The **Stewardship** Series

The Streamkeepers Handbook

A Practical Guide To Stream And Wetland Care

Canada

Province of British Columbia

STREAMKEEPERS

Module 4
Stream Invertebrate Survey

Project Approval Required	Training	Time Commitment (per year)	Number of People	Time of Year
no	recommended	2 days to ongoing	2 or more	Early spring early fall

Fisheries and Oceans / Pêches et Océans

Canada

MODULE 4:

Stream Invertebrate Survey

Welcome to the Streamkeepers Program! The Department of Fisheries and Oceans Community Involvement Program provides these Streamkeepers training modules. These modules encourage"hands on" environmental activities in watersheds in British Columbia. Volunteer groups, schools, and individuals are using this material to monitor and restore local waterways. Your local Fisheries and Oceans Community Advisor can provide more information.

Acknowledgments

Michele Nielsen of the Comox Project Watershed Society and Catherine Cardinal, education coordinator for the Salmonid Enhancement Program provided material for this module. Material originated with several projects, including the Adopt-A-Stream Foundation (Everett, Washington), Alaska Water Watch (Alaska), and Save our Streams (Maryland).

Project Activity and Purpose

You will select one or more sampling locations in a stream, and collect invertebrates from the stream bottom. On shore, you will sort, identify, and count the invertebrates, then return them to the stream. The data you collect will help you assess the health of your stream, changes over time, and impacts of pollution.

Introduction

Pick up a rock from a stream and turn it over. Those wiggly critters you see are benthic macroinvertebrates - bottom dwelling, spineless creatures that are small but visible to the naked eye. Most of them are insects at immature stages of development, but worms, snails, and clams also can be found. The kinds and numbers of invertebrates give a good indication of stream health.

Some species of invertebrates require very good water quality, whereas others tolerate a wide range of environmental conditions. Although invertebrates can move about in the stream and drift downstream, they do not move as quickly as fish to avoid adverse conditions. Deteriorating water quality and pollutants usually kill the less tolerant species and encourage other more tolerant ones. You can compare invertebrate populations in different parts of your stream or in different streams in the area. These comparisons will help you to decide whether a stream is healthy or has chronic or periodic water quality problems.

Samples taken in one location, over time, provide information about changes in stream health, seasonal changes, and normal annual variation. Samples taken at several locations provide information about specific problems in a particular watershed.

Project Guidance And Approval

You require no formal approval or permit. Check with your Community Advisor for current information about your stream. Ask for permission to cross or use private property. A Streamkeepers certification course offers training for the module.

Avoid spawning fish and spawning habitat (redds) when sampling. Salmonid eggs will not survive if you disturb them. Because of the wide variety of species of salmonids, eggs can be present any time of year.

Level Of Effort

The survey takes from one half to one whole day, depending on the number of stations. Take samples at least twice a year. You need two people to sample in the stream. Others can stay on shore to sort, identify, and count invertebrates. You will need at least two hours to collect and process the samples at each site. Instructions for an alternate quick and simple method are included in the procedure.

Time of Year and Working Conditions

Early spring (when water temperature is less than 7oC) and fall (before heavy rainfall) are the best times of year to sample. Many invertebrates are large and easy to identify then. Do not sample the stream during or soon after a flood, because conditions may be dangerous and many organisms will have been washed away.

Safety

PERSONAL SAFETY

Concern for personal safety is essential when working outdoors. Always tell someone where you are going and when you will return. Work in pairs, never alone. Carry emergency phone numbers for police and ambulance.

Choose easily accessible, safe sites. Do not attempt to wade fast water or water deeper than your knees. Watch out for slippery stream beds, undercut banks, waterfalls and fast flowing areas. Log jams can be unstable, so take care to walk around them.

Warn everyone, especially children, about urban hazards such as syringes, needles, broken glass, and condoms.Remove them with tongs and place them in a special hazardous materials bucket, or flag them with bright tape. Avoid foul smelling areas, spills of unknown substances, or containers of hazardous or unidentified materials. Contact emergency response agencies or municipal crews to remove these materials.

Beware of domestic animals and wildlife.

HEALTH

Do not drink stream water. Although it may look pristine, it can harbour bacteria or parasites that will make you sick. Do not expose cuts and wounds to stream water. Know the symptoms and treatment for hypothermia.

EQUIPMENT

Carry a first aid kit. When working in isolated areas, carry a survival kit containing at least a lighter, fire starter, candle, and flares. Take a cellular phone if you have one.

CLOTHING

Dress for the weather and stream conditions. Wear waders with felts when walking in the stream. Wear highly visible clothing.

