

**Compendium of Recommended Keys  
for British Columbia Freshwater  
Organisms: Part 1  
Freshwater Keys**

## Executive Summary

This document identifies taxonomic keys which are useful for the identification of British Columbian freshwater organisms. This information was gathered from existing publications and from contacting experts on individual groups. All the keys should be readily available from scientific publishing houses and major university or research libraries. There are a few keys listed which are less readily available, but which are very useful if copies can be obtained.

Due to the time constraints on this project, experts were not contacted for every group. This document should be reviewed by experts on each of the major taxonomic groups and revised as necessary

### Findings:

The following table outlines the major works available for each group. North American keys which are suitable for Canada are listed only as keys for Canada:

<b>Taxonomic Group</b>	<b>Key for B.C.</b>	<b>Checklist for B.C. (P=partial)</b>	<b>Key for Canada (N.A.)= North American Key</b>	<b>Checklist for Canada (P=partial)</b>
<b>Kingdom Monera</b>				
Bacteria	<i>not applicable</i>	<i>not applicable</i>	<i>not applicable</i>	<i>not applicable</i>
Cyanobacteria ("Blue-green algae")				
<b>Kingdom Protista</b>				
Protozoa				
<b>Kingdom Fungi</b>				
Fungi				
<b>Kingdom Plantae</b>				
Algae		Stein & Borden 1979		
Aquatic Plants	Warrington 1995	Warrington 1995	<i>See Bibliography</i>	<i>See Bibliography</i>
<b>Kingdom Animalia</b>				
Sponges			Frost 1991	(P) Ricciardi & Reiswig 1993

*Freshwater Keys*

<b>Taxonomic Group</b>	<b>Key for B.C.</b>	<b>Checklist for B.C. (P=partial)</b>	<b>Key for Canada (N.A.)= North American Key</b>	<b>Checklist for Canada (P=partial)</b>
Hydrozoans				(P) Adshead, Mackie & Paetkau 1963
Flatworms			Kolasa 1991 Kenk 1976	
Gastrotrichs			Strayer & Hummon 1991 Brunson 1959	
Rotifers			Wallace & Snell 1991 Edmondson 1959	Chengalath 1984 ; Chengalath & Koste 1987
Nematodes			Poinar 1991	
Nematomorpha			Poinar 1991	
Snails			Burch 1982 Clarke 1981	LaRoque 1953
Mussels & Clams			Burch 1975 Clarke 1981	LaRoque 1953
Annelids (worms)			Davies 1991 Klemm 1985 Holmquist 1976 (Oligochaetes) Brinkhurst 1978 (Oligochaetes)	Brinkhurst 1978 (Oligochaetes)
Leeches			Klemm 1985	Davies (1991) Madill (1985) Oosthusien & Davies (1993)
Tardigrades (water bears)		Kathman 1990; Kathman & Cross 1991	Nelson & Higgins 1990 (N.A.)	Behan-Pelletier 1993
Bryozoans			Wood 1991 (N.A.)	
Ticks & mites			Smith & Cook 1991 (N.A.)	

Taxonomic Group	Key for B.C.	Checklist for B.C. (P=partial)	Key for Canada (N.A.)= North American Key	Checklist for Canada (P=partial)
Spiders		West , Dondale & Ring 1984 & 1988		(P) Dondale & Redner 1990
Springtails		(P) Spencer 1948	Merritt & Cummins 1996	
Mayflies	Needham 1996	Scudder 1976	Merritt & Cummins 1996	Edmunds & Allen 1957
Dragonflies & Damselflies	Cannings & Stuart 1977	Scudder, Cannings & Stuart 1977	Walker 1953; Walker 1958; Walker & Corbet 1975	
Stoneflies	Stewart & Oswood 1997	Ricker & Scudder 1976 Ricker 1943	Stewart & Stark 1988 ( <i>nymphs</i> ) Harper & Stewart 1996	Stark Szczytko & Baumann
True bugs (Hemiptera)		(P) Lansbury 1960 ( <i>Corixidae</i> ) Scudder 1971 a & b ( <i>Gerridae</i> )	Merritt & Cummins. 1996	Hungerford 1948 ( <i>Corixidae</i> )
Fishflies (Megaloptera)			Merritt & Cummins 1996; Ross 1937 (N.A.)	
Neuroptera (spongilla-flies)		(P) Spencer 1942	Merritt & Cummins 1996	
Butterflies & Moths	Shepard <i>in preparation</i>	Guppy & Shepard <i>unpublished</i>	Merritt & Cummins 1996	Hodges et al 1983
Caddisflies		Nimmo & Scudder 1979 Nimmo & Scudder 1984	Wiggins 1977 <i>to be updated 1996</i>	
Beetles		(P) Hatch 1953-1971	Merritt & Cummins 1996	Bousquet 1991
True Flies			McAlpine et al 1981 Saether 1972 ( <i>Chaoboridae</i> )	Saether 1975 ( <i>Chironomidae</i> )

Freshwater Keys

<b>Taxonomic Group</b>	<b>Key for B.C.</b>	<b>Checklist for B.C. (P=partial)</b>	<b>Key for Canada (N.A.)= North American Key</b>	<b>Checklist for Canada (P=partial)</b>
Mosquitoes		Belton & Belton 1981	Wood et al 1979	Wood et al 1979
Blackflies	Currie et al 1998? ( <i>Canada</i> )	(P) Currie & Adler 1986	Peterson 1970	
Craneflies		(P) Spencer 1948		
Branchipods (incl. Cladocerans)	Green 1996		Dodson & Frey 1991 (N.A.) Brooks JL 1959	Chengalath 1982; Chengalath 1987
Fairy shrimp; tadpole shrimp & clam shrimp			Belk 1975 Edmondson 1959	Hartland-Rowe 1965
Copepods	Sandercock & Scudder 1996 ( <i>Calanoid</i> )	Carl 1940	Williamson 1991 (N.A.)	
Ostracods	Green <i>in preparation</i>	(P) Green 1994.	Delorme 1970 1971 Delorme 1991 (N.A.)	Delorme 1970 1971
Brine Shrimp (Mysids)			Covich & Thorp 1991 (N.A.)	
Amphipods		(P) Saunders 1933	Covich & Thorp 1991 Holsinger 1972 Bousfield 1958	Bousfield 1958
Isopods			Covich & Thorp 1991 (N.A.)	
Shrimps & Crayfishes			Hobbs III 1991	
Vertebrates		Cannings & Harcombe (eds) 1990		
Reptiles		Orchard, S. <i>in Cannings &amp; Harcombe (eds) 1990</i>		

Taxonomic Group	Key for B.C.	Checklist for B.C. (P=partial)	Key for Canada (N.A.)= North American Key	Checklist for Canada (P=partial)
Amphibians	Corkran, C & Thoms, C, 1996	Orchard, S. <i>in Cannings &amp; Harcombe (eds) 1990</i>		
Birds		Campbell, R.W. <i>in Cannings &amp; Harcombe (eds) 1990</i>		
Mammals		Nagorsen, D, <i>in Cannings &amp; Harcombe (eds) 1990</i>		
Fish		McPhail & Carveth, 1996; Peden, A.E. <i>in Cannings &amp; Harcombe (eds) 1990</i>		

The above summary table demonstrates that keys, and even species lists, are lacking for most freshwater organisms in B.C. In particular, there are no keys specific to Canadian Cyanobacteria, algae, hydrozoans or aquatic arachnids. Many keys presently in use for other groups are North American keys. Keys for British Columbia are lacking for all groups except the aquatic plants, mayflies, dragonflies, butterflies, blackflies, cladocerans, copepods, ostracods and fish. The fish key was completed only two years ago; the zooplankton and mayfly keys are being completed in the next few months and the black fly key is two years away. These gaps must be filled if aquatic inventory and biodiversity studies are to be successful in B.C.

The number of keys itemized in this document is indicative of the complexity of taxonomic study. Most taxonomists spend years, even decades, learning the organisms, the literature and the ecosystems in which the organisms are found. This is not a science that can be performed by amateurs. Incorrect identification of organisms will lead to confusion, poor interpretation of the inventory data and, ultimately, poor decisions regarding the protection and management of aquatic ecosystems. In a recent document entitled *Systematics: an Impending Crisis* (1995) Dr. Ian Efford states "Correct identification is vital to the protection of our natural resources, our health, and our environment. Furthermore, identification of pests and diseases must be accurate and timely if we are to sustain the mainstay of our economy—that is our forest, fisheries and agricultural resources." Taxonomic keys for all of B.C.'s aquatic organisms are therefore essential.

### Recommendations:

1. Resources should first be focused on groups for which Canadian keys do not exist.

## *Freshwater Keys*

2. New keys for B.C. organisms must be written by experienced taxonomists. These individuals have the background knowledge, literature collections and contacts with other taxonomists which are vital to producing good keys.
3. Experts throughout North America must be contacted before new works are commissioned to ensure that other similar keys are not in production or that a major taxonomic revision of the group is not forthcoming.
4. A central database should be created into which all taxonomic information can be entered and updated as systematics change.
5. Quality control for biological data is essential. A central repository for specimens is necessary so that identifications can be verified in the future. This could include digitized photographs with dimensions and descriptions of organisms and site information. Funds should be provided for care of the specimens by the individual submitting them when they are submitted to the repository. This repository must provide for the long term storage (many decades) of these specimens.
6. Consideration should be given to producing interactive computerized "expert" systems, simultaneously with keys for B.C. organisms, so that the accuracy of identifications by non-specialists can be improved.

## Table of Contents

<b>EXECUTIVE SUMMARY</b> .....	<b>2</b>
FINDINGS: .....	2
RECOMMENDATIONS:.....	6
<b>TABLE OF CONTENTS</b> .....	<b>8</b>
<b>HOW TO USE THIS COMPENDIUM AND GUIDE:</b> .....	<b>12</b>
<b>INTRODUCTION</b> .....	<b>13</b>
<b>RECOMMENDED KEYS AND CHECKLISTS FOR B.C FRESHWATER ORGANISMS:</b> .....	<b>15</b>
<b>KINGDOM MONERA</b> .....	<b>15</b>
PHYLUM CYANOBACTERIA .....	15
<b>KINGDOM PROTISTA</b> .....	<b>16</b>
PROTOZOA .....	16
<b>KINGDOM FUNGI</b> .....	<b>17</b>
<b>KINGDOM PLANTAE</b> .....	<b>18</b>
<b>ALGAE</b> .....	<b>18</b>
DIVISION CHLOROPHYTA.....	20
Order CHLOROCOCCALES .....	20
Order ULOTRICHALES .....	21
Order SPHAEROPLEALES.....	21
Order CHAETOPHORALES .....	21
Order TRENTEPOHLIALES .....	21
Order OEDOGONIALES.....	21
Order ULVALES .....	21
Order CLADOPHORALES.....	21
Order SIPHONOCLADALES.....	21
Order ZYNEMATALES (Conjugales).....	22
Family DESMIDACEAE (Desmids).....	22
Family ZYNEMATACEAE.....	23
DIVISION CHAROPHYTA (STONEWORTS) .....	23
DIVISION EUGLENOPHYTA .....	23
Class <i>EUGLENOPHYCEAE</i> .....	23
Order EUGLENALES .....	23
DIVISION PHAEOPHYTA (BROWN ALGAE) .....	23
Heribaudiella .....	23
Sphacelaria .....	23
Pseudobodanella.....	23
Lithoderma .....	23
Pleurocladia lacustris.....	23
Porterinema fluviatile .....	23
DIVISION CHRYSOPHYTA.....	23
Class <i>CHRYSOPHYCEAE</i> .....	23
Class <i>XANTHOPHYCEAE</i> .....	24
Class <i>BACILLARIOPHYCEAE</i> (diatoms).....	24



DIVISION PYRRHOPHYTA.....	26
DIVISION RHODOPHYTA.....	26
Subclass <i>FLORIDIOPHYCIDAE</i> .....	26
DIVISION CRYPTOPHYTA.....	27
<b>KINGDOM ANIMALIA: SUBKINGDOM PARAZOA.....</b>	<b>28</b>
PHYLUM PORIFERA (SPONGES).....	28
Class <i>DEMOSPONGIAE</i> .....	28
Family SPONGILLIDAE.....	28
<b>KINGDOM ANIMALIA: SUBKINGDOM EUMETAZOA.....</b>	<b>29</b>
PHYLUM CNIDARIA (ALSO CALLED COELENTERATA).....	29
Class <i>HYDROZOA</i> ( <i>hydras</i> ).....	29
PHYLUM PLATYHELMINTHES (FLATWORMS).....	29
Class <i>TURBELLARIA</i> ( <i>free-living</i> ).....	29
Order TRICLADIDA ( <i>planarians</i> ).....	29
PHYLUM NEMERTEA (PROBOSCIS WORMS).....	30
PHYLUM GASTROTRICHA.....	30
PHYLUM ROTIFERA (WHEEL ANIMALS).....	31
PHYLUM NEMATODA (UNSEGMENTED WORMS).....	32
PHYLUM NEMATOMORPHA (HORSEHAIR WORMS).....	32
PHYLUM MOLLUSCA.....	33
Class <i>GASTROPODA</i> ( <i>snails</i> ).....	34
Class <i>BIVALVIA</i> ( <i>mussels and clams</i> ).....	34
Superfamily UNIONACEA.....	34
Family UNIONIDAE.....	34
PHYLUM ANNELIDA.....	35
Class <i>POLYCHAETA</i> .....	35
Class <i>OLIGOCHAETA</i> ( <i>aquatic earthworms</i> ).....	35
Class <i>BRANCHIOBELLELLIDA</i> ( <i>crayfish parasites</i> ).....	36
Class <i>HIRUDINOIDEA</i> ( <i>leeches</i> ).....	36
PHYLUM TARDIGRADA (WATER BEARS).....	37
PHYLUM BRYOZOA.....	38
PHYLUM ARTHROPODA.....	39
SUBPHYLUM CHELICERATA.....	39
Class <i>ARACHNIDA</i> .....	39
Order ARANEAE ( <i>spiders</i> ).....	39
Family PISAURIDAE ( <i>fishing and nursery-web spiders</i> ).....	39
Subclass <i>ACARI</i> ( <i>mites and ticks</i> ).....	39
Order ACARIFORMES.....	39
Family TYDEIDAE.....	39
Family ACALYPTONOTIDAE.....	39
Family ANISITSIELLIDAE.....	39
Family NEOACARIDAE.....	39
Family ATHIENEMANNIIDAE.....	40
Family ATURIDAE.....	40
Family HYDRYPHANTIDAE.....	40
Family MOMONIIDAE.....	40
Family UNIONICOLIDAE.....	40
Suborder ORIBATIDA.....	40
Class <i>INSECTA</i> .....	41
Order COLLEMBOLA ( <i>springtails</i> ).....	41
Order EPHEMEROPTERA ( <i>mayflies</i> ).....	42
Order ODONATA ( <i>dragonflies and damselflies</i> ).....	43
Order PLECOPTERA ( <i>stoneflies</i> ).....	43

