Compendium of Recommended Keys for British Columbia Freshwater Organisms: Part 3

Classification Scheme of Freshwater Aquatic Organisms

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Freshwater Keys: Classification

The Compendium of Recommended Keys for British Columbia Freshwater Organisms:

Part 1: Freshwater Keys.

Part 2: Taxonomic Bibliography of Literature pertaining to the Freshwater Organisms of British Columbia.

Part 3: Classification Scheme of Freshwater Organisms

Introduction

This document is the third part of the series, Compendium of Recommended Keys for British Columbia Freshwater Organisms, and presents the working taxonomic classification scheme for aquatic organisms used to compile the Compendium. It should be noted that this scheme is unverifed and is intended to only serve as a guide for the Compendium. The following documents served as a guide for this scheme:

- Algae: Bold, H. and M.C. Wynne. 1991. An introduction to the Algae. 2nd ed. Prentice-Hall, Englewood Cliffs New Jersey. 720 pp.
- Plants: The aquatic plants other than the algae are not subdivided here. See Warrington, 1995.
- Invertebrates including the insects: Thorp, J.H. and A.P. Covich. 1991. Ecology and Classification of North American Freshwater Invertebrates. Academic press, Inc. Toronto. 911 pp.
- Vertebrates: Cannings, R.A. and A.P. Harcombe (eds). The Vertebrates of British Columbia: Scientific and English Names. Royal British Columbia Museum Heritage Record No. 20; Wildlife Report No. R24. Ministry of Municipal Affairs, Recreation and Culture and Ministry of Environment. Victoria, B.C., 116 pp.

This document is subject to updates as amendments to the classification schemes are made.

Kingdom MONERA

Phylum METHANOCREATRICES

Phylum OMNIBACTERIA

Phylum CHLOROXYBACTERIA

Phylum APHRAGMABACTERIA

Phylum SPIROCHAETAE

Phylum ACTINOBACTERIA

Phylum MYXOBACTERIA

Phylum CYANOBACTERIA

Kingdom PROTISTA

Protozoa Unicellular or colonial eukaryotes that are heterotrophic (Thorp and Covich, 1991).

Kingdom FUNGI

Division ZYGOMYCOTA

Division ASCOMYCOTA

Division BASIDIOMYCOTA

Fungi Imperfecti

This artificial groups consists of approximately 25,000 named species. most are ascomycetes for which the reproductive structures are not known.

Kingdom PLANTAE

"Algae"

Division CHLOROPHYTA Class CHLOROPHYCEAE

Order VOLVOCALES Order TETRASPORALES Order CHLOROCOCCALES Order CHLOROSARCINALES Order ULOTRICHALES Order SPHAEROPLEALES Order CHAETOPHORALES Order TRENTEPOHLIALES Order OEDOGONIALES Order ULVALES Order CLADOPHORALES Order ACROSIPHONALES Order CAULERPALES Order SIPHONOCLADALES Order DASYCLADALES Order CONJUGALES

Division CHAROPHYTA (stoneworts)

Class CHAROPHYCEAE

Order CHARALES Family CHARACEAE

Division EUGLENOPHYTA

Class EUGLENOPHYCEAE

Order EUTREPTIALES Order EUGLENALES Order HETERONEMATALES

Division PHAEOPHYTA (Brown algae)

Brown algae are very rare in freshwater. Only six genera have been recorded:

Heribaudiella Sphacelaria Pseudobodanella Lithoderma Pleurocladia lacustris. Porterinema fluviatile

Division CHRYSOPHYTA

Class CHRYSOPHYCEAE Subclass CHYSOPHYCIDAE Order OCHROMONADALES Family OCHROMOADACEAE Family MALLOMONADACEAE Family DINOBRYACEAE

Order CHRYSAMOEBIDALES

Order CHRYSOSPHAERALES

Order PHAEOTHAMNIALES

Order PEDINELLALES

Class PRYMNESIOPHYCEAE

Order ISOCHRYSIDALES Order COCCOSPHAERALES (Coccolithophores) most coccolithophores are marine. Order PRYMNESIALES

