Valvatidae**										
Genus - *Valvata*	x	x	x		x	x	x	x		

Footnotes

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Literature

Bouchet, P., J. Rocroi, B. Hausdorf, A. Kaim, Y. Kano, A. Nützel, P. Parkhaev, M. Schrödl and E. E. Strong. 2017. Revised Classification, Nomenclator and Typification of Gastropod and Monoplacophoran Families. Malacologia, 61(1–2): 1–526.

Brown, K. M. and C. Lydeard. 2010. Chapter 10 - Mollusca: Gastropoda. Pages 277-307. In: Thorp, J. H. & A.P. Covich (eds.), Ecology and Classification of North American Freshwater Invertebrates, Third Edition, Academic Press, Boston, MA.

Burch, J. B. 1982. Freshwater snails (Mollusca: Gastropoda) of North America. Environmental Monitoring and Support Laboratory, Office of Research and Development, U. S. Environmental Protection Agency, Cincinnati, Ohio, pp. i-vi, 1-194.

Carlton, J. T. (ed.). 2007. The Light and Smith Manual: Intertidal Invertebrates from Central California to Oregon, Fourth Edition, Completely Revised and Expanded. University of California Press, Berkeley. xvii + 1002pp.

Dillon, R. T. 2006. The Xerces Society Pacific Northwest Taxonomic Workshop. Missoula, Montana May 11-12, 2006 - Gastropoda.

Hershler, R. and H.P. Liu, 2017. Annotated Checklist of Freshwater Truncatelloidean Gastropods of the Western United States, with an Illustrated Key to the Genera. U.S. Department of the Interior Bureau of Land Management Technical Note 449.

Perez, K. E., S. A. Clark, and C. Lydeard. 2004. Showing your shells; a primer to freshwater gastropod identification. Freshwater gastropod identification workshop manual: 60 pp.

Thorp, J. H. and D. C. Rogers. 2016. Chapter 11 - Phylum Mollusca. pp. 189-209. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Useful Websites:

NAS - Nonindigenous Aquatic Species. USGS website:
https://nas.er.usgs.gov/default.aspx

New Zealand Mudsnails in the Western USA. Maintained by David Richards at Montana State University, updated 5 November 2007. Accessed 14 February 2011 at URL:
http://www.esg.montana.edu/aim/mollusca/nzms/

Phylum: **Nemata** (Nematoda)
Standard Effort Level I: Excluded from benthic datasets.
Standard Effort Level II: Excluded from benthic datasets.
Standard Taxonomic Reference(s): Poinar, 2016.

Nematoda is now considered to be a junior synonym of Nemata. Nematodes are typically left at phylum. The vast majority of freshwater nematodes are not large enough to be considered "macroinvertebrates". Typically, the only nematodes encountered in benthic samples are in the family Mermithidae, which are parasitic on aquatic insects. As they are parasites, they are of little ecological importance and typically excluded from bioassessment samples (See STE Rules section 3.4.3)

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Nemata**	x	x	x	x						Found in fresh and brackish water; excluded from benthic datasets.

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Literature

Poinar, G. O., Jr. 2016. Chapter 9 - Nemata. pp. 169-180. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Phylum: **Nematomorpha**
Standard Effort Level I: Excluded from benthic datasets.
Standard Effort Level II: Excluded from benthic datasets.
Standard Taxonomic Reference(s): Schmidt-Rhaesa et.al, 2016.

Nematomorphans are typically excluded from SWAMP bioassessment datasets. As they are parasites of terrestrial insects, and do not feed as free living adults, they are of little ecological importance importance and typically excluded from bioassessment samples (See STE Rules Section 3.4.3).

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Nematomorpha**	x	x	x							Excluded from benthic datasets.

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Literature

Schmidt-Rhaesa et.al, 2016. Chapter 10 - Nematomorpha. pp. 181-188. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Phylum: **Nemertea**
Standard Effort Level I: Genus.
Standard Effort Level II: Genus.
Standard Taxonomic Reference(s): Strand and Sundberg (2016).

Freshwater nemerteans are monogeneric, and are identified using Strand and Sundberg (2016).

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Nemertea**										
Class - **Hoplonemertea***										
Order - **Monostilifera***										
Family - **Prostomatidae***										
Genus - *Prostoma*	x	x	x		x					Peviously in the Family Tetrastemmatidae.

Footnotes
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Literature

Strand, M. and P. Sundberg, 2016. Chapter 6 - Nemertea. pp. 111-113. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Phylum: **Platyhelminthes**
Standard Effort Level I: Class.
Standard Effort Level II: Class.
Standard Taxonomic Reference(s): Noreña, Damborenea, and Brusa (2016).

Platyhelminthes are identified only to class level using Noreña, Damborenea, and Brusa (2016). Most characters for separating taxa are internal, and there is some confusion regarding the identity of many taxa. Many turbellarians cannot be accurately placed to order even by experts (Dr. John Holleman, personal communication).

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Platyhelminthes**										
Class - **Turbellaria**	x	x	x		x	x	x	x		

Footnotes
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** - Denotes a name change from previous STE.

Literature

Noreña, C., C. Damborenea, and F. Brusa. 2016. Chapter 5 - Platyhelminthes. pp. 91-109. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.

Phylum: **Porifera**
Standard Effort Level I: Family
Standard Effort Level II: Family
Standard Taxonomic Reference(s): Reiswig, Frost and Ricciardi (2016).

The freshwater sponges are generally identified using Reiswig, Frost and Ricciardi (2016). They are not typically enumerated as a quantitative part of benthic samples, as they are colonial and sessile. However, their presence in samples should be noted, as most species are indicators of clean, well oxygenated water.

	Benthic	Lotic	Lentic	Estuarine	CA	OR	NV	AZ	Baja	Comments
Phylum - **Porifera***										
Class - Demospongiae*										
Order - Spongillida*										
Family - Spongillidae*	x	x	x	x	x			x		Previously in the Phylum Silicea.

Footnotes
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Literature

Reiswig, H. M., T. M. Frost, and A. Ricciardi. 2016. Chapter 3 - Porifera. [pp. 39-83]. In: Thorp, J. H. and D. C. Rogers (editors). Keys to Nearctic Fauna Thorp and Covich's Freshwater Invertebrates - Volume II, fourth edition, xxii + 740 pp. Academic Press, San Diego, CA.