Order HEMIPTERA (true bugs).....	45
Family BELOSTOMATIDAE (giant water bugs).....	45
Family CORIXIDAE (water boatmen).....	45
Family GERRIDAE (water striders).....	45
Family HEBRIDAE (velvet water bugs).....	46
Family MESOVELIIDAE (water treaders).....	46
Family NOTONECTIDAE (back swimmers).....	46
Family SALSIDAE (shore bugs).....	46
Family VELIIDAE (broad-shouldered water striders).....	46
Order MEGALOPTERA.....	46
Family SIALIDAE (fishflies).....	46
Order NEUROPTERA.....	47
Family SISYRIDAE (spongilla-flies).....	47
Order LEPIDOPTERA (aquatic moths).....	47
Family NOCTUIDAE.....	48
Order TRICHOPTERA (caddisflies).....	48
Order COLEOPTERA (beetles).....	48
Order DIPTERA (true flies).....	49
Suborder NEMATOCERA.....	49
Family BLEPHARICERIDAE (net-winged midges).....	49
Family CERATOPOGONIDAE (= Heleidae, biting midges).....	50
Family CHAOBORIDAE (phantom midges).....	50
Family CHIRONOMIDAE (= Tendipedidae, midges).....	50
Family CULICIDAE (mosquitoes).....	50
Family DEUTEROPHLEBIIDAE (mountain midges).....	51
Family DIXIDAE (dixid midges).....	51
Family NYMPHOMYIIDAE.....	51
Family PSYCHODIDAE (moth flies).....	51
Family PTYCHOPTERA (= Liriopidae, phantom crane flies).....	51
Family SIMULIIDAE (black flies).....	51
Family TANYDERIDAE (primitive crane flies).....	52
Family THAUMALEIDAE (solitary midges).....	52
Family TIPULIDAE (crane flies).....	52
Suborder BRACHYCERA.....	53
Family TABANIDAE (deer flies and horse flies).....	53
SUBPHYLUM CRUSTACEA.....	53
Class BRANCHIOPODA.....	53
Order ANOSTRACA (fairy shrimp).....	55
Order NOTOSTRACA (tadpole shrimp).....	55
Order CONCHOSTRACA (clam shrimp).....	55
Class MAXILLOPODA.....	55
Subclass BRANCHIURA (fish lice).....	55
Subclass COPEPODA (copepods).....	55
Class OSTRACODA (seed shrimp).....	56
Class MALACOSTRACA.....	57
Superorder PERACARIDA.....	57
Order MYSIDACEA (opossum shrimp).....	57
Order AMPHIPODA (scuds).....	57
Order ISOPODA (aquatic sow bugs).....	58
Superorder EUCARIIDA.....	58
Order DECAPODA (freshwater shrimps and crayfishes).....	58
PHYLUM CHORDATA.....	60
SUBPHYLUM VERTEBRATA.....	60
Class MAMMALIA (Mammals).....	60
Class REPTILIA (Reptiles).....	60
Class AVES (Birds).....	60
Class AMPHIBIA (Amphibians).....	61

*Freshwater Keys*

*Class CYCLOSTOMATA (Hagfishes and Lampreys) ..... 61*  
*Class OSTEICHTHYS (Bony fishes)..... 61*

## 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*

## How to Use This Compendium and Guide:

These keys follow the taxonomic classification schemes generally accepted by the scientific community. (For classification of each phylum (to family) see Part 3: Classification Scheme). In some cases it is necessary to use a new key for each order. In other cases a key to the class is sufficient. Only groups for which literature has been located are listed. Each major group heading is followed by explanatory notes. If a key for B.C. exists, it is listed first, followed by:

2. checklist for B.C.
3. endangered status of the group in B.C.\*
4. key for Canada
5. checklist for Canada
6. key for North America
7. checklist for North America
8. key for the world
9. other relevant literature.

\*Note: Item 3, the endangered status of the group in B.C., refers to those organisms listed by Scudder (1994) as rare or endangered. Scudder notes that some organisms may be listed as rare simply because few collections have been made in B.C., not because there are few organisms in the province. These organisms are not listed as "rare or endangered" by either the Federal or Provincial government at this time. (\*\*=endemic to B.C, \*=B.C. only in Canada, but recorded elsewhere in North America)

Where possible the International Standard Book/Serial Number (ISBN/ISSN) or Library of Congress Card Catalogue number (LOCCC number) is provided to aid the reader in obtaining a copy of the document.

Please note that this is not a comprehensive list. Furthermore, this document is subject to updates as more literature becomes available and/or amendments to the classification schemes are made.

## Introduction

There is a vast number of freshwater organisms in North America. It is estimated that invertebrates alone number more than 10,000 species. In order to understand these organisms and their relationship to one another, it is necessary to classify and name them in a systematic manner. This is the role of the disciplines called taxonomy and systematics.

Taxonomic classification schemes are ever-changing. As new organisms are discovered and as we gain new insight into known species, we rename and regroup them to better reflect their similarities and differences. There are two very similar systems of arranging organisms into groups, or ranks; one for plants and one for animals. The system used to rank plants, and the rules for doing so, are outlined in the International Code of Botanical Nomenclature. Similarly, the International Code of Zoological Nomenclature sets out the rules for naming and classifying animals. The botanical and zoological ranks and their endings are outlined below (those most commonly used are indicated in **bold print**).

Botanical Ranks	Zoological Ranks
Kingdom	Kingdom
Division (-phyta)	Phylum
Class	Class
	Cohort
Order (-ales)	Order
	Superfamily (-oidea)
Family (-aceae)	Family (-idae)
Subfamily	Subfamily (-inae)
Tribe	Tribe (-ini)
Subtribe	Subtribe (-ina)
Genus	Genus
Species	Species
Variety	

Many ranks have unique endings which act as a code to indicate its level i.e. a rank which ends in “-idae” can immediately be recognized as a zoological family name. The two part, or binomial, Latin name which is assigned to an organism consists of the Genus name first, which is capitalized, followed by the species name, which is not capitalized e.g. *Daphnia pulex*. Both names are either italicized or underlined. If the organism can be identified to Genus, but not to species, this is indicated by writing the Genus name followed by “sp.” eg. *Daphnia* sp.

There is considerable debate among taxonomists regarding the number of kingdoms into which all organisms should be classified. The most widely accepted classification scheme uses five kingdoms. In increasing order of complexity, they are: **Monera** (the bacteria), **Protista**, **Fungi**, **Plantae** and **Animalia**. Certain groups of organisms, such as the algae, do not lend themselves to neat classification systems, but have characteristics of more than one kingdom. In other cases, organisms previously known as a single class or family are now split into many different classes or families, but are still widely referred to by a common "catch-all" term which bears no relationship to the present classification scheme. The terms "protozoa" and "cladocera" are two such terms. For the purposes of this document, organisms are grouped according to the classification schemes outlined in the following documents:

Algae: Bold, H. and M.C. Wynne. 1991. An introduction to the Algae. 2nd ed. Prentice-Hall, Englewood Cliffs New Jersey. pp.

Plants: 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.

The taxonomic keys which are recommended in this document are most often general keys, that is, they are intended for use by the non-specialist. This said, for many groups it is nearly impossible to identify an organism to species, or even to genus, without highly specialized expertise. The keys are therefore not always easy to use, not because they are poorly written, but because the group of organisms is so complex. When using a key, it is important not to "force an organism to fit" a given description. Where possible, use a different key that may use clearer terms. It is advisable to contact an expert in the field to confirm an identification.

## **Recommended Keys and Checklists for B.C Freshwater Organisms:**

---

### **Kingdom MONERA**

The distribution of bacteria is not treated in the same manner as other organisms. Keys for B.C. and Canada are not practical and therefore do not exist. The taxonomy of bacteria has been completely revised in recent decades and for this reason up-to-date taxonomic keys are essential.

Bacteria, unlike many other organisms, are not classified by morphological characteristics alone. Their physiology, biochemistry and fatty acid profiles are all essential to a correct identification. These techniques are certainly beyond the resources of all but a few specialized labs. One exception are the large cyanobacteria. This group is often treated as part of the algae, especially in older texts, but modern evidence suggests that they are in fact more bacterial than algal in nature.

#### **Recommended Key for Bacterial Identification:**

Staley, J.T., M.P. Bryant, M. Pfenning and J.G. Holt. (eds.). 1989. *Bergey's Manual of Systematic Bacteriology*. Volumes 1-4. Williams and Wilkins. ISBN 0-683-07908-5.

#### **Phylum CYANOBACTERIA**

Fogg, G.E., W.D. P. Stewart, P. Fay and A.E. Walsby. 1972. *The Blue-Green Algae*. Academic Press, London and New York. vii + 459 pp.

Staley, J.T., M.P. Bryant, M. Pfenning and J.G. Holt. (eds.). 1989. *Bergey's Manual of Systematic Bacteriology*. Volume 3. Sections 18 and 19. pp 1635-1806. Williams and Wilkins. ISBN 0-683-07908-5.

Drouet, F. 1968. *Revision of the classification of the Oscillatoriaceae*. Fulton Press, Inc., U.S.A. 370 pp. ISBN 0-910006-23-7.

Vanlandingham, S.L. 1982. *Guide to the identification, environmental requirements and pollution tolerance of fresh water blue-green algae (Cyanophyta)*. Environmental monitoring and support laboratory office of research and development U.S. E.P.A., Ohio. 342 pp.

## **Kingdom PROTISTA**

### **Protozoa**

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

Lee, J.J., S.H. Hutner and E.C. Bovee (eds.) 1985. An illustrated guide to the protozoa. Society of Protozoologists. Allen Press. Lawrence, Kansas. pp. ix + 629. ISBN 0-914023-25-X

Patterson, D.J. and S. Hedley. 1992. Free-living freshwater protozoa. Wolfe Publishing Ltd. London, U.K. 282 pp.

Margulis, L. J.O. Corliss, M. Melkonian and D.V. Chapman (eds.) 1989. Handbook of Protoctista. Jones and Bartlett, Boston. xli + 914 pp. ISBN 0-86720-052-9.



## **Kingdom FUNGI**

No checklists or keys are known to exist for B.C. or Canada.

**Status:** unknown

### **Keys to fungi of the world:**

Barnett, H.L. and B.B. Hunter. 1987. *Illustrated Genera of Imperfect Fungi*. 4th ed. MacMillan Publishers and Collier MacMillan. ISBN 0-02-306395-5.

*This illustrated key has numerous line drawings.*

Talbot, P.H.B. 1971. *Principles of Fungal Taxonomy*. MacMillan. ISBN 333115619/333115643

Hawksworth, B.L., B.C. Sutton and G.C. Ainsworth. 1996. *Ainsworth & Bisby's Dictionary of the Fungi*. 8th ed. Commonwealth Mycological Institute. Surrey. 554 pp.

Margulis, L. J.O. Corliss, M. Melkonian and D.V. Chapman (eds.) 1989. *Handbook of Protoctista*. Jones and Bartlett, Boston. xli + 914 pp. ISBN 0-86720-052-9.

Sparrow, F.K. 1960. *Aquatic Phycomycetes*. 2nd ed. University of Michigan Press. Ann Arbor, Michigan. vii + 1187 pp.

Dick, M.W. 1994. *Straminopilous Fungi: A new classification for the biflagellate fungi and their uniflagellate relatives with particular reference to Lagenidiaceous fungi*. CAB International (Mycological Papers Series). Wallingford, U.K.

## Kingdom PLANTAE

**The aquatic plants of British Columbia have been recently catalogued. A complete set of keys and checklists are contained in:**

Warrington, P.D. 1995. Identification Keys to the Aquatic Plants of B.C. Resources Inventory Committee. Ministry of Environment, Lands and Parks. Victoria.

Warrington, P. D. 1983. A Field Manual and Guide to the Collecting and Preserving of British Columbia Aquatic Plants. Resource Quality Section, Water Management Branch, Ministry of Environment, Government of British Columbia.

Warrington, P. D. 1988. Aquatic Plants of British Columbia: Common Names, Selected References, Synonymy and Classification by Life-forms and Habitat. Resource Quality Section, Water Management Branch, Ministry of Environment, Government of British Columbia.

*See bibliography for an extensive list of literature pertaining to aquatic plants in B.C.*

## Algae

The algae are a nebulous group of organisms, the members of which belong to many different phyla and in fact to different kingdoms. In the new book: *The Freshwater Algae, Their Microscopic World Explored* (1995), John Lund states "...at the algal level there is no distinction between the plant and animal kingdoms. Most algae are plants but some are animals and in between there is a considerable number of algae with both plant and animal characteristics. Some of these algae are more like plants than animals, other more like animals than plants and there is every gradation between the two." Therefore, with the exception of the blue-green algae (Cyanobacteria) which are treated under bacteria, all algal groups will be dealt with here, under the Kingdom Plantae.

The identification of algae often requires the use of literature from all over the globe. In addition to English, much of the literature is in German, some is in French and a few volumes are in Polish. Many of these keys have been reprinted, in spite of their age, because they are so useful. Higher taxonomic reclassification rarely affects the genus and species names of algae, so many old texts are still in use. The texts listed here are the major works in common use. There are many more books, particularly regional floras, not listed here. An excellent source of phycological literature is: Balogh Scientific Books, 1911 North Duncan Road, Champaign Illinois 61821 USA. Phone: 1 (217) 355 9331. FAX: 1(217) 355 9413 e-mail: balogh@balogh.com.

### **Keys to the Algae of B.C.:**

No keys exist which are specific to the algae of B.C. Some papers which illustrate species of B.C. are listed under their appropriate heading.

### **Checklist of the Algae of B.C.:**

Stein, J.R. 1975. Freshwater algae of British Columbia: the lower Fraser Valley. *Syesis*. 8:119-163.

Stein, J.R. 1969. Freshwater algae of British Columbia: the Queen Charlotte Islands. *Syesis*. 2: 213-226..

## *Freshwater Keys*

Stein, J.R. and J.F. Gerrath. 1968. Freshwater algae of British Columbia: desmids of bog lakes in the Coast Mountain area. *Syesis*. 1: 187-197.

Stein, J.R. and C.A. Borden. 1979. Checklist of the Freshwater Algae of British Columbia. *Syesis*. 12: 3-39.

*This checklist is a compilation of the previous three with additions.*

### **General keys to the algae of North America:**

Bold, H.C. and M.J. Wynne. 1985. Introduction to the algae. 2nd ed. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. xv + 920 pp.