Order PAVLOVALES

Class XANTHOPHYCEAE

Order HETEROCHLORIDALES Order RHIZOCHLORIDALES Order HETEROGLOEALES Order TRIBONEMATALES Order VAUCHERIALES

Class EUSTIGMATOPHYCEAE

Class RAPHIDOPHYCEAE

Order RAPHIDOMONADALES

Class BACILLARIOPHYCEAE (diatoms)

Division PYRRHOPHYTA

Order DINOPHYSIALES Order GYMNDINIALES Order NOCTILUCALES Order PERIDINALES Order GONYAULACALES Order PYROCYSTALES Order PROROCENTRALES

Division RHODOPHYTA

Subclass BANGIPHYCIDAE Order PORPHYRIDIALES Order COMPSOPOGONALES Order BANGIALES Subclass FLORIDIOPHYCIDAE Order BATRACHOSPERMALES Order PALMARIALES Order NEMALIALES

Division CRYPTOPHYTA

Kingdom ANIMALIA

Subkingdom PARAZOA

Phylum PORIFERA (Sponges) Class DEMOSPONGIAE Family SPONGILLIDAE

Subkingdom EUMETAZOA

Phylum CNIDARIA (also called Coelenterata) Class HYDROZOA (hydras) Order HYDROIDA Family HYDRIDAE Hydra Chlorohydra Protohydra Family CLAVIDAE Cordylophora Order TRACHYLINA Family PETASIDAE Polypodium Order LIMNOMEDUSAE Craspedacusta (freshwater jellyfish) Limnocnida Calposoma

Phylum PLATYHELMINTHES (Flatworms)

Class TURBELLARIA (free-living) macroturbellarians Order TRICLADIDA (planarians) microturbellarians (microflatworms) includes Turbellarian orders other than Tricladida Order CATENULIDA Family CATENULIDAE Family CHORDARIIDAE Family STENOSTOMIDAE Order MACROSTOMIDA Family MACROSTOMIDAE Order LECITHOEPITHELIATA Family PRORHYNCIDAE Order PROSERIATA Family PLAGIOSTOMIDAE Order PROLECITHOPHORA Family BOTHRIOPLANIDAE Family OTOMESOSTOMIDAE

Order DALYELLIOIDA Family PROVORTICIDAE Family DALYELLIIDAE Order TYPHLOPLANIDA Family TYPHLOPLANIDAE Order KALYPTORHYNCHIA Family POLYCYSTIDAE Family undertermined Microrhynchus virginianus Class MONOGENEA (parasitic flukes) Class TREMATODA (internal flukes) Class CESTODA (tapeworms) Class CESTODARIA (tapeworm-like parasites)

Phylum NEMERTEA (proboscis worms)

Family HETERONEMERTEA Family HOPLONEMERTEA

Phylum GASTROTRICHA

Order MACRODASYIDA mostly marine Order CHAETONOTIDA

Phylum ROTIFERA (wheel animals)

Order BDELLOIDEA Family ADINETIDAE Family HABROTROCHIDAE Family PHILODINAAVIDAE Family PHILODINIDAE Order COLLOTHECACEA Family COLLOTHECIDAE Order FLOSCULARIACEA Family CONOCHILIDAE Family FILINIIDAE Family FLOSCULARIACEA Family HEXARTHRIDAE Family TESTUDINELLIDAE Family TROCHOSPHAERIDAE Order PLOIMIDA (mostly planktonic) Family ASPLANCHNIDAE Family BIRGEIDAE Family BRACHIONIDAE Family BRACHIONINAE Family COLURELLIDAE Family DICRANOPHORIDAE

Family EPIPHANIDAE Family EUCHLANIDAE Family GASTROPODIDAE Family LECANINIDAE Family LINDIIDAE Family MICROCODONIDAE Family MYTILINIDAE Family NOTOMMATIDAE Family PLOESOMATIDAE Family PROALIDAE Family SYNCHAETIDAE Family TRICHOCERCIDAE Family TRICHOTRIIDAE

Phylum NEMATODA (unsegmented worms)