Materials And Equipment

Surber sampler or 30 cm wide D net (363 micron mesh size)

waders or high boots	thermometer
scrub brush or nail brush	insulated rubber gloves
white 20 litre bucket	shallow white tray
ice cube trays (at least 2)	plastic spoons
eye droppers or pipettes	gridded pan (optional)
laminated field key	data sheets
pencils	blunt tweezers
hand lens or magnifying glass	first aid kit

optional for preserving samples: (seldom recommended)

99% isopropyl alcohol	bottles, labels

optional for a very quick survey:

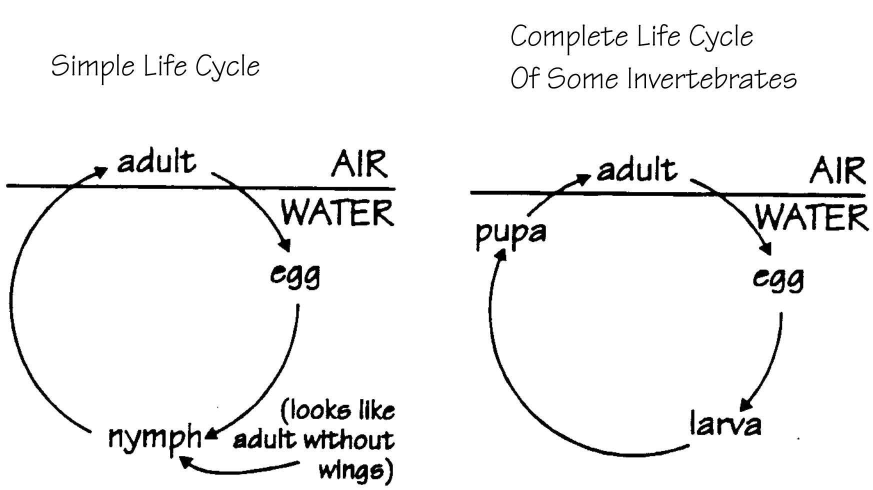
small bucket	scrub brush or nail brush
laminated field key	paper, pencils

Background Information

LIFE CYCLES

Life spans of invertebrates range from days to years, depending on the species. Worms, snails, and clams spend their lives in water. Adult aquatic insects live very briefly in the air, mate, and then lay eggs in the water. Most of their life is spent in the water, in the larval stage. Some insect species pass through true larval and pupal stages before they emerge as adults (Figure 1). Other species grow through a series of nymph stages that resemble wingless adults, then emerge as adults.

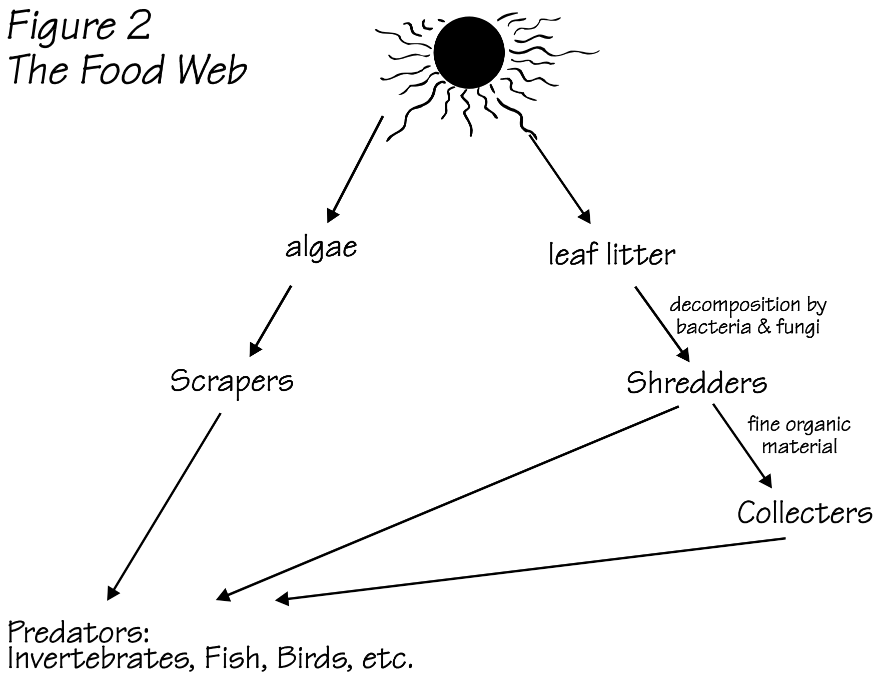
Figure 1 Life Cycle of Aquatic Insects



FOOD WEB

Figure 2 illustrates how food energy in streams is converted. The sun provides energy for plant growth in and around streams. Bacteria and fungi feed on dead plant material. Many herbivorous invertebrate species feed on the algae, bacteria, fungi, and partially decomposed leaves. These invertebrates provide food for predators such as other invertebrates, juvenile and adult fish, reptiles, amphibians, and birds. Aquatic insect larvae and adults are the main food source for many fish, including salmonids. The pathway shown on the right in Figure 2 is most common in headwater streams and the pathway shown on the left is most common in larger streams and rivers.