*This text provides details of algal classification and contains many family and genus keys.*

Prescott, G.W. 1962. Algae of the Western Great Lakes Area. Wm. C. Brown Company Publishers, Dubuque, Iowa. 977 pp. LOCCC No. 61-18674.

Prescott, G.W. 1978. How to know the freshwater algae. 3rd ed. W.C. Brown, Dubuque Iowa. 348 pp.

Smith, G.M. 1950. The fresh-water algae of the United States. McGraw-Hill Book Company, Inc, U.S.A. 719 pgs. ( 3 copies)

### **General keys to the freshwater algae of the world:**

Belcher, H. and E. Swale. 1978. A Beginner's Guide to Freshwater Algae. H.M. Stationery Office, London, U.K. 47 pp.

Belcher, H. and Swale, E. 1979. An Illustrated Guide to river phytoplankton. Institute of Terrestrial Ecology, Natural Environment Research Council, London. 64 pp. ISBN 0-11-886602-8.

Bellinger, E.G. 1992. A Key to the Common Algae. 4th ed. Institution of Water and Environmental Management. London, U.K. v + 138 pp.

Fritsch, F.E. The structure and reproduction of the algae Vol. 1.

Fritsch, F.E. The structure and reproduction of the algae Vol. II.

Huber-Pestalozzi, G. 1938. Das Phytoplankton des Süsswassers, Band XVI Teil 1. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart. 342 pp.

Huber-Pestalozzi, G. 1950. Das Phytoplankton des Süsswassers. Band XVI Teil 3. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart. 310 pp.

Huber-Pestalozzi, G. 1955. Das Phytoplankton des Süsswassers Band XVI Teil 4. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart. 834 pp.

Huber-Pestalozzi, G. 1961. Das Phytoplankton des Süsswassers. Band XVI Teil 5. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart. 1060 pp.

Huber-Pestalozzi, G. 1972. Das Phytoplankton des Süsswassers. Band XVI Teil 6. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart. 210 pp.

Kützing, F.T. 1969. Species algarum. A. Asher and Co., Amsterdam. 922 pgs.

Pascher, F. 1932. Die süßwasser-flora mitteleuropas. Verlag von Gustav Fischer, Jena. 232 pgs.

Silva, P. 1980. Names of classes and families of living algae. Bohn, Scheltema and Holkema, The Netherlands. 156 pgs.

Skuja, H. 1956. Taxonomische und biologische studien uber das phytoplankton schwedischer binnengewasser. Almquist & Wilsells Boktryckeri, Uppsala. 467 pp.

Starmach K. 1966. Flora Slodkowodna Polski. Tom 2. Cyanophyta-Sinice, Glaucophyta-Glaukofity. Polska Akademia Nauk, Instytut Botaniki, Warszawa.

Starmach, K. 1968. Flora Slodkowodna Polski. Tom 5. Chrysophyceae. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 598 pp.

Starmach, K. 1968. Flora Slodkowodna Polski. Tom 7. Xanthophyceae. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 394 pp.

Starmach, K. 1969. Flora Slodkowodna Polski Tom 11. Chlorophyta IV. Oedogoniales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 659 pp.

Starmach, K. 1972. Flora Slodkowodna Polski Tom 12A. Chlorophyta V. Conjugales, Zygnemaceae. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 454 pp.

Starmach, K. 1972. Flora Slodkowodna Polski. Tom 10. Chlorophyta III: Ulothrichales, Ulvales, Prasiolales, Sphaeropleales, Cladophorales, Chaetophorales, Trentepohliales, Siphonales, Dichotomosiphonales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 750 pp.

Starmach, K. 1974. Flora Slodkowodna Polski. Tom 4. Cryptophyceae, Dinophyceae, Raphidophyceae. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 520 pp.

Starmach, K. 1977. Flora Slodkowodna Polski Tom 14: Phaeophyta, Rhodophyta. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 445 pp.

### **Division CHLOROPHYTA**

Bourelly, P. 1966. Les algues d'eau douce Tome I: Les Algues Vertes. Editions N. Boubee & Cie, Paris. 511 pp.

Collins, F.S. 1970. The green algae of North America. reprint. including two supplements (1908-1818) 450 pp. 5 pls. Bibliotheca Phycologica, Band 11.

### **Order CHLOROCOCCALES**

Philipose, M.T. 1967. Chlorococcales. Indian Council of Agricultural Research. New Delhi. 365 pp.

### **Order ULOTRICHALES**

Ramantgan, K.R. 1964. Ulotrichales. Indian Council of Agricultural Research, New Delhi. 188 pgs.

Starmach, K. 1972. Flora Slodkowodna Polski. Tom 10. Chlorophyta III: Ulothrichales, Ulvales, Prasiolales, Sphaeropleales, Cladophorales, Chaetophorales, Trentepohliales, Siphonales, Dichotomosiphonales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 750 pp.

### **Order SPHAEROPLEALES**

Starmach, K. 1972. Flora Slodkowodna Polski. Tom 10. Chlorophyta III: Ulothrichales, Ulvales, Prasiolales, Sphaeropleales, Cladophorales, Chaetophorales, Trentepohliales, Siphonales, Dichotomosiphonales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 750 pp.

### **Order CHAETOPHORALES**

Starmach, K. 1972. Flora Slodkowodna Polski. Tom 10. Chlorophyta III: Ulothrichales, Ulvales, Prasiolales, Sphaeropleales, Cladophorales, Chaetophorales, Trentepohliales, Siphonales, Dichotomosiphonales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 750 pp.

### **Order TRENTEPOHLIALES**

Starmach, K. 1972. Flora Slodkowodna Polski. Tom 10. Chlorophyta III: Ulothrichales, Ulvales, Prasiolales, Sphaeropleales, Cladophorales, Chaetophorales, Trentepohliales, Siphonales, Dichotomosiphonales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 750 pp.

### **Order OEDOGONIALES**

Starmach, K. 1969. Flora Slodkowodna Polski Tom 11. Chlorophyta IV. Oedogoniales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 659 pp.

### **Order ULVALES**

Starmach, K. 1972. Flora Slodkowodna Polski. Tom 10. Chlorophyta III: Ulothrichales, Ulvales, Prasiolales, Sphaeropleales, Cladophorales, Chaetophorales, Trentepohliales, Siphonales, Dichotomosiphonales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 750 pp.

### **Order CLADOPHORALES**

Starmach, K. 1972. Flora Slodkowodna Polski. Tom 10. Chlorophyta III: Ulothrichales, Ulvales, Prasiolales, Sphaeropleales, Cladophorales, Chaetophorales, Trentepohliales, Siphonales, Dichotomosiphonales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 750 pp.

### **Order SIPHONOCLADALES**

Starmach, K. 1972. Flora Slodkowodna Polski. Tom 10. Chlorophyta III: Ulothrichales, Ulvales, Prasiolales, Sphaeropleales, Cladophorales, Chaetophorales, Trentepohliales, Siphonales, Dichotomosiphonales. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 750 pp.

## Order ZYNEATALES (Conjugales)

Starmach, K. 1972. Flora Slodkowodna Polski Tom 12A. Chlorophyta V. Conjugales, Zygnemaceae. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 454 pp.

## Family DESMIDACEAE (Desmids)

### Key to Desmids of North America:

Croasdale, H.T., C.E. de M. Bicudo and G.W. Prescott. 1983. A Synopsis of North American Desmids Part II: Desmidiaceae: Placodermae, Section 5. University of Nebraska Press, Lincoln. 117 pp. ISBN 0-8032-3661-1.

Prescott, G.W., C.E. de M. Bicudo and W.C. Vinyard. 1982. A Synopsis of North American Desmids Part II: Desmidiaceae: Placodermae, Section 4. University of Nebraska Press, Lincoln. 700 pp. ISBN 0-8032-3650-6.

Prescott, G.W., H.T. Croasdale and W.C. Vinyard and C.E. de M. Bicudo. 1981. A Synopsis of North American Desmids. Part II: Desmidiaceae: Placodermae, Section 3. University of Nebraska Press, Lincoln. 720 pp. ISBN 0-8032-3660-3.

Prescott, G.W., H.T. Croasdale and W.C. Vinyard. 1975. A Synopsis of North American Desmids. Part II: Desmidiaceae: Placodermae, Section 1. University of Nebraska Press, Lincoln. 275 pp. ISBN 0-8032-0854-5.

Prescott, G.W., H.T. Croasdale and W.C. Vinyard. 1977. A Synopsis of North American Desmids. Part II: Desmidiaceae: Placodermae, Section 2. University of Nebraska Press, Lincoln. 413 pp. ISBN 0-8032-0899-5.

### Keys to Desmids of the world:

Krieger, W and J. Gerloff. 1965. Die gattung Cosmarium- part 2. Verlag Von J. Cramer, Germany. 167 pgs.

Krieger, W and J. Gerloff. 1969. Die gattung Cosmarium-part 3. Verlag Von J. Cramer, Germany. 225 pgs.

Krieger, W. and J. Gerloff. 1962. Die gattung Cosmarium-part 1. Verlag Von J. Cramer, Germany. 156 pgs.

Lind, E., and A.J. Brook. 1980. Desmids of the English Lake District. Freshwater Biological Association, Scientific Publication No. 42. 123 pp. ISBN 0-900386-40-1.

*This book covers desmids with worldwide distribution.*

Ralfs, J. 1962. The British Desmidieae. J. Cramer, Germany. 226 pgs.

West, W. & West, G.S. 1971. A monograph of the British Desmidieae. Johnson Reprint Collection, U.S.A. 236 pgs.

### **Family ZYNEMATACEAE**

Randhawa, M.S. 1959. Zygnemaceae. Indian Council of Agricultural Research, New Delhi. 278 pgs.

Devi, K.U. 1994. Bibliotheca Phycologica Band 97. Species of the genus Spirogyra from Kerala, India (Chlorophyceae: Zygnemataceae). 124 pp. 302 fig.

### **Division CHAROPHYTA (stoneworts)**

Pascher, A. 1925. Die Susswasser-/flora Deutschlands. Osterreichs und der Schweiz Heft 11: Heterokontae, Phaeophyta, Rhodophyta, Charophyta. Verlag Von Gustav Fischer, Jena. 250 pp.

Corillion, R. 1957. Les Charaphycees de France et d'Europe Occidentale. reprint 1972. 499 p. 35 pls.

*See Also Aquatic Plants*

### **Division EUGLENOPHYTA**

Bourelly, P. 1970. Les algues d'eau douce Tome III: Les Algues bleues et rouges. Editions N. Boubée & Cie, Paris. 512 pp.

### **Class EUGLENOPHYCEAE**

### **Order EUGLENALES**

Gojdics, M. 1953. The Genus Euglena. The University of Wisconsin Press, Madison. 268 pp.

### **Division PHAEOPHYTA (Brown algae)**

Bourelly, P. 1968. Les algues d'eau douce. Tome II: Jaunes et brunes. Editions N. Boubée & Cie, Paris. 438 pp.

Starmach, K. 1977. Flora Slodkowodna Polski Tom 14: Phaeophyta, Rhodophyta. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 445 pp.

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**

Starmach, K. 1968. Flora Slodkowodna Polski. Tom 5. Chrysophyceae. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 598 pp.

**Class XANTHOPHYCEAE**

Bourrelly, P. 1968. Les algues d'eau douce. Tome II: Jaunes et brunes. Editions N. Boubée & Cie, Paris. 438 pp.

Starmach, K. 1968. Flora Ślaskowa. Tom 7. Xanthophyceae. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 394 pp.

**Class BACILLARIOPHYCEAE (diatoms)**

**Literature pertaining to the freshwater diatoms of British Columbia:**

Barracough, C.L. 1995. Paleolimnological Elucidation Of The Historical Water Quality Of Sooke Reservoir, Victoria, British Columbia, By Diatom Stratigraphic Analysis. M.Sc. Thesis. University of Victoria, Victoria, British Columbia, Canada. 168 pp.

Brown, S.-D. 1979. Environmental characteristics and sediment diatoms of 51 lakes on Southern Vancouver Island and Salt Spring Island. PhD. dissertation. University of Victoria Department of Biology.

Brown, S.-D. and A.P. Austin. 1973. Spatial and temporal variation in periphyton and physico-chemical conditions in the littoral of a lake. *Archives of Hydrobiology*. 71(2): 183-232.

Cumming, B.F. and J.P. Smol. 1993. Development of diatom-based models for paleoclimatic research from lakes in British Columbia (Canada). *Hydrobiologia* 269/270: 179-196.

Cumming, B.F., S.E. Wilson, R.I. Hall and J.P. Smol. 1995. Diatoms from British Columbia (Canada) Lakes and Their Relationship to Salinity, Nutrients and Other Limnological Variables. *Bibliotheca Diatomologica*. Band 31. J. Cramer. Berlin. 207 pp.

Ennis, G.L., T.G. Northcote and J.G. Stockner. 1983. Recent changes in Kootenay Lake, British Columbia, as recorded by fossil diatoms. *Can. J. Bot.* 61: 1983-1992.

Hall, R.I. and J.P. Smol. 1992. A weighted-averaging regression and calibration model for inferring total phosphorus concentrations from diatoms in British Columbia lakes. *Freshwater Biology*. 27: 417-434.

Reavie, E. 1994. Paleolimnological Investigation of Post-Settlement Eutrophication in British Columbia. M.Sc. thesis. Queen's University, Kingston, Canada. 92 pp.

Reavie, E.D., R.I. Hall and J.P. Smol. 1995. An expanded weighted-averaging model for inferring past total phosphorus in eutrophic British Columbia (Canada) lakes. *Journal of Paleolimnology*. 14: 49-67.

Walker, I.R., E. Reavie, S. Palmer and R.N. Nordin. 1993. A Palaeoenvironmental assessment of human impact on Wood Lake, Okanagan Valley, British Columbia, Canada. *Quaternary International*. 20: 51-70.

**Keys to Diatoms of North America:**

Cox, E. (due 1996). Identification of freshwater diatoms. Illustrated guide. 256 pp. 100 fig.

Foged, N. 1981. *Bibliotheca Phycologia*. Band 53. Diatoms in Alaska. J. Cramer. Germany. 317 pp.



## *Freshwater Keys*

Patrick, R. and C.W. Reimer. 1966. The Diatoms of the United States. Vol. 1. Monographs of The Academy of Natural Sciences of Philadelphia, Philadelphia. 688 pp. LOCCC No. 65-29113.

Patrick, R. and Reimer, C.W. 1975. The Diatoms of the United States. Vol. 2, Part 1. Monographs of The Academy of Natural Sciences of Philadelphia, no. 13. The Academy of Natural Sciences of Philadelphia. Philadelphia. 213 pp. LOCCC No. 75-24638.