Class ADENOPHOREA Subclass CHROMADORIDA Order ARAEOLAIMIDA Suborder ARAEOLAIMINA Superfamily AXONOLAIMOIDEA Family AXONOLAIMIDAE Superfamily LEPTOLAIMOIDEA Family BASTIANIIDAE Family LEPTOLAIMIDAE Superfamily CAMACOLAIMIDAE Family CAMACOLAIMIDAE Superfamily PLECTOIDEA Family PLECTIDAE Family TERATOCEPHALIDAE Order MONHYSTERIDA Superfamily MONHYSTEROIDEA Family MONHYSTERIDAE Order CHROMADORIDA Suborder CHROMADORINA Superfamily CHROMADORADEA Family CHROMADORADAE Suborder CYATOLAIMINA Superfamily CYATOLAIMOIDEA Family CYATOLAIMIDAE Family MICROLAIMIDAE Order ENOPLIDA Suborder ENOPLINA Superfamily TRIPYLOIDEA Family TRIPLIDAE Family ALAMIDAE Family IRONIDAE

Suborder ONCHOLAIMINA Superfamily ONCHOLAIMOIDEA Family ONCHOLAIMIDAE Order DORYLAIMIDA Suborder DORYLAIMINA Superfamily DORYLAIMOIDEA Family DORYLAIMIDAE Family NYGOLAIMIDAE Superfamily LEPTONCHOIDEA Family CAMPYDORIDAE Order MONONCHIDA Suborder MONONCHINA Superfamily MONONCHOIDEA Family MONONCHIDAE Order MERMITHIDA Suborder MERMITHINA Superfamily MERMITHOIDEA Family MERMITHIDAE **Class SECERNENTEA** Order TYLENCHIDA Suborder TYLENCHINA Superfamily HOPLOLAIMOIDEA Family HOPLOLAIMIDAE Superfamily THYLENCHOIDEA Family TYLENCHIDAE Superfamily ATYLENCHOIDEA Family ATYLENCHIDAE Suborder CRICONEMATINA Superfamily HEMICYCLIOPHOROIDEA Family HEMICYCLIOPHORIDAE Order APHELENCHIDA Suborder APHELENCHINA Superfamily APHELENCHOIDOIDEA Family APHELENCHOIDIDAE Order RHABDITIDA Suborder DIPLOGASTEROIDEA Superfamily DIPLOGASTEROIDEA Family DIPLOGASTERIDAE

Superfamily DH ECCARTERIES Superfamily RHABDITOIDEA Family CEPHALOBIDAE Family RHABDITIDAE Family DAUBAYLIIDAE

Phylum NEMATOMORPHA (horsehair worms)

Order NECTONEMATOIDEA Nectonema Order GORDIOIDEA Family GORDIIDAE Goridus Gcutogrodius Family CHORDODIDAE Chordodiolus Neochordodes Chordodes Euchordodes Pseudochordodes Paragordius Progodius Digordius Beatogordium Semigordium Gordionus Parachordodes Paragordonius

Phylum MOLLUSCA

Subclass PROSOBRANCHIA Family AMPULLARIDAE Family BITHYNIIDAE Family HYDROBIIDAE Family MICROMELANIIDAE Family NERITINIDAE Family PLEUROCERIDAE Family POMATIOPSIDAE Family THIARIDAE Family VAVLVATIDAE Family VIVIPARIDAE Subclass PULMONATA Family ACROLOXIDAE Family ANCYLIDAE Family LYMNAEIDAE Family PHYSIDAE Family PLANORBIDAE **Class BIVALVIA (mussels and clams)** Superfamily CORBICULACEA Family Corbiculidae Family Sphaeriidae Superfamily CYRENOIDACEA Superfamily UNIONACEA Family Margaritiferidae Family Unionidae Superfamily MACTRACEA Superfamily DREISSENACEA

Class GASTROPODA (freshwater snails)

Phylum ANNELIDA

Superclass ACLITELLATA Class POLYCHAETA

Family Nereididae Family Ampharetidae Family Sabellidae Family Serpulidae

Superclass CLITELLATA

Class OLIGOCHAETA (aquatic earthworms)