Vinyard, W.C. 1979. Diatoms of North America. Mad River Press Inc. Eureka California. 119 pp.

Vinyard, W.C. 1974. Key to the genera of diatoms of the inland waters of temperate North America. Mad River Press, U.S.A. 19 pgs.

Weber, C.I. 1971. A Guide to the Common Diatoms at Water Pollution Surveillance System Stations. U.S. E.P.A., National Environmental Research Center, Cincinnati, Ohio. 101 pp.

### **Keys to diatoms of the world:**

Barber, H.G. and E.Y. Haworth. 1981. A Guide to the Morphology of the Diatom Frustule. Scientific Publication no. 44. The Freshwater Biological Association, Ambleside, Cumbria. U.K. 112 pp.

*This book is indispensable for describing the features of the diatom frustule which allow for identification.*

Cleve, R.T. 1965. Synopsis of the Naviculoid diatoms. A. Asher and Co., Amsterdam. 219 pgs.

Cleve-Euler, A. (1934). The Diatoms of Finnish Lapland. Cleve-Euler, A. 1932. Die Kieselalgen des Takernsees in Schweden. Almqvist & Wiksells Boktryckeri. Stockholm. 254 pp.

Cleve-Euler, A. 1968. Die diatomeen von Schweden und Finnland. Stockholm: Almqvist & Wiksells Boktryckeri AB. Authorized Reprint. Wheldon & Wesley, Ltd. Codicote, Herts. Band 2. No. 1.; Band 4. No. 1.; Band 4. No. 5.; Band 5. No. 4.; Band 3. No. 3.

Cleve-Euler, A. Key to Diatoms of Sweden & Finland. Centricae; Pennatae. Monoraphideae, Biraphideae I (Amphora, Navicula spp).

Foged, N. 1964. Freshwater Diatoms from Spitsbergen. Universitetsforlaget, Oslo. 205 pp.

Foged, N. Freshwater Diatoms from Spitsbergen II. Summary, III.

Foged, N. Freshwater Diatoms from Spitsbergen.

Foged, N. Freshwater Diatoms from Spitsbergen I. Taxonomy.

Greville, R.K. 1968. Descriptions of New and Rare Diatoms. Verlag Von J. Cramer, Germany. 229 pgs.

Hustedt, F. 1962. Die Kieselalgen. 1. Teil. Weinheim Verlag Von J. Cramer. Johnson Reprint Corporation, New York. 920 pp.

Kramer, K. and H. Lange-Bertalot. 1988. Bacillariophyceae. 2. Teil: Bacillariaceae, Epithemiaceae, Surirellaceae. (in) H. Ettl, G. Gärtner, J. Gerloff, H. Heynig and D. Mollenhauer (eds.), Süßwasserflora von Mitteleuropa, Band 2/1, Gustav Fischer Verlag, Stuttgart/New York, 596 pp.

Kramer, K. and H. Lange-Bertalot. 1988. Bacillariophyceae. 1. Teil: Naviculaceae. (in) H. Ettl, G. Gärtner, J. Gerloff, H. Heynig and D. Mollenhauer (eds.), Süßwasserflora von Mitteleuropa, Band 2/1, Gustav Fischer Verlag, Stuttgart/New York, 876 pp.

Kramer, K. and H. Lange-Bertalot. 1991. Bacillariophyceae. 1. Teil: Centrales, Fragilariaceae, Eunoticeae. (in) H. Ettl, G. Gärtner, J. Gerloff, H. Heynig and D. Mollenhauer (eds.), Süßwasserflora von Mitteleuropa, Band 2/3, Gustav Fischer Verlag, Stuttgart/Jena, 576 pp.

Kramer, K. and H. Lange-Bertalot. 1991. Bacillariophyceae. 1. Teil: Achnanthaceae Kritische Ergänzungen zu Navicula (Lineolatae) und Gomphonema. (in) H. Ettl, G. Gärtner, J. Gerloff, H. Heynig and D. Mollenhauer (eds.), Süßwasserflora von Mitteleuropa, Band 2/4, Gustav Fischer Verlag, Stuttgart/Jena, 437 pp.

Round, F.E., R.M. Crawford and D.G. Mann. 1990. The Diatoms. Biology and morphology of the genera. Cambridge University Press, Cambridge, U.K. viii + 747 pp.

Schoeman, F. R. and R. E. Archibald. 1976. The diatom flora of Southern Africa. CSIR, Pretoria.

Simonsen, R. 1987. Atlas and catalogue of the diatom types of Friedrich Hustedt: vol I: catalogue. J. Cramer, Germany. 525 pgs.

Simonsen, R. 1987. Atlas and catalogue of the diatom types of Friedrich Hustedt: vol II: Atlas. J. Cramer, Germany. 597 pgs.

Simonsen, R. 1987. Atlas and catalogue of the diatom types of Friedrich Hustedt: vol III: Atlas. J. Cramer, Germany. 619 pgs.

Van Heurck, H. A. 1896. A Treatise on the Diatomaceae. William Wesley & Son. 558 pgs.

### **Division PYRRHOPHYTA**

Starmach, K. 1974. Flora Slodkowodna Polski. Tom 4. Cryptophyceae, Dinophyceae, Raphidophyceae. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 520 pp.

### **Division RHODOPHYTA**

Bourelly, P. 1970. Les algues d'eau douce Tome III: Les Algues bleues et rouges. Editions N. Boubée & Cie, Paris. 512 pp.

Cole, K.M. & Sheath, R.G. 1990. Biology of the Red Algae. Cambridge University Press, U.S.A. 517 pgs.

Flint, L.H. 1970. Freshwater red algae of North America: an introduction. Vantage Press, U.S.A. 110 pgs.

Starmach, K. 1977. Flora Slodkowodna Polski Tom 14: Phaeophyta, Rhodophyta. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 445 pp.

### **Subclass FLORIDIOPHYCIDAE**

Israelson, G. 1942. The freshwater florideae of Sweden: studies on their taxonomy, ecology and distribution. A-B Lundequistska bokhandeln, Uppsala. 137 pgs.

**Division CRYPTOPHYTA**

Bourelly, P. 1970. Les algues d'eau douce Tome III: Les Algues bleues et rouges. Editions N. Boubée & Cie, Paris. 512 pp.

Starmach, K. 1974. Flora Slodkowodna Polski. Tom 4. Cryptophyceae, Dinophyceae, Raphidophyceae. Polska Akademia Nauk, Instytut Botaniki, Warszawa. 520 pp.

## **Kingdom ANIMALIA: Subkingdom PARAZOA**

### **Phylum PORIFERA (Sponges)**

#### **Class DEMOSPONGIAE**

#### **Family SPONGILLIDAE**

No checklists or keys are known to exist for B.C.

**Status:** None of the sponges that occur in B.C. are considered rare or endangered.

#### **Key to freshwater sponges of Eastern Canada:**

Ricciardi, A. and H.M. Reiswig. 1993. Freshwater sponges (Porifera, Spongillidae) of eastern Canada: taxonomy, distribution and ecology. *Canadian Journal of Zoology*. 71: 665-682.

No checklist is known to exist for Canada.

#### **Key to freshwater sponges of North America:**

Frost, T.M. 1991. Porifera. pp. 95-124 (in) Thorp, J.H. and A.P. Covich (eds.) *Ecology and Classification of North American Freshwater Invertebrates*. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

#### **Key to freshwater sponges of the world:**

Penney, J.T. and A.A. Racek. 1968, Comprehensive revision of a worldwide collection of freshwater sponges (Porifera- Spongillidae). *United States National museum Bulletin* 272. Smithsonian Institution Press. Washington D.C. 182 pp.

## **Kingdom ANIMALIA: Subkingdom EUMETAZOA**

### **Phylum CNIDARIA (also called Coelenterata)**

#### **Class HYDROZOA (hydras)**

No checklists or keys are known to exist for B.C.

**Status:** None of the hydrozoans that occur in B.C. are considered rare or endangered.

#### **One paper is known which describes hydrozoan species from western Canada:**

Adshead, P.C., G.O. Mackie, and P. Paetkau. 1963. On the hydras of Alberta and the Northwest Territories. National Museum of Canada Bulletin. 199: 13 pp.

#### **Key to the Hydrozoans of North America:**

Slobodkin, L.B. and P.E. Bossert. 1991. The Freshwater Cnidaria- or Coelenterates. pp. 125-143 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

### **Phylum PLATYHELMINTHES (Flatworms)**

**Status:** None of the flatworms that occur in B.C. are considered rare or endangered (Scudder, 1994).

#### **Class TURBELLARIA (free-living)**

*The term "microturbellarians" (microflatworms) includes Turbellarian orders other than Tricladida.*

No checklists or keys are known to exist for B.C. or Canada.

#### **Key to the Turbellarians of North America:**

Kolasa, J. 1991. Flatworms: Turbellaria and Nemertea. 145-171 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

#### **Key to the Turbellarians of the World:**

Cannon, L.R.G. 1986. Turbellaria of the world. A guide to families and genera. Queensland Museum. South Brisbane, Australia. 131 pp.

#### **Order TRICLADIDA (planarians)**

No checklists or keys are known to exist for B.C. or Canada.

*The identification of most planarians to species requires examination of serial sections; therefore, identification only to the Genus level is more common.*

**Key to Planarians of North America:**

Kenk, R. 1976. Freshwater planarians (Turbellaria) of North America. United States Environmental Protection Agency. Cincinnati, Ohio. 81 pp.

**Phylum NEMERTEA (proboscis worms)**

No checklists or keys are known to exist for B.C. or Canada.

**Status:** None of the species known to North America have been identified from British Columbia.

**Key to the Nemerteans of North America:**

\*\*Kolasa, J. 1991. Flatworms: Turbellaria and Nemertea. 145-171 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

*\*\* Three freshwater North American species are keyed by Kolasa; however, none of these species have been recorded in B.C. In the instance that a nemertean is found which cannot be keyed using Kolasa (1991), the following world-wide keys should be used:*

**Key to the Nemerteans of the world:**

Gibson, R. and J. Moore. 1976. Freshwater nemerteans: Zoological Journal of the Linnean Society. 58: 177-218.

Gibson, R. and J. Moore. 1978. Freshwater nemerteans: new records of Prostome and a description of *P. canadensis* sp. nov. Zoologischer Anzeiger. 201: 77-85.

**Phylum GASTROTRICHA**

No checklists or keys are known to exist for B.C. or Canada.

**Status:** These organisms are very difficult to identify to species. As a result, little research has been done on these organisms in B.C.. None of the gastrotrichs that occur here are believed to be rare or endangered.

**Key to the Genera of Gastrotrichs in North America:**

Strayer, D.L. and W.D. Hummon. 1991. Gastrotricha. pp. 173-185 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

Pennak, R.W. 1978. *Freshwater Invertebrates of the United States*. 2nd ed. John Wiley and Sons, New York. 803 pp. ISBN 0-471-04249-8.

Brunson, R.B. 1959. *Gastrotricha*, pp. 406-418. (in) Edmondson, W.T. (ed.) *Freshwater Biology*. John Wiley and Sons, New York, 1248 pp.

*Brunson (1959) is the definitive publication on this group. Strayer and Hummon (1991) and Pennak (1978) both rely on this text for pictorial keys. As a result, Strayer and Hummon (1991) and Pennak (1978) are very similar; however, the former key has more recent references.*

### **Phylum ROTIFERA (wheel animals)**

*The rotifers are a vast group and can be very complicated to identify. Persistence and patience are needed to key these organisms to Genus.*

No checklists or keys are known to exist for B.C.

**Status:** Eighty-two named species of rotifers are reported from B.C. Of these, 13 are found only in B.C. None of the rotifers that occur in B.C. are considered rare or endangered.

No key is known to exist for Canada.

### **Pictorial key to Common Genera of Rotifers in Alberta:**

Clifford, H.F. 1991. *Aquatic Invertebrates of Alberta*. The University of Alberta Press. 538 pp. ISBN 0-88864-233-4 cloth, are very clear and cover the common Genera. This is a good place to start, as there are numerous species in North America and the larger keys may be confusing.

### **Checklists of the Rotifers of Canada:**

Chengalath, R. 1984. *Synopsis Speciorum. Rotifera. Bibliographia Invertebratorum Aquaticorum Canadensum*. 3: 102 pp.

Chengalath, R., and W. Koste. 1987. *Rotifera from northwestern Canada*. *Hydrobiologia*. 147: 49-56.

### **Key to Families of Rotifers in North America:**

Wallace, R. and T. Snell. 1991. *Rotifera*. pp. 187-248 (in) Thorp, J.H. and A.P. Covich (eds.) *Ecology and Classification of North American Freshwater Invertebrates*. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

*This key is very comprehensive, but too detailed and technical for those without prior expertise in this group. Some of the simpler line drawings are helpful.*

### **Key to Genera of Rotifers in North America:**

Edmondson, W.T. 1959. *Rotifers*. pp. 420-494 (in) Edmondson, W.T. (ed.) *Ward and Whipple's Freshwater Biology*. 2nd ed. Wiley, New York.

Pennak, R.W. 1989. Freshwater Invertebrates of the United States. Protozoa to Mollusca. 3rd ed. Wiley, New York. 803 pp. ISBN 0 471 04249 8.

*This key is also very detailed. in general, the terms are more straightforward than those in Wallace and Snell (1991).*

**Keys to Rotifers of the world:**

Nogrady, T. R.L. Wallace and T.W. Snell. (eds.) 1993. Guides to the Identification of Microinvertebrates of the Continental Waters of the World. Volume 4: Rotifera 1, Biology, Ecology and Systematics. Academic press. Amsterdam. 142 pp. ISBN 90-5103-080-0.

Nogrady, T. R. Pourriot and H. Segers. 1995. Guides to the Identification of Microinvertebrates of the Continental Waters of the World. Volume 8: Rotifera 3: The Notommatidae and the Scaridiidae. Academic Press. Amsterdam. 228 pp. ISBN 90-5103-103-3.

Segers, H. 1994. Guides to the Identification of Microinvertebrates of the Continental Waters of the World. Volume 6: Rotifera 2: The Lecanidae (Monogononta) Academic Press. Amsterdam. 226 pp. ISBN 90-5103-091-6.

*Ten additional volumes on Rotifers are forthcoming from Academic Press. See bibliography.*

**Phylum NEMATODA (unsegmented worms)**

No checklists or keys are known to exist for B.C. or Canada.

**Status:** Very little information is available on the nematodes of B.C., therefore no attempt can be made to assess rarity (Scudder, 1994).

**Key to the Nematodes of North America:**

Poinar, G.O. Jr. 1991. Nematoda and Nematomorpha. pp. 249-283 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

*This key does not include all freshwater genera.*

**Phylum NEMATOMORPHA (horsehair worms)**

No checklists or keys are known to exist for B.C. or Canada.

**Status:** None of the freshwater horsehair worms recorded from B.C. appear to be rare or endangered (Scudder, 1994).



**Key to the Genera of Nematomorpha in North America:**

Poinar, G.O. Jr. 1991. Nematoda and Nematomorpha. pp. 249-283 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp.  
ISBN# 0-12-690645-9.

**Phylum MOLLUSCA**

No checklists or keys are known to exist for B.C..

**Status:** Threatened and endangered freshwater molluscs in Western North America are listed in: Taylor, D.W. 1970. Western freshwater molluscs. Malacologica. 10: 33-34. he does not list any species as threatened in British Columbia (c. 1970); however, two species which are found in B.C., *Physella columbiana* and *P. virginea*, are listed as rare and endangered in the U.S.

Six species or subspecies which may be endangered in B.C. are listed in: Clarke, A.H. 1976. Endangered freshwater molluscs of northwestern North America. Bulletin of the American Malacological Union Inc. 1976: 18-19. Also, *Physella wrightii*, a tadpole snail found only in a small portion of the Liard Hot Springs is first mentioned by Clarke (1976) and was later described by Te and Clark (1985). It is considered both rare and endangered.

As of 1994, Scudder notes that 13 freshwater species may be rare and endangered: \**Flumnicola virens* (Lea), \**Juga plicifera* (Lea), *Acroloxus coloradensis* (Henderson), \**Fisherola nuttalli* (Haldeman), *Fossaria truncatula* (Müller), \**Physella columbiana* (Hemphill), *P. hordacea* (Lea), *P. lordi* (Baird), *P. propinqua nuttalli* (Lea), *P. virginea* (Gould), \*\**P. wrightii* Te & Clarke.

**The history of collectors and collections of non-marine Molluscs in British Columbia:**

Drake, R.J. 1962. The history of non-marine malacology in B.C. Nat. Mus. Can. Bull. 185: 1-16.

**Key to the Molluscs of Canada:**

Clarke, A.H. 1981. The Freshwater Molluscs of Canada. Nat. Mus. Nat. Sci. Ottawa.

**Most recent checklist of Canadian Molluscs:**

\*LaRoque, A. 1953. Catalogue of the recent Mollusca of Canada. Bull. Nat. Mus. Can. 129: 406 pp.

*\*According to Scudder (1994) the nomenclature of this checklist is now out of date. Nomenclature currently follows Turgeon et al.:*

Turgeon, D.D., A.E. Bogan, E.V. Coan, W.K. Emerson, W.G. Lyons, W.L. Pratt, C.F.E. Roper, A. Scheltema, F.G. Thompson and J.D. Williams. 1988. Common and Scientific Names of Aquatic invertebrates from the United States and Canada: mollusks. American Fisheries Society Special Publication. 16: 277.

**Keys to the North American freshwater molluscs:**

Pennak, R.W. 1989. Freshwater Invertebrates of the United States. Protozoa to Mollusca. 3rd ed. Wiley, New York.

**Class GASTROPODA (snails)**

**Pictorial key to the families of gastropods in Alberta:**

Clifford, H.F. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press. 538 pp. ISBN 0-88864-233-4.

*This key is very useful for the pulmonate snails, since it includes all five families recorded in North America. It includes only two families of prosobranch snails out of the ten known from North America.*

**Key to Gastropods in North America:**

Brown, K.M. 1991. Mollusca: Gastropoda pp. 285-314 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

Burch, J.B. 1982. Freshwater Snails (Mollusca: Gastropoda) of North America. EPA 600/3-82-026: 294 pp.

Burch, J.B. 1989. North American Freshwater Snails. Malacological Publ. Hamburg, Michigan. 365. pp.

**Class BIVALVIA (mussels and clams)**

**Key to the Bivalves of North America:**

Harrington, H.B. 1962. A revision of the Sphaeriidae of North America (Mollusca: Pelecypoda). University of Michigan Museum of Zoology Miscellaneous publication. 118: 74 pp.

McMahon, R.F. 1991. Mollusca: Bivalvia, pp. 315-399 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Pres Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

**Superfamily UNIONACEA**

**Family UNIONIDAE**

**Status:** One species of Unionacean clam is believed to be rare and possibly endangered in B.C.:

\* *Gonidea angulata* (Lea)

**Key to the Unionacean Clams of North America:**

Burch, J.B. 1975. Freshwater Unionacean clams (Mollusca: Pelecypoda) of North America. U.S. E.P.A. Identification Manual #11: 204 pp.

**Phylum ANNELIDA**

**Class POLYCHAETA**

No checklists or keys are known to exist for B.C. or Canada.

**Status:** Three species of polychaete worms have been recorded in freshwater in British Columbia. None is considered rare or endangered (Scudder, 1994).

**Key to Polychaetes in North America:**

Davies, R.W. 1991. Annelida: Leeches, Polychaetes and Acanthobdellids. pp. 437-479 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Pres Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

**Class OLIGOCHAETA (aquatic earthworms)**

No checklists or keys are known to exist for B.C. though Brinkhurst (1978) contains distribution records.

**Status:** None of the freshwater species in B.C. are considered rare or endangered (Scudder, 1994)

**Key to the families of Oligochaetes in Alberta:**

Clifford, H.F. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press. 538 pp. ISBN 0-88864-233-4.

*This key is very clear and outlines the principal differences between families.*

**Key to the Oligochaetes of northwestern Canada:**

Holmquist, C. 1976. Lumbriculids (Oligochaeta) of Northern Alaska and Northwestern Canada. Zoologische Jahrbucher (Systematik). 103: 377-431.

**Key and Checklist to the Oligochaetes in Canada:**

Brinkhurst, R.O. 1978. Freshwater oligochaetes in Canada. Canadian Journal of Zoology. 56: 2166-2175.

**Keys to the North American Oligochaetes:**

Brinkhurst, R.O. 1986. Guide to the freshwater aquatic microdrile oligochaetes of North America. Canadian Special Publication of Fisheries and Aquatic Sciences. 84: 1-259.

Brinkhurst, R.O. and S.R. Gelder. 1991 Annelida: Oligochaeta and Branchiobdellida, pp. 401-435 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Pres Inc., San Diego. 911 pp. ISBN 0-12-690645-9.

Simpson, K.S., D.J. Klemm, and J.K. Hiltunen. 1985. Freshwater Tubificidae (Annelida: Oligochaeta). Pages 44-69. In: D.J. Klemm (ed.). A guide to the freshwater annelida (Polychaeta, nauidid and tubificid Oligochaeta and Hirudinea) of North America. Kendall/Hunt Publishing Company, Dubuque, Iowa. 198 pp.

**Keys to the Oligochaetes of the world:**

Brinkhurst, R.O., and M.J. Wetzel. 1984. Aquatic Oligochaeta of the World: Supplement. A Catalogue of New Freshwater Species, Descriptions and Revisions. Canadian Technical Report of Hydrography and Ocean Sciences. 44: i-v + 101 pp.

Brinkhurst, R.O., and B.G.M. Jamieson. 1971. Aquatic Oligochaeta of the world. Oliver and Boyd, Edinburgh.

Brinkhurst, R.O., and D.G. Cook, editors. 1980. Aquatic Oligochaete Biology. Plenum, New York.

**Class BRANCHIOBELLELLIDA (crayfish parasites)**

No checklists or keys are known to exist for B.C. or Canada.

**Status:** unknown.

**Key to the Branchiobdellids of North America:**

Brinkhurst, R.O. and S.R. Gelder. 1991 Annelida: Oligochaeta and Branchiobdellida, pp. 401-435 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

**Class HIRUDINOIDEA (leeches)**

No checklists or keys are known to exist for B.C.

**Status:** There are presently twenty known species of leeches in B.C. They are listed by Davies (1991) Madill (1985) and Oosthuisen and Davies (1993). Five species may be considered rare in B.C. (Scudder, 1994): *Batrachobdella picta* (Verrill), *Marvinmeyeria lucida* (Moore), *Theromyzon tessulatum* (Muller) *Piscicola punctata* (Verrill) \* *Dina anoculata* Moore.

**Pictorial key to the three orders and four families of Leeches in Alberta:**

Clifford, H.F. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press. 538 pp. ISBN 0-88864-233-4.

*This key is extremely clear and should be sufficient for all the most common leeches in B.C. It includes colour photographs which are very helpful.*

**Checklist of the Leeches in Canada:**

Davies, R.W. 1991. Annelida: Leeches, Polychaetes and Acanthobdellids. pp. 437-479 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Pres Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

Madill, J. 1985. Synopsis Speciorum. Annelida; Hirundinea. Bibliographia Invertebratorum Aquaticorum Canadensum. 5: 33 pp.

Oosthizen, J.H. and R.W. Davies. 1993. A new species of *Theromyzon* (Rhyacobdellida: Glossiphoniidae), with a review of the genus in North America. Canadian Journal of Zoology. 71: 1311-1318.

Davies, R.W. 1973. The geographic distribution of freshwater Hirudinoidea in Canada. Canadian Journal of Zoology. 51: 531-545.

**Keys to the Leeches of North America:**

Klemm, D.J. 1982. Leeches (Annelida: Hirudinea) of North America. United States Environmental Protection Agency. 600/3-82-025: 177 pp.

Klemm, D.J. 1985. A Guide to the Freshwater Annelida (Polychaeta, Naidid and Tubificid Oligochaeta, and Hirudinea) of North America. Kendall/Hunt, Dubuque, Iowa. 198 pp.

**Keys to the Leeches of the world:**

Soos, A. 1965. Identification key to the leech (Hirudinoidea) genera of the world, with a catalogue of the species. I. Family: Piscicolidae. Acta Zoologica Academiae Scientiarum Hungaricae. 2: 417-466.

Soos, A. 1966. Identification key to the leech (Hirudinoidea) genera of the world, with a catalogue of the species. II. Families: Semiscolecidae, Trematobdellidae, Americobdellidae, Diestecostomatidae. Acta Zoologica Academiae Scientiarum Hungaricae. 12: 145-160.

Soos, A. 1966. Identification key to the leech (Hirudinoidea) genera of the world, with a catalogue of the species. III. Family: Erpobdellidae. Acta Zoologica Academiae Scientiarum Hungaricae. 12: 371-407.

Soos, A. 1967. Identification key to the leech (Hirudinoidea) genera of the world, with a catalogue of the species. IV. Family: Haemodipsidae. Acta Zoologica Academiae Scientiarum Hungaricae. 13: 417-432.

Soos, A. 1969. Identification key to the leech (Hirudinoidea) genera of the world, with a catalogue of the species. V. Family: Hirudinoidea. Acta Zoologica Academiae Scientiarum Hungaricae. 15: 151-201.

Soos, A. 1969. Identification key to the leech (Hirudinoidea) genera of the world, with a catalogue of the species. VI. Family: Glossiphoniidae. Acta Zoologica Academiae Scientiarum Hungaricae. 15: 397-454.

**Phylum TARDIGRADA (water bears)**

No keys are known to exist for B.C. or Canada.

**Partial checklists of Tardigrades in B.C.:**

Behan-Pelletier, V.M. 1993. Diversity of soil arthropods in Canada: systematic and ecological problems. Mem. Entomol. Soc. of Canada. 165: 11-50.

Kathman, R.D. 1990. Eutardigrada from Vancouver Island, British Columbia, Canada, including a description of *Platicrista cheleusis* n.sp. Canadian Journal of Zoology. 68: 1880-1895.

Kathman, R.D., and D.F. Cross. 1991. Ecological distribution of moss-dwelling tardigrades on Vancouver Island, British Columbia, Canada. Can. J. Zool. 69: 122-129.

**Status:** There are currently 49 species of tardigrades which have been reported from B.C., three of which are believed to be endemic: \*\**Isohypsibius woodsae* Kathman; \*\**Platicrista cheleusis* Kathman; \*\**Pseudodiphascon arrowsmithii* Kathman and Nelson.

No keys or checklists are known to exist for Canada.

**Key to the Genera of Tardigrades in North America:**

Nelson, D.R. and R.P. Higgins. 1990. Tardigrada. pp 393-419 (in Dinsal, D.L (ed.) Soil Biology Guide, John Wiley and Sons, New York.

**Key to the Tardigrades of Britain:**

Morgan, C.I. and P.E. King. 1976. British Tardigrades. Tardigrada. Keys and notes for the identification of the species. Linnean Society of London, New Series 9: 133 pp.

*In spite of the fact that it is written for Britain, his key is useful since many tardigrades have a worldwide distribution (Clifford, 1991).*

**Phylum BRYOZOA**

No keys or checklists are known to exist for B.C. Canada.

**Status:** None of the bryozoans found in B.C. are considered rare or endangered (Scudder, 1994).

**Key to the Bryozoans of North America:**

Wood, T.S. 1991. Bryozoa, pp. 481-499 (in Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Pres Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

Rogick, M.D. 1959. Bryozoa. pp.495-507 (in Edmondson, W.T. (ed.) Freshwater biology. John Wiley and Sons, New York. 1248 pp.

**Phylum ARTHROPODA**

**Subphylum CHELICERATA**

**Class ARACHNIDA**

**Order ARANEAE (spiders)**

No keys are known to exist for B.C. or Canada.

**Checklists of spiders in B.C.:**

West, R., C.D. Dondale, and R.A. Ring. 1984. A revised checklist of the spiders (Aranae) of British Columbia. Journal of the Entomological Society of British Columbia. 81:80-98.

West, R., C.D. Dondale, and R.A. Ring. 1988. Additions to the revised checklist of the spiders (Aranae) of British Columbia. Journal of the Entomological Society of British Columbia. 85:77-86.

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

Dondale, C.D. and J.H. Redner. 1990. The wolf spiders, nursery web spiders and Lynx spiders of Canada and Alaska. Aranae: Lycosidae, Pisauridae, and Oxyptidae. Agriculture Canada Publication 1856: 383 pp.

**Subclass ACARI (mites and ticks)**

**Order ACARIFORMES**

No keys or checklists are known to exist for B.C. or Canada.

**Status:** Twelve species of water mites are considered to be rare and perhaps endangered (Scudder, 1994). They are listed under their respective family headings below.

**Family TYDEIDAE**

One endemic species of this family is considered rare and perhaps endangered: \*\**Meyerella marshalli* Andre

**Family ACALYPTONOTIDAE**

One species of this family is considered rare and perhaps endangered: \**Acalyptonus pacificus* Smith

**Family ANISITSIELLIDAE**

Two species of this family are considered rare and perhaps endangered: \**Bandakiopsis fonticola* Smith and \**Cookacarus columbiensis* Barr.