Family AEOLOSOMATIDAE Family OPISTOCYSTIDAE Family NAIDIDAE Family HAPLOTAXIDAE Family ENCHYTRAEIDAE Family LUMBRICULIDAE Family TUBIFICIDAE Family MEGASCOLECIDAE Family GLOSSOSCOLECIDAE

Class BRANCHIOBDELLIDA (crayfish parasites)

Class HIRUNDINEA (leeches)

Order RHYCHOBDELLIDA Family GLOSSIPHONIIDAE Family PISCICOLIDAE Order GNATHOBDELLIDA Family HIRUNDINIDAE Order PHARYNGOBDELLIDA Family ERPOBDELLIDAE

Phylum BRYOZOA (Ectoprocta)

Class GYMNOLAEMATA

Subclass CTENOSTOMATA Family PLUMATELLIDAE Family PALUDICELLIDAE Family CRISTATELLIDAE Family PECTINATELLIDAE Family FREDERICELLIDAE

Class PHYLACTOLAEMATA

Phylum ENTOPROCTA

Family URNATELLIDAE Urnatella (only freshwater genus) gracilis (most common species)

Phylum TARDIGRADA (water bears) Class HETEROTARDIGRADA

Order ARTHROTARDIGRADA Family ECHINISCOIDIDAE (marine) Family OREELLIDAE (terrestrial) Family CARPHANIDAE Family ECHINISCIDAE

Class MESOTARDIGRADA

Order THERMOZODIA

Family THERMOZODIIDAE (hot springs)

Class EUTARDIGRADA

Order PARACHELA

Family MACROBIOTIDAE

Family CALOHYPSIBIIDAE (terrestrial)

Family EOHYPSIBIIDAE

Family HYPSIBIIDAE (marine)

Family NECOPINATIDAE (terrestrial)

Order APOCHELA

Family MILNESIIDAE (terrestrial)

Phylum ARTHROPODA Subphylum CHELICERATA

Class ARACHNIDA

Order ARANEAE (spiders)

Family PISAURIDAE (fishing and nursery-web spiders) Family ERIGONIDAE

Subclass ACARI (mites and ticks)

Order ACARIFORMES

Family HYDRACHNIDIA Family ACALYPTONOTIDAE Family ANISITSIELLIDAE Family ARRENURIDAE Family ATHIENEMANNIIDAE Family ATURIDAE Family EYLAIDAE Family FELTRIIDAE Family HYDRACHNIDAE Family HYDRODROMIDAE Family HYROVOLZIIDAE Family HYDRYPHANTIDAE Family HYGROBATIDAE Family LAVERSIIDAE Family LEBERTIIDAE Family LIMNESIIDAE Family LIMNOCHARIDAE Family MIDEIDAE Family MIDEOPSIDAE

Family MOMONIIDAE Family NEOACARIDAE Family OXIDAE Family PIONIDAE Family SPERCHONIDAE Family TEUTONIIDAE Family TORRENTICOLIDAE Family UCHIDASTYGACARIDAE Family UNIONICOLIDAE Suborder ORIBATIDA **Class INSECTA*** *Note: The classification of many aquatic insects has recently been updated in Merritt and Cummins (1995). The following scheme DOES NOT reflect this update. Order COLLEMBOLA (springtails) Family PODURIDAE Family SMINTHURIDAE Order EPHEMEROPTERA (mayflies) Suborder PANNOTA Family BAETISCIDAE Family CAENIDAE Family EPHEMERELLIDAE Family NEOEPHEMERIDAE Family TRICORYTHIDAE Suborder SCHISTONOTA Family AMETROPODIDAE Family BAETIDAE Family BEHNINGIIDAE Family EPHEMERIDAE Family HEPTAGENIIDAE Family LEPTOPHLEBIIDAE Family METRETOPODIDAE Family OLIGONEURIIDAE Family PALINGENIIDAE Family POLYMITARCYIDAE Family POTAMONTHIDAE Family SIPHLONURIDAE Order ODONATA (dragonflies and damselflies) Suborder ANISOPTERA (dragonflies) Family AESHNIDAE Family CORDULEGASTRIDAE Family CORDULIIDAE Family GOMPHIDAE Family LIBELLULIDAE Family MACROMIIDAE