**Family NEOACARIDAE**

One species of this family is considered rare and perhaps endangered: \**Neoacarus occidentalis* Cook

**Family ATHIENEMANNIIDAE**

One species of this family is considered rare and perhaps endangered: \**Chelomideopsis brunsoni* (Cook).

**Family ATURIDAE**

One species of this family is considered rare and perhaps endangered: \**Lethaxona oregonensis* Cook.

**Family HYDRYPHANTIDAE**

Three species of this family are considered rare and perhaps endangered, one is endemic to B.C.: \**Cowichania interstitialis* Smith, \*\**Tadjikothyas* sp.n. and \**Tartarothyas* sp.n.

**Family MOMONIIDAE**

One species of this family is considered rare and perhaps endangered: \**Cyclomomonía andrewsi* Smith.

**Family UNIONICOLIDAE**

One endemic species of this family is considered rare and perhaps endangered: \*\**Koenikea* sp.n.

**Key to families of freshwater mites in North America:**

Smith, I.M. and Cook, D.R. 1991. Water Mites, (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Pres Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

**Suborder ORIBATIDA**

**Checklist of 43 described species of oribatid mites in B.C.:**

Behan-Pelletier, V.M. 1993. Diversity of soil arthropods in Canada: Systematic and ecological problems. Memoirs of the Entomological Society of Canada. 165: 11-50.

**Catalogue of the Oribatid mite Species of North America:**

Marshall, V.G., R.M. Reeves, R.A. Norton. 1987. Catalogue of the Oribatida (Acari) of Continental United States and Canada. Memoirs of the Entomological Society of Canada. 139. 418 pp.

**Key to families of Oribatid mites in North America:**

Norton, R.A. 1990. Acarina: Oribatida. pp. 779-803 (in) Dinsal, D.L (ed.) Soil Biology Guide, John Wiley and Sons, New York.



**Key to Genera of Oribatid mites in North America:**

Balogh, J. and P. Balogh. 1992. The Oribatid Mite Genera of the World. Hungarian National Museum Press. Budapest. Volume 1. 263 pp., Volume 2, 375 pp.

**Class INSECTA**

Many insects collected in freshwater are found in the larval stage. Only very few experts can identify larvae to species and then often only by rearing the larvae to the adult stage. Often, larvae can only be identified to Genus, and most frequently only to family. Detailed keys to species may serve only to confuse rather than clarify and may lead to incorrect identifications which appear to be more precise than they are. With this in mind, a general key is recommended for field work, while monographs and more detailed papers should be used only by experts in the field.

**General key to the aquatic insects of North America:**

Merritt, R.W. and K.W. Cummins. 1996. An Introduction to the Aquatic Insects of North America. 3rd ed. Kendall Hunt Publishing. Dubuque, Iowa. 862 pp. ISBN 0-7872-1761-1.

*This volume updates the classification of many aquatic insects and should be considered the definitive reference for classification matters.*

**General key to the aquatic insects of Vancouver Island:**

Mounce, D.E. 1973. An introductory guide to stream insects of southern Vancouver Island. Fish. Res. Bd. Can., Pac. Biol. Sta. Circ. (95). 39 pp.

**Order COLLEMBOLA (springtails)**

No keys are known to exist for B.C. or Canada.

**Preliminary checklist of the Collembola of B.C.:**

Spencer, G.J. 1948. Some records of Collembola from British Columbia. Proceedings of the Entomological Society of British Columbia. 44: 22.

**Status:** Ten species of Collembola are currently considered rare and endemic to B.C. None of these belong to the families Poduridae or Sminthuridae, which are primarily aquatic.

**Pictorial key to the aquatic families of Collembola:**

Clifford, H.J. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press. 538 pp.

**Key to the Collembola of North America:**

Christiansen, K. and P. Bellinger. 1980-1981. The Collembola of North America north of the Rio Grande. A taxonomic analysis. 4 parts. Grinnell College, Grinnell Iowa.

## Order EPHEMEROPTERA (mayflies)

Note: the order Ephemeroptera has recently been revised by Merritt and Cummins (1996). Please to refer to this volume for up-to-date classification.

### Key to the Mayflies of B.C.:

A key to the Mayflies of B.C. is currently in preparation by Ms. Karen Needham at the University of British Columbia. It is expected to be available in April 1996.

### Checklist of the Mayflies of B.C.:

Scudder, G.G.E. 1976. An annotated checklist of the Ephemeroptera (Insecta) of British Columbia. *Syesis*. 8 (1975): 311-315.

### Pictorial key to the Mayflies of Alberta:

Clifford, H.L. 1991. *Aquatic Invertebrates of Alberta*. University of Alberta Press. 538 pp.

*This key is very clear and has excellent line drawings. Caution should be exercised when using this key, since species not included in it may occur in B.C.*

### Recent additions to the B.C. checklist:

Wigle, M.J. and H.V. Thommasen. 1990. Ephemeroptera of the Bella Coola and Owikeno L. watersheds, British Columbia central coast. *Journal of the Entomological Society of British Columbia*. 87: 7-15.

McCafferty, W.P., M.J. Wigle and R.D. Waltz. 1994. Systematics and Biology of *Acentrella turbida* (McDunnough) (Ephemeroptera: Baetida). *Pan Pacific Entomologist*. 70(4): 301-308.

**Status:** Four British Columbian species have a very restricted distribution and may be considered rare and endangered (Scudder, 1994): *Baetes parallelus* Banks, *Heptagenia elegantula* (Eaton), *Leptophlebia gravastella* (Eaton) and *Ameletus sparsatus* McDunnough.

### Checklist of the mayflies of North America:

Edmunds, G.F. Jr., and R.K. Allen. 1957. A checklist of the Ephemeroptera of North America north of Mexico. *Annals of the Entomological Society of America*. 50: 317-324.

### Keys to the mayflies of North America:

#### Merritt, R and Cummins

Edmunds, G.F. Jr., S.L. Jensen, and L. Berner. 1976. *The Mayflies of North and Central America*. University of Minnesota Press. Minneapolis. check

Needham, J.G., J.R. Traver and Y-C Hsu. 1935. *The Biology of Mayflies, with a systematic account of North American Species*. Comstock Publishing. Co. inc. Ithaca, NY. 759 pp.

*This key is quite old and somewhat outdated.*

### **Order ODONATA (dragonflies and damselflies)**

The dragonflies and damselflies in B.C. have been well studied. Both a checklist and a key for B.C. species were written in 1977:

#### **Monograph of (key to) the Odonata of B.C.:**

Cannings, R.A. and K.M. Stuart. 1977. The Dragonflies of British Columbia. British Columbia Provincial Museum Handbook. 35: 254 pp.

#### **Checklist of the Odonata of B.C.:**

Scudder, G.G.E., R.A. Cannings and K.M. Stuart. 1977. An annotated checklist of the Odonata (Insecta) of British Columbia. *Syesis* 9 (1976): 143-161.

**Status:** There are 18 species in B.C. which may be considered rare and/or endangered: *Argia vivida* Hagen, *Coenagrion angulatum* Walker, *Coenagrion interrogatum* (Hagen), *Enallagma civile* (Hagen), *Ischnura damula* Calvert, *Aeshna tuberculifera* Walker, \**Tanypteryx hageni* (Selys), \**Octogomphus specularis* (Hagen) *Ophiogomphus colubrinus* Selys, *Macromia magnifica* MacLachlan, \*\**Macromia rickeri* Walker, *Somatochlora cingulata* (Selys), *Somatochlora septryonalis* (Hagen), *Somatochlora whitehousei* Walker, \**Erythemis collocata* (Hagen), *Pachydiplax* y (Burmeister), \**Libellula subornata* (Hagen), *Leucorrhinia patricia* (Walker). (Scudder, 1994).

#### **Pictorial key to the families of Odonata in Alberta:**

Clifford, H.L. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press. 538 pp.

#### **Monographs of the Odonata of Canada and Alaska:**

Walker, E.M. 1953. The Odonata of Canada and Alaska. Volume 1. Part 1: general, Part II: Zygoptera-Damselflies. University of Toronto Press. Toronto. 292 pp.

Walker E.M. 1958. The Odonata of Canada and Alaska. Volume 2. Part III: The Anisoptera-Four Families. University of Toronto Press. Toronto. 318 pp.

Walker, E.M. and P.S. Corbet. 1975. The Odonata of Canada and Alaska. Volume 3. Part III: The Anisoptera-Three Families. University of Toronto Press. Toronto. 307 pp.

### **Order PLECOPTERA (stoneflies)**

#### **Keys to the Stoneflies of British Columbia:**

A key to the Plecoptera of Alaska and Northwest Canada by Dr. Ken Stewart of the University of North Texas at Denton and Dr. Mark Oswood of the University of Alaska is currently in progress. This book will cover all of British Columbia, Alberta, the Yukon, the Northwest Territories and Alaska. It is to be published by the University of Alaska Press. The anticipated date of publication is spring 1997.

Dr. Ken Stewart also has a book chapter in press with the Biological Survey of Canada. This book will cover Yukon insects and will therefore be useful for northern B.C. Neither the exact title nor the release date is known at this time.

Baumann, R.W., A.R. Gaufin, and R.F. Surdick. 1977. The stoneflies (Plecoptera) of the Rocky Mountains. *Memoirs of the American Entomological Society*. 31: 1-208.

*This publication is useful for western and perhaps central B.C., but does not cover stoneflies of the coastal ranges.*

### **Checklist of the Stoneflies of B.C.:**

Ricker, W.E. and G.G.E. Scudder. 1976. An annotated checklist of the Plecoptera (Insecta) of British Columbia. *Syesis* 8 (1975): 333-348.

Ricker, W.E. 1943. Stoneflies of southwestern British Columbia. *Indiana University Publ. Sci. Ser.* 12: 1-145.

**Status:** There are 125 species of stoneflies recorded from British Columbia. Three are endemic (\*\*) and an additional 22 are rare and may be considered endangered (Scudder, 1994):

\*\* *Bolshecapnia gregsoni* (Ricker), *Bolshecapnia milami* (Nebeker and Gaufin), *Bolshecapnia rogozera* (Ricker), *Bolshecapnia sasquatchi* (Ricker), *Bolshecapnia spenceri* (Ricker), *Capnia cheama* Ricker, *Capnia nearctica* Banks, \* *Capnia elongata* Claassen, *Capnia petila* Jewett, *Capnia pileata* Jewett, *Capnia sextuberculata* Jewett, \*\* *Isocapnia fraseri* Ricker, *Isocapnia vedderensis* (Ricker), *Megaleuctra spectabilis* Neave, \* *Soyedina interrupta* (Claassen), *Alloperla medveda* Ricker, \* *Haploperla chilnualna* (Ricker), \* *Yoroperla mariana* (Ricker), \* *Cascadoperla trictura* (Hoppe), *Isoperla transmarina* (Newman), *Arcynopteryx compacta* (McLachlan), *Setvena tibialis* (Banks), \* *Cultus tostonus* (Ricker), \* *Osobenus yakimae* (Hoppe), *Isogenoides elongatus* (Hagen).

### **Pictorial key to the families of Stoneflies of Alberta (North America):**

Clifford, H.L. 1991. *Aquatic Invertebrates of Alberta*. University of Alberta Press. 538 pp.

### **Illustrated key to the immature stages (Generic level) of Stoneflies in North America:**

Stewart, K.W. and B.P. Stark. 1988. *Nymphs of North American Stonefly Genera (Plecoptera)*. Entomol. Soc. Am. Thomas Say Found. 12: 1-460. reprinted by: University of North Texas Press. ISBN 0-929398-55-6.

*This book includes 244 illustrations, new family and generic keys as well as a complete species list for North America.*

### **Keys to the Stoneflies of North America:**

Harper, P.P. and K.W. Stewart. 1996. Plecoptera, pp. 182-260 (in) Merritt, R.W. and K.W. Cummins. *An Introduction to the Aquatic Insects of North America*. 3rd ed. Kendall Hunt Publishing. Dubuque, Iowa. 862 pp. ISBN 0-7872-1761-1.

Jewett, S.G. Jr. 1959. The stoneflies (Plecoptera) of the Pacific Northwest. Oregon State Mon. Entomol. 95 pp.

Stark, B.P., S.W. Szczytko and R.W. Baumann. 1986. North American stoneflies (Plecoptera): systematics, distribution and taxonomic references. Great Basin Nat. 46: 383-397.

**Key to the Stoneflies of the world:**

Illies, J. 1966. Katalog der rezenten Plecoptera. Das tierreich 82. Walter de Gruyter and Company. Berlin. 632 pp.

**Order HEMIPTERA (true bugs)**

No checklists or keys are known to exist for the whole of the aquatic Hemiptera of B.C. or Canada. Checklists of individual families are listed under their respective subheadings.

**Status:** unknown

**Pictorial key to eight families of Hemiptera in Alberta:**

Clifford, H.L. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press. 538 pp.

*This key covers the Corixidae, Notonectidae, Belostomatidae, Gerridae, Veliidae, Mesovelidae, Saldidae and Hebridae. Keys to Genera found in Alberta are also included.*

**Key to the Hemiptera of North America:**

Merritt, R.W. and K.W. Cummins. 1996. An Introduction to the Aquatic Insects of North America. 3rd ed. Kendall Hunt Publishing. Dubuque, Iowa. 862 pp. ISBN 0-7872-1761-1.

*Supplemental literature is listed under individual family headings.*

**Family BELOSTOMATIDAE (giant water bugs)**

**Family CORIXIDAE (water boatmen)**

Lansbury, I. 1960. The Corixidae (Hemiptera-Heteroptera) of British Columbia. Proceedings of the Entomological Society of British Columbia. 67: 48-59.

Hungerford, H.B. 1948. The Corixidae of the Western Hemisphere. University of Kansas Science Bulletin. 32: 1-288, 408-827.

**Family GERRIDAE (water striders)**

Scudder, G.G.E. 1971. The Gerridae (Hemiptera) of British Columbia. Journal of the Entomological Society of British Columbia. 68: 3-10.

Scudder, G.G.E. 1971. The immature stages of *Gerris* (Hemiptera) in British Columbia. Journal of the Entomological Society of British Columbia. 69:72-79.

Spence, J.R. and G.G.E. Scudder. 1978. Larval taxonomy and distribution of *Gerris pingreensis* and *G. incognitis* (Hemiptera: Gerridae) in British Columbia. Journal of the Entomological Society of British Columbia. 75: 41-45.

**Family HEBRIDAE (velvet water bugs)**

Porter, T.W. 1950. Taxonomy of the American Hebridae (Hemiptera) and the natural history of selected species. Ph.D. Thesis. University of Kansas, Lawrence, Kansas. (velvet water bugs).

**Family MESOVELIIDAE (water treaders)**

**Family NOTONECTIDAE (back swimmers)**

Notonectidae ( back swimmers) Hungerford, H.B. 1933. The genus Notonecta of the world (Notonectidae-Hemiptera). University of Kansas Science Bulletin. 21: 5-193.

**Family SALSIDAE (shore bugs)**

**Family VELIIDAE (broad-shouldered water striders)**

**Order MEGALOPTERA**

See also: NEUROPTERA

No keys or checklists are known to exist for B.C.:

**Records of species from B.C.:**

Munroe, E.G. 1951. The identity and generic position of *Chauliodes disjunctus* Walker (Megaloptera: Corydalidae). Can. Entomol. 83: 33-35.

Munroe, E.G. 1952. *Cauliodes disjunctus* Walker: a correction, with descriptions of a new species and a new genus (Megaloptera: Corydalidae). Can. Entomol. 85: 190-192.

**Status:** Very little information is available of the Megaloptera of B.C.; however two species of the family Sialidae may be rare and endangered in B.C.

**Family SIALIDAE (fishflies)**

Two species of fishflies may be rare and endangered in B.C.: *Sialis hamata* Ross and *Sialis velata* Ross (Scudder, 1994).

**Key to the Fishflies of North America:**

Ross, H.H. 1937. Studies of Nearctic Aquatic insects. I. Nearctic alder flies of the genus *Sialis* (Megaloptera, Sialidae). Bull. Ill. Nat. Hist. Surv. 21: 57-78.

## **Order NEUROPTERA**

### **Checklist of the Neuroptera of B.C.**

\*Spencer, G.J. 1942. A preliminary list of the Neuroptera of British Columbia. Proceedings of the Entomological Society of British Columbia. 38: 23-28.

*\*This list includes insects which are now placed in the orders Megaloptera and Raphidioptera.*

**Status:** Twenty neuropteroid species (includes the orders Megaloptera Raphidioptera and Neuroptera) in B.C. may be rare and endangered; of these only two species are aquatic (see SIALIDAE above).

### **Family SISYRIDAE (spongilla-flies)**

#### **Key to the Spongilla-flies of North America:**

Parfin, S.I. and A.B. Gurney, 1956. The spongilla-flies, with special reference to those of the Western Hemisphere (Sisyrida/Neuroptera). Proceedings of the U.S. National Museum. 105: 421-529.

## **Order LEPIDOPTERA (aquatic moths)**

A great deal of information is available on the terrestrial moths and butterflies of B.C. but very little information exists on the aquatic forms. The publications listed here may include aquatic species in their treatment of the entire order.

#### **Key to the butterflies of Mount Revelstoke and Glacier National Park:**

Threatful, D.L. 1982. Butterflies of Mount Revelstoke and Glacier National Parks, British Columbia, Canada. Parks Canada, Western Region. 20 pp.

#### **Checklist of the Lepidoptera of B.C.:**

Guppy, C.S. and J.H. Shepard. unpublished. C.S. Guppy may be reached at the Ministry of Environment, Lands and Parks, Quesnel, B.C.

A checklist of the moths of B.C. is currently in preparation by J.H. Shepard of Nelson, B.C.

**Status:** Sixty-one butterflies and moths are listed as rare and potentially endangered in B.C. Only one species (Family Noctuidae) is known to be semi-aquatic by this author; however others may also be semi-aquatic (see Scudder, 1994).

#### **Checklist of the Lepidoptera of North America:**

Hodges, R.W., T. Dominick, D.R. Davis, D.C. Ferguson, J.G. Franclemont, E.G. Monroe, and J.A. Powell (eds.) 1983. Check List of the Lepidoptera of America North of Mexico including Greenland. E.W. Classey Ltd., & Wedge Entomological Research Foundation. London. et al 1983.

### Family NOCTUIDAE

One marsh species of this family is considered rare and perhaps endangered: \**Apamea maxima* (Dyar) (Scudder, 1994)

### Order TRICHOPTERA (caddisflies)

#### Checklist of the Caddisflies of B.C.:

Nimmo, A.P. and G.G.E. Scudder. 1979. An annotated checklist of the Trichoptera (Insecta) of British Columbia. *Syesis* 11(1978): 117-133.

Nimmo, A.P. and G.G.E. Scudder. 1984. Supplement to an annotated checklist of the Trichoptera (Insecta) of British Columbia. *Syesis* 16 (1983): 71-83.

**Status:** There are four species of caddisflies endemic to British Columbia. Seventy other species have been recorded from only a single locality, so are probably not rare. The four endemic species are: \*\**Limnephilus chilcotinensis* Nimmo, *Psychoglypha* sp.n. \*\**Rhyacophila perplana* Ross & Spencer, \*\* *R. unimaculata* Denning.

#### Pictorial key to the Caddisflies of Alberta:

Clifford, H.L. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press. 538 pp.

*This key has an excellent description of the morphological features of caddisflies. It includes 15 of the twenty families in north America.*

#### Key to Caddisflies of North America:

Wiggins, G.B. 1977. Larvae of North American caddisfly genera (Trichoptera). University of Toronto Press, Toronto and Buffalo. 401 pp.

*This book is currently being updated. A new edition is expected in early 1996.*

### Order COLEOPTERA (beetles)

**Status:** There are currently 114 rare and possibly endangered beetle species and subspecies in B.C. Of these at least three are aquatic: \**Amphizoa striata* Van Dyke, \* *Agabinus glabrellus* (Motschulsky), \* *Agabinus sculpturellus* Zimmerman. There are 16 Curculionid beetles which are rare in B.C.—some of these beetles may also be considered aquatic (see Scudder, 1994).

#### Catalogue of the Beetles of Canada and Alaska:

Bousquet, Y. 1991. Checklist of the Beetles of Canada and Alaska. Agriculture Canada Publication. 1861/E: 430 pp.



**Keys to the Beetles of the Pacific Northwest:**

Hatch 1953-1971. The Beetles of the Pacific Northwest. Parts I-IV. University of Washington Publications in Biology.

**A Checklist of the Beetles of North and Central America and the West Indies:**

Arnett, Jr. R.A. (ed.) 1983. Checklist of the Beetles of North and Central America and the West Indies. Flora and Fauna Publications. Gainesville, Florida.

Though some terrestrial beetles have been covered, none of the aquatic beetle families have been thoroughly monographed recently.

**Keys to North American Beetles:**

Brown, H.P. 1972. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of freshwater ecosystems identification manual no. 6. Water pollution Research Series 657-695/6119. U.S.E.P.A. Washington, D.C. 82 pp.

Young, F.N. 1956. A preliminary key to the species of hydrovatus of the Eastern United States. (Coleoptera: Dystiscidae). Coleop. Bulletin. 10: 53-54.

Young, F.N. 1956. Two new North American species of Hydrovatus, with notes on other species (Coleoptera: Dystiscidae). Psyche. 70:184-192.

**Order DIPTERA (true flies)**

No checklist is known to exist for the whole of the Diptera of B.C. or Canada.

**Key to Diptera of Canada:**

McAlpine, J.F., B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockroth and D.M. Wood. (eds). 1981. Manual of Nearctic Diptera: Volume 1. Research Branch of Agriculture Canada. Monograph No. 27. Ottawa. 674 pp.

**Status:** At present, a checklist for British Columbian Diptera does not exist; however, Scudder (1994) lists 76 species which may be rare or endangered. His list was constructed in consultation with many experts on B.C dipteran fauna. Of the rare/endangered species listed by Scudder, 25 are aquatic. They are listed under their respective family headings below.

**Suborder NEMATOCERA**

**Family BLEPHARICERIDAE (net-winged midges)**

Hogue, C.L. 1982. Revised status of net-winged midges of the genus *Bibliocephala* in North America based on a study of quantitative variation in the males (Diptera: Blephariceridae). Contrib. Sci. 338: 1-16.

**Family CERATOPOGONIDAE (= Heleidae, biting midges)**

**Family CHAOBORIDAE (phantom midges)**

**Key to the Chaoboridae of the world:**

Saether, O.A. 1972. Chaoboridae. pp. 257-280 (in) Elster, H.J. and W. Ohle (eds.) Das Zooplankton der Binnengewässer. Die Binnengewässer 26 Stuttgart, E. Schweizerbart'sche Verlagbuchhandlung. 294 pp.

**Family CHIRONOMIDAE (= Tendipedidae, midges)**

Seven species of Chironomids are believed to be rare or endangered in B.C, all of which are endemic to B.C.:

\*\* *Chironomus vancouveri* Michailova and Fischer, \*\* *Doithrix hamiltoni* Saether and Sublette, \*\* *Heterotanytarsus perennis* Saether, \*\* *Odontomesa lutospora* (Garrett), \*\* *Parachaetocladius hirtipectus* Saether, \*\* *Pseudosmittia setavena* Saether, \*\* *Skutzia inopinata* Reiss.

**Partial Checklist of Chironomids of Canada:**

Saether, O.A. 1975. Nearctic and Palearctic *Heteortrissocladius* (Diptera: Chironomidae). Bulletin of the Fisheries Research board of Canada. 193: 67 pp.

**Catalog of Chironomids of North America:**

Oliver, D.R., M.E. Dillon and P.S. Cranston. 1990. A catalog of Nearctic Chironomidae. Agriculture Canada Publication 1857/B. 89 pp.

**Key to Chironomids of the world:**

Wiederholm, T. (ed.) 1983. Chironomidae of the Holarctic Region part 1: larvae. Entmol. Scand. Suppl. no. 19. Lund, Sweden. 457 pp.

Wiederholm, T. (ed.) 1983. Chironomidae of the Holarctic Region part 2: pupae. Entmol. Scand. Suppl. no. 28. Lund, Sweden. 498 pp.

*The above two keys are reportedly very good, but difficult to use.*

**Family CULICIDAE (mosquitoes)**

**Checklist of the Mosquitoes of B.C.:**

Belton, P. and E.M. Belton. 1981. A revised checklist of the mosquitoes of British Columbia. Journal of the Entomological Society of British Columbia. 78: 55-61.

**Status:** There are five species of mosquitoes in Canada which have been recorded only in B.C. Two of these have a very restricted distribution. Scudder (1994) suggests that the following species warrant further study: *Aedes hendersonii* Cockerell, \**Aedes nevadensis* Chapman & Barr, *Aedes nigripes* (Zetterstedt) and *Culiseta minnesotae* Barr.

**Key to the Mosquitoes of Canada:**

Wood, D.M., P.T. Dang and R.A. Ellis. 1979. The Mosquitoes of Canada. (Diptera: Culicidae). The Insects and Arachnids of Canada. Part 6. Agriculture Canada Publication 1686. 390 pp.

**Key to Mosquitoes of North America:**

Carpenter, S.J. and W.J. LaCasse. 1955. Mosquitoes of North America (North of Mexico). University of California Press. Berkeley and Los Angeles.

Darsie, R.F. Jr. and R.A. Ward. 1981. Identification and geographical distribution of the mosquitoes of North America, north of Mexico. Mosquito Syst. Suppl. 1:313 pp.

**Family DEUTEROPHLEBIIDAE (mountain midges)**

**Status:** One species, *Deuterophlebia personata* Courtney is rare in B.C. The rarity of this species may be an artifact of lack of collecting rather than scarcity of the insect (Scudder, 1994).

**Key to the Mountain midges of North America:**

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

**Family DIXIDAE (dixid midges)**

**Family NYMPHOMYIIDAE**

**Family PSYCHODIDAE (moth flies)**

**Family PTYCHOPTERA (= Liriopeidae, phantom crane flies)**

**Family SIMULIIDAE (black flies)**

Black flies are a very difficult group to identify to species. Often two groups of reproductively isolated species will appear identical in external appearance. Chromosomal examination is then required to distinguish them. There are no cytological keys for B.C. and many species are as yet undescribed (Currie, pers. comm.). Only experts should attempt black fly identification to species.

**Key to the Black flies of B.C.:**

Dr. Doug Currie of the Royal Ontario Museum together with Dr. Peter Adler (Clemson University) and Dr. Monty Wood (Agriculture Canada) are currently completing a key to the blackflies of North America. This volume will contain keys and figures for all 290 North American species including the 60+ species known from B.C. It is expected to be available in 1998.

No keys or checklists are known to exist which pertain directly to B.C. black flies .

*See bibliography for references pertaining to records of B.C. Genera and Species.*

**Status:** Six species of black flies are considered rare or endangered in B.C.; three of these are endemic to B.C. : \**Parasimulium furcatum* Malloch, \*\**Prosimulium constrictistylum* Peterson, \*\**Prosimulium woodorum* Peterson, \*\**Prosimulium* n.sp. near *fulvum* (Coquillett), \**Simulium* n.sp.1 near *pugetense* (Dyar and Shannon), \**Simulium* n.sp.2 near *virgatum* Coquillett (Scudder, 1994).

### **Keys to the immature stages of most Black flies in B.C.:**

Clifford, H.L. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press. 538 pp.

Currie, D.C. 1986. An annotated list of and keys to the immature black flies of Alberta (Diptera: Simuliidae). Memoirs Entomological Society of Canada. 134. 90 pp.

Currie, D.C., and P.H. Adler. 1986. Black flies (Diptera: Simuliidae) of the Queen Charlotte Islands, British Columbia, with discussion of their origin and description of *Simulium* (Hellichiella) *nebulosum* n. sp. Canadian Journal of Zoology. 64: 218-227.

### **Keys to Black flies of Canada:**

Peterson, B.V. 1970. The *Prosimulium* of Canada and Alaska (Diptera: Simuliidae). Memoirs of the Entomological Society of Canada No. 69: 216 pp.

Wood, D.M. 1978. Taxonomy of the Nearctic species of *Twinnia* and *Gymnopais* (Diptera: Simuliidae) and a discussion of the ancestry of the Simuliidae. Canadian Entomologist. 100: 1297-1337.

Wood, D.M., B.V. Peterson, D.M. Davies, and H. Gyorkos. 1963. The black flies (Diptera: Simuliidae) of Ontario. Part II. Larval identification, with descriptions and illustrations. Proceedings of the Entomological Society of Ontario. 93: 99-129.

### **Family TANYDERIDAE (primitive crane flies)**

### **Family THAUMALEIDAE (solitary midges)**

### **Family TIPULIDAE (crane flies)**

### **A preliminary checklist of Tipulidae of B.C.:**

Spencer, G.J. 1948. A preliminary list of Tipulidae from British Columbia (Diptera). Proceedings of the Entomological Society of British Columbia. 44: 19-21.

**Status:** At present, seven species of crane flies are rare or endangered in B.C. Five of these are endemic to B.C.: \**Chionea macnabeana* Alexander, \**Tipula imbellis* Alexander, \*\**Phalacrocera vancouverensis* Alexander, \*\**Limonia suffusca* (Garrett), \*\**Phyllolabis bryantiana* Alexander, \*\**Limnophila columbiana* Alexander, \*\**Limnophila lobifera* Alexander (Scudder, 1994).