Family PETALURIDAE Suborder ZYGOPTERA (damselflies) Family CALOPTERYGIDAE Family COENAGRIONIDAE Family LESTIDAE Family PROTONEURIDAE Order PLECOPTERA (stoneflies) Suborder EUHOLOGNATHA Family CAPNIIDAE Family LEUCTRIDAE Family NEMOURIDAE Family TAENIOPTERYGIDAE Suborder SYSTELLOGNATHA Family CHLOROPERLIDAE Family PELTOPERLIDAE Family PERLIDAE Family PERLODIDAE Family PTERONARCYIDAE Order HEMIPTERA (true bugs) Family BELOSTOMATIDAE (giant water bugs) Family CORIXIDAE (water boatmen) Family GERRIDAE (water striders) Family HEBRIDAE (velvet water bugs) Family MESOVELIIDAE (water treaders) Family NOTONECTIDAE (back swimmers) Family SALDIDAE (shore bugs) Family VELIIDAE (broad-shouldered water striders) Order MEGALOPTERA Family SIALIDAE (fishflies) Order NEUROPTERA Family SISYRIDAE (spongilla-flies) Order LEPIDOPTERA (aquatic moths) Family PYRALIDAE Subfamily NYMPHULINAE Subfamily SCHOENOBIINAE Subfamily CRAMBINAE Subfamily PYRAUSTINAE Family COSMOPTERYGIDAE Family NEPTICULIDAE Family NOCTUIDAE Order TRICHOPTERA (caddisflies) Suborder ANNULIPALPIA Family DIPSEUDOPSIDAE Family ECNOMIDAE Family HYDROPSYCHIDAE

Family PHILOPOTAMIDAE Family POLYCENTROPODIDAE Family PSYCHOMYIIDAE Family XIPHOCENTRONIDAE Suborder SPICIPALPIA Family GLOSSOSOMATIDAE Family HYDROBIOSIDAE Family HYDROPTILLIDAE Family RHYACOPHILIDAE Suborder INTEGRIPALPIA Family BERAEIDAE Family BRACHYCENTRIDAE Family CALAMOCERATIDAE Family GOERIDAE Family HELICOPSYCHIDAE Family LEPIDOSTOMATIDAE Family LEPTOCERIDAE Family LIMNEPHILIDAE Family MOLANNIDAE Family ODONTOCERIDAE Family PHRYGANEIDAE Family SERICOSTOMATIDAE Family UENOIDAE Order COLEOPTERA (beetles) Family AMPHIZOIDAE (trout stream beetles) Family CHRYSOMELIDAE (leaf beetles) Family CURCULIONIDAE (weevils) Family DRYOPIDAE (long-toed waterbeetles) Family DYTISCIDAE (predacious water beetles) Family ELMIDAE (riffle beetles) Family GYRINIDAE (whirliging beetles) Family HYDROPHILIDAE (water scavenger beetles) Family LAMPYRIDAE (fireflies and relatives) Family LIMNICHIDAE (marsh-loving beetles) Family SCIRTIDAE (marsh beetles) Order DIPTERA (true flies) Suborder NEMATOCERA Family BLEPHARICERIDAE (net-winged midges) Family CERATOPOGONIDAE (= Heleidae, biting midges) Family CHAOBORIDAE (phantom midges) Family CHIRONOMIDAE (= Tendipedidae, midges) Family CULICIDAE (mosquitoes) Family DEUTEROPHLEBIIDAE (mountain midges) Family DIXIDAE (dixid midges)

Family NYMPHOMYIIDAE Family PSYCHODIDAE (moth flies)

Family PTYCHOPTERA

(= Liriopeidae, phantom crane flies)

Family SIMULIIDAE (black flies)

Family TANYDERIDAE (primitive crane flies)

Family THAUMALEIDAE (solitary midges)

Family TIPULIDAE (crane flies)

Suborder BRACHYCERA

Family ATHERICIDAE (= RHAGIONIDAE, snipe flies)

Family DOLICHOPODIDAE (long-legged flies)

Family EMPIDIDAE (dance flies)

Family EPHYDRIDAE (shore flies or brine flies)

Family MUSCIDAE

Family SCIOMYZIDAE (marsh flies)