**Suborder BRACHYCERA**

**Family TABANIDAE (deer flies and horse flies)**

No checklists or keys are known to exist for B.C.

**Status:** Sixty-one species have been recorded in B.C. Sixteen of these are not found elsewhere in Canada and of these sixteen, five are believed to be rare (Scudder, 1994): \**Chrysops coloradensis* Bigot, \**Chrysops surdus* Osten Sacken, \**Hybomitra aasa* Philip, \**Tabanus laticeps* Hine, \**Tabanus punctifer* Osten Sacken.

**Key to Canadian Deer flies and Horse flies:**

Teskey, H.J. 1990. The Horse Flies and Deer Flies of Canada and Alaska. the Insects and Arachnids of Canada. Part 16. Agriculture Canada Publication 1838: 381 pp.

**Subphylum CRUSTACEA**

An annotated checklist of the freshwater crustacea of B.C. is in preparation by Dr. Geoff Scudder at the University of British Columbia.

**Status:** None of the planktonic crustacea in B.C. are believed to be rare or endangered.

**Class BRANCHIOPODA**

**Key to the Branchipoda (Cladocera) of B.C.:**

Green, G.D. 1996. A Key for the Cladocera (Crustacea) reported from British Columbia: Daphniidae, Bosminidae, Sididae, Polyphemidae and Leptodoridae. Royal B.C. Museum. In press.

**Partial checklists of the Branchipoda of B.C.:**

Hann, B.J., and B.G. Warner. 1987. Late Quaternary Cladocera from coastal British Columbia, Canada: A record of climatic or limnologic change? Arch. Hydrobiol. 110: 161-177.

Patalas, K. and A. Salki. 1973. Crustacean plankton and the eutrophication of lakes in the Okanagan Valley British Columbia. Journal of the Fisheries Research Board of Canada. 30: 519-542.

**Checklist of Branchipoda of Canada:**

Chengalath, R. 1982. A faunistic and ecological survey of the littoral cladocera of Canada. Canadian Journal of Zoology. 60: 2668-2682.

Chengalath, R. 1987. The distribution of chydorid Cladocera in Canada. Hydrobiologia. 145: 157-158.

Shan, R.K. and D.G. Frey. 1983. *Pleuroxus denticulatus* and *P. procurvus* (Cladocera, Chydoridae) in North America: distribution, experimental hybridization and the possibility of natural hybridization. Canadian Journal of Zoology. 61: 1605-1617.

**Keys to the Branchiopoda of North America:**

Dodson, S.I. and D.G. Frey. 1991. Cladocera and other Branchiopoda. pp. 723-786 (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Pres Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

*This key is the most up-to-date; however, Brooks (1959) is still highly regarded and useful.*

Berner, D.B. 1986. Taxonomy of Ceriodaphnia (Crustacea: Cladocera) in U.S. Environmental Protection Agency cultures. U.S.E.P.A., Environmental Monitoring and Support Lab. EPA/600/4-86/032.

Brooks, J.L. 1957. The systematics of North American Daphnia. Memoirs of the Connecticut Academy of Arts and Sciences. 13: 1-180.

Brooks, J.L. 1959. Cladocera. Pages: 587-656. In: W. T. Edmondson (ed.). Ward and Whipple's Freshwater Biology. John Wiley and Sons, New York. 1248 pp.

**Keys to the Branchiopoda of the World:**

Benzie, J. 1996. Guides to the Identification of microinvertebrates of the Continental Waters of the World. Cladocera: Daphnia and Daphniopsis. Academic Press. Amsterdam. in preparation.

Forro, L. 1996. Guides to the Identification of Microinvertebrates of the Continental Waters of the World. Volume ? : Cladocera: Moinidae. Academic Press. Amsterdam. in preparation.

Korincek, V. 1996. Guides to the Identification of Microinvertebrates of the Continental Waters of the World. Bosminidae: Bosmina/Bosminopsis. Academic Press. Amsterdam. in preparation.

Frey, F.G. 1987. The taxonomy and biogeography of the Cladocera. Hydrobiologia. 145: 5-17.

Goulden, C.E. 1968. The systematics and evolution of the Moinidae. Transactions of the American Philosophical Society. 58(6): 5-99.

Korovchinsky, N.M. 1992. Guides to the Identification of microinvertebrates of the Continental Waters of the World. Volume 3: Sididae and Holopediidae (Crustacea: Daphniformes). Academic publishing. Amsterdam. 82 pp. ISBN 90 5103 074 6.

Kubersky, E.S. 1977. Worldwide distribution and ecology of *Alonopsis* (Cladocera: Chydoridae) with a description of *Alonopsis americana* sp. nov. Int. Revue ges. Hydrobiol. 62(5): 649-685.

Smirnov, N.N. 1992. Guides to the Identification of microinvertebrates of the Continental Waters of the World. Volume 1: The Macrothricidae of the World. Guides to the Identification of the Microinvertebrates of the Continental Waters of the World. Academic Publishing. Amsterdam. 143 pp. ISBN 90 5103 067 3.

Smirnov, N.N. 1996. Guides to the Identification of Microinvertebrates of the Continental Waters of the World. Volume ? : Chydorinae. Academic Press. Amsterdam. in preparation.

**Order ANOSTRACA (fairy shrimp)**

**Checklist of the Anostraca in Canada**

Hartland-Rowe, R. 1965. The Anostraca and Notostraca of Canada with some new distribution records. *The Canadian Field-Naturalist*. 79: 185-189.

**Keys to the Anostraca of North America:**

Belk, D. 1975. Key to the Anostraca (Fairy Shrimps) of North America. *The Southwestern Naturalist*. 20: 91-103.

**Order NOTOSTRACA (tadpole shrimp)**

Hartland-Rowe, R. 1965. The Anostraca and Notostraca of Canada with some new distribution records. *The Canadian Field-Naturalist*. 79: 185-189.

Linder, F. 1959. Nostraca. Pages 572-576. In: W.T. Edmondson (ed.). *Ward and Whipple's Freshwater Biology*. John Wiley and Sons, New York. 1248 pp.

**Order CONCHOSTRACA (clam shrimp)**

Martin, J.W., and D. Belk. 1988. Review of the clam shrimp family Lynceidae Stebbing, 1902 (Branchipoda: Conchostraca), in the Americas. *Journal of Crustacean Biology*: 451-482.

Mattox, N.T. 1959. Conchostraca. Pages 577-586. In: W.T. Edmondson (ed.). *Ward and Whipple's Freshwater Biology*. John Wiley and Sons, New York. 1248 pp.

**Class MAXILLOPODA**

**Subclass BRANCHIURA (fish lice)**

*Argulus* (only genus)

**Subclass COPEPODA (copepods)**

**Key to the Copepod species of B.C.:**

A monograph of the Calanoid Copepods of British Columbia is in preparation by Dr. Gail Sandercock and Dr. Geoff Scudder at the University of British Columbia. It is expected to be complete in April 1996.

**Partial checklist of Copepoda in B.C.:**

Carl, G.C. 1940. The distribution of some cladocera and free-living Copepoda in British Columbia. *Ecol. Monogr.* 10:55-110.

**Key to the Copepods of North America:**

Williamson, C.E. 1991. Copepoda. pp. 878-822. (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

**Class OSTRACODA (seed shrimp)**

**Key to the Ostracodes of B.C.:**

A key to the ostracodes of British Columbia is currently in preparation by Gordon Green, Curator of Invertebrates at the Royal B.C. Museum.

**Checklist of the Ostracodes in B.C.:**

DeLorme, L.D. 1977. Freshwater Ostracoda from the Okanagan Valley, British Columbia. Environment Canada. Canada Centre for Inland Waters. unpublished report.

Green, G.D. 1994. Freshwater Ostracoda (Crustacea) from the Southern Interior of British Columbia. Royal British Columbia Museum. Victoria. 38 pp. ISBN 0 7718 9415 5.

**Status:** None of the Ostracodes in B.C. are believed to be rare or endangered.

**Keys to the Ostracodes of Canada:**

Delorme, L.D. 1967. Field key and methods of collecting freshwater ostracodes in Canada. Canadian Journal of Zoology. 45: 1275-1281.

Delorme, L.D. 1970. Freshwater ostracodes of Canada. Part I. Subfamily Cypridinae. Canadian Journal of Zoology. 48: 153-169.

Delorme, L.D. 1970. Freshwater ostracodes of Canada. Part II. Subfamilies Cypridopsinae, Herpetocypridinae, and family cyclocyprididae. Canadian Journal of Zoology. 48: 253-266.

Delorme, L.D. 1970. Freshwater ostracodes of Canada. Part III. Family Candonidae. Canadian Journal of Zoology. 48: 1099-1127.

Delorme, L.D. 1970. Freshwater ostracodes of Canada. Part IV. Families Ilyocyprididae, Notodromadidae, Darwinulidae, Cytherideidae, and Enthocytheridae. Canadian Journal of Zoology. 48: 1251-1259.

Delorme, L.D. 1971. Freshwater ostracodes of Canada. Part V. Families Limnocytheridae, Loxoconchidae. Canadian Journal of Zoology. 49: 43-64.

*Please see bibliography for additional references on Canadian Ostracodes.*



**Key to the Ostracodes of North America:**

Delorme, L.D. 1991. Ostracoda, pp. 691-772 in: Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Pres Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

**Key to the Ostracodes of the world:**

Bronstein, Z.S. 1988. Freshwater Ostracoda. Russian Translation Series 64. New Series No. 31. Fauna of the U.S.S.R. Crustaceans. Vol 11 (1). A.A. Balkema, Rotterdam.

**Class MALACOSTRACA**

**Superorder PERACARIDA**

**Order MYSIDACEA (opossum shrimp)**

No keys are known to exist for B.C. or Canada.

**Status:** unknown.

**Key to the Genera of Mysids of North America:**

Covich, A.P. and J.H. Thorp. 1991. Crustacea: Introduction and Peracarida. (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Pres Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

**Order AMPHIPODA (scuds)**

No keys are known to exist for B.C.

**Checklist of the Amphipods of B.C.:**

Saunders, L.G. 1933. The freshwater amphipods of Vancouver Island. Contr. Can. Biol. Fish., N.S. 19. 243-251.

**Additions to the checklist:**

Bousfield, E.L. 1979. The amphipod Superfamily Gammaroidae in the northeastern Pacific region: systematics and distributional ecology. Bulletin of the biological Society of Washington. 3: 297-357.

Bousfield, E.L. and H. Morino. 1992. The amphipod genus *Rammellogammarus* in fresh waters of Western North America: systematics and distributional ecology. Royal British Columbia Museum Contributions in Natural Science. 17: 1-22.

Holsinger, J.R. and D.P. Shaw. 1987. *Stygobromus quatsinensis*, a new amphipod crustacean (Crangonyctidae) from caves on Vancouver Island British Columbia, with remarks of zoogeographic relationships. Canadian Journal of Zoology. 65: 2202-2209.

**Status:** Three species of freshwater Amphipods, which are all endemic to B.C., are thought to be at risk: \*\**Ramellogrammarus vancouverensis* Bousfield, \*\**Stygobromus quatsinensis* Holsinger & Shaw, \*\**Paramoera carlottensis* Bousfield.

**Key to the freshwater Amphipods of North America:**

Holsinger, J.R. 1972. The freshwater amphipod crustaceans (Gammaridae) of North America. Biota of Freshwater Ecosystems, Identification Manual 5, U.S. Environmental Protection Agency.

Covich, A.P. and J.H. Thorp. 1991. Crustacea: Introduction and Peracarida. (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

**Checklist of the freshwater Amphipods of North America:**

Bousfield, E.L. 1958. Fresh-water amphipod crustaceans of glaciated North America. Canadian Field-Naturalist. 72: 55-113.

**Order ISOPODA (aquatic sow bugs)**

No checklists or keys are known to exist for B.C. or Canada

**Status:** Six species of Isopods in B.C. are believed to be at risk, though only one species is a freshwater form: \**Caecidotea occidentalis* (Williams).

**A key to the Genera of Isopods of North America:**

Covich, A.P. and J.H. Thorp. 1991. Crustacea: Introduction and Peracarida. pp. 677-689. (in) Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

*Further details of the ispod genus Asellus are contained in:*

Williams, W.D. 1970. A revision of North American Epigeal species of *Asellus* (Crustacea: Isopoda). Smithsonian Contr. Zool. 49: 1-79.

**Superorder EUCARIIDA**

**Order DECAPODA (freshwater shrimps and crayfishes)**

No checklists or keys are known to exist for B.C. or Canada.

**Keys to North American Shrimps and Crayfishes:**

Hobbs, H.H. III. 1991. Decapoda, pp. 823-858 (in): Thorp, J.H. and A.P. Covich (eds.) Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., San Diego. 911 pp. ISBN# 0-12-690645-9.

*Freshwater Keys*

Hobbs, H.H. Jr. 1972. Crayfishes (Astacidae) of North and Middle America. Biota of Freshwater Ecosystems. U.S. Environmental Protection Agency, Water Pollution Control Research Service Identification Manual 9, 173 pp.

**Phylum CHORDATA**

**Subphylum VERTEBRATA**

The vertebrates of British Columbia have been well catalogued. A complete list of species (to 1988) is contained in:

Cannings, R.A. and A.P. Harcombe (eds). 1990. 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.

**Class MAMMALIA (Mammals)**

**Checklist of the Mammals of B.C.:**

Nagorsen, D. 1990. Mammals. pp. 39-43 in 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.

**Class REPTILIA (Reptiles)**

**Checklist of the Reptiles of B.C.:**

Orchard, S. 1990. Reptiles. pp. 25-26 in 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.

**Class AVES (Birds)**

**Checklist of the Birds of B.C.:**

Campbell, R.W. 1990 Birds pp. 27-37 in 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.

**Class AMPHIBIA (Amphibians)**

**Checklist of the Amphibians of B.C:**

Corkran, C.C. and Thoms, C.R. 1996. Amphibians of Oregon, Washington and British Columbia. Lone Pine Publishing. ~ 172 pp.

Orchard, S. 1990. Amphibians. pp. 23-24 in 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.

**Class CYCLOSTOMATA (Hagfishes and Lampreys)**

**Class OSTEICHTHYS (Bony fishes)**

**Key to the Freshwater Fishes of British Columbia:**

McPhail, J.D. and R. Carveth. 1996. Field Key to the Freshwater Fishes of British Columbia. Fish museum, Department of Zoology, University of British Columbia..

**Checklist of the Freshwater Fishes of B.C:**

Peden, A.E. 1990. Freshwater Fishes. pp. 19-22 in 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.