Family STRATOMYIDAE

Family SYRPHIDAE (flower flies)

Family TABANIDAE (deer flies and horse flies)

SubPhylum CRUSTACEA

Class BRANCHIOPODA

Order ANOMOPODA

Family DAPHNIIDAE Family MOINIDAE Family BOSMINIDAE Family MACROTHRICIDAE Family CHYDORIDAE Order CTENOPODA Family SIDIDAE Family HOLOPEDIIDAE

Order ONYCHOPODA

Family POLYPHEMIDAE

Family CERCOPAGIDAE

Family PODONIDAE

Order HAPLOPODA

Family LEPTODORIDAE

Order ANOSTRACA (fairy shrimp)

Family ARTEMIIDAE

Family BRANCHINECTIDAE

Family BRANCHIPODIDAE

Family CHIROCEPHALIDAE Family LINDERIELLIDAE

Family POLYARTEMIIDAE

Family STREPTOCEPHALIDAE

Family THAMNOCEPHALIDAE

Order SPINICAUDATA Family CYCLESTHERIIDAE Family CYZCIDAE Family LEPTESTHERIIDAE Family LIMNADIIDAE Order LAEVICAUDATA Family LYNCEIDAE Order NOTOSTRACA (tadpole shrimp) Family TRIOPSIDAE Order CONCHOSTRACA (clam shrimp) **Class MAXILLOPODA** Subclass BRANCHIURA (fish lice) Argulus (only genus) Subclass COPEPODA (copepods) Order CALIGOIDA (fish parasites) Order LERNAEOPODIDA (fish parasites) Order NOTODELPHYOIDA (commensal in tunicates) Order CALANOIDA Family CENTROPAGIDAE Family DIAPTOMIDAE Family PSEUDOCALANIDAE Family TEMORIDAE Order CYCLOPOIDA Order HARPACTICOIDA Family AMEIRIDAE Family CANTHOCAMPTIDAE Family CLETODIDAE Family CYLINDROPSYLLIDAE Family DIOSACCIDAE Family HARPACTICIDAE Family LAOPHONTIDAE Family METIDAE Family PARASTENOCARIDAE Family PHYLLOGNATHOPODIDAE Family TACHIDIIDAE Family THALESTRIDAE Class OSTRACODA (seed shrimp) Subclass PODOCOPA Order PODOCOPIDA Suborder METACOPINA Superfamily DARWINULOIDEA Family DARWINULIDAE Suborder PODOCOPINA Superfamily CYPRIDOIDEA Family CANDONIIDAE Subfamily CANDONINAE

Family CYPRIDAE Subfamily CYPRIDINAE Subfamily CYCLOCYPRINAE

Family CYPRIDOPSIDAE Subfamily CYPRIDOPSINAE Family ILYOCYPRIDIDAE

Subfamily ILYOCYPRINAE Family NOTODROMADIDAE Subfamily NOTODROMADINAE

Superfamily CYTHEROIDEA Family CYTHERIDAE Subfamily CYTHERIDEINAE

Family ENTOCYTHERIDAE Subfamily ENTOCYTHERINAE

Family LIMNOCYTHERIDAE Subfamily LIMNOCYTHERINAE

Family LOXOCONCHIDAE Subfamily LOXOCONCHINAE Family NEOCYTHERIDEIDAE

Subfamily NEOCYTHERIDEIDINAE

Class MALACOSTRACA

Superorder PERACARIDA

Order MYSIDACEA (opossum shrimp)

Family MYSIDAE

Family PONTOPOREIIDAE

Family HYALELLIIDAE

Family GAMMARIDAE

Family CRANGONYCTIDAE

Family ASELLIDAE

Order AMPHIPODA (scuds)

Order ISOPODA (aquatic sow bugs)

Superorder EUCARIIDA

Order DECAPODA

Phylum CHORDATA

Subphylum VERTEBRATA

Class MAMMALIA (Mammals)

Class REPTILIA (Reptiles)

Class AVES (Birds)

Class AMPHIBIA (Amphibians)

Class CYCLOSTOMATA (Hagfishes and Lampreys)

Class OSTEICHTHYS (Bony fishes)