Figure 2
The Food Web



THE STREAM CONTINUUM

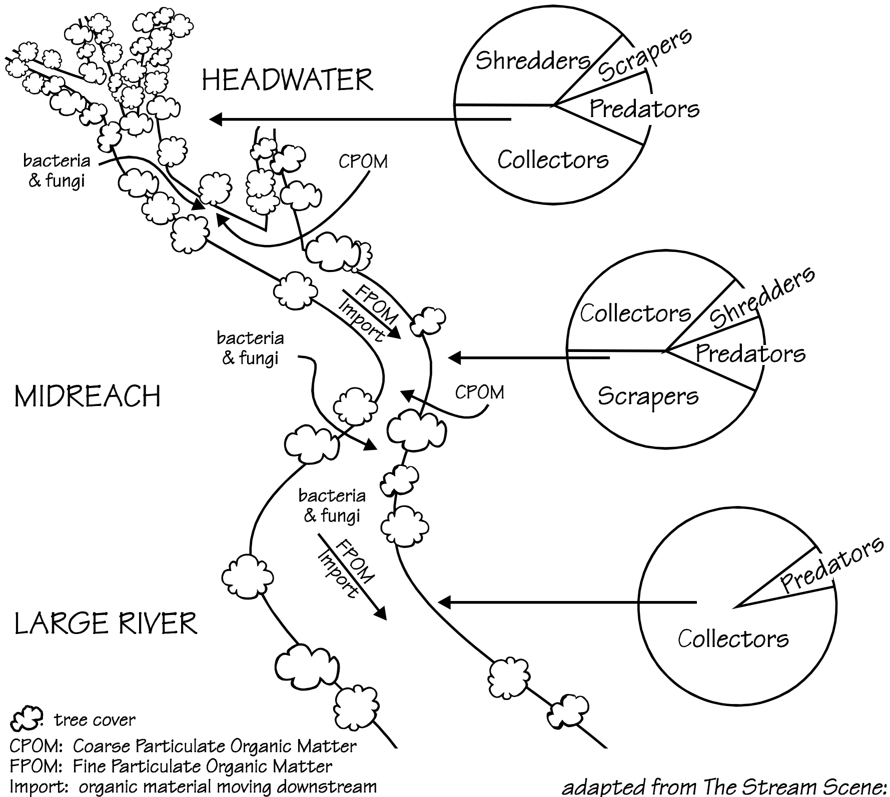
Gradient, stream flow, bottom composition, and streamside vegetation change as streams flow from headwaters, through mid-reaches, into large rivers. These changes in habitat affect plant and animal species in streams, and changes in these species in turn alter the types of food available within the food web.

Invertebrates are classified as shredders, collectors, scrapers, or predators, depending on how they feed. Table 1 describes food, habitat, and some examples of each feeding type. The table is simplified, in that there are thousands of species of invertebrates. Feeding types are not consistent, even within families or genera. However, recognizing the major feeding types in a sample provides useful information about the stream. A good diversity of species and feeding types suggests a healthy stream.

TABLE 1
Feeding Types, Food Sources and Habitats of Stream Invertebrates

FOOD SOURCE	PREFERRED HABITAT	EXAMPLES
SHREDDERS		
leaves, needles, twigs which have had some bacterial decomposition (coarse particulate organic material, CPOM)	shaded headwaters, variety of streamside vegetation indicate good water quality	some stonefly nymphs, some caddisfly larvae
COLLECTORS		
fine particulate organic material from upstream (FPOM ,<1 mm size, e.g. faecal pellets, algae, bacteria, animal and plant fragments)	most abundant in mid-reaches, also in headwater areas; species such as worms are common in large rivers mayflies and caddisflies indicate good water quality; some midges and worms tolerate a wide range of conditions, including organic pollution	FILTERERS :blackfly larvae, clams, some caddisfly larvae <u>or</u> GATHERERS: some mayfly nymphs, midge larvae, some caddisfly larvae, worms
SCRAPERS		
graze on algae, bacteria, and fungi on stream bottom	areas favourable to algal growth: less shaded midreaches, headwater areas during spring and autumn when leaves are off trees	some mayfly nymphs, some caddisfly larvae, snails, water penny
PREDATORS		
small insects	anywhere there is prey	cranefly larvae, some caddisfly larvae; some stonefly nymphs, dragonfly and damselfly nymphs; crayfish, leeches

Figure 3:
Changes in the Aquatic Invertebrate Community as a Stream Widens



adapted from The Stream Scene: Watersheds, Wildlife and People, Oregon dept. of Fish & Wildlife

Figure 3 shows the "stream continuum" model. Dr. K. W. Cummins developed this model to predict changes that occur naturally in the invertebrate community. As with any model, there are exceptions. Generally, water volume and amounts of particulate matter, nutrients, and dissolved substances increase as a stream flows downstream. Gradient and substrate size decrease downstream, as does the importance of streamside vegetation as food. The highest species diversity occurs in the mid-reaches, where there are many food sources and habitat types.

POLLUTION TOLERANCE

Invertebrate communities provide an accurate reflection of stream health because individual species are suited to particular environmental conditions. Invertebrates die or flourish in response to changing water quality conditions. Many insect species require good water quality, especially the larvae of caddisflies, mayflies, and stoneflies. These species require clear, clean, well-oxygenated water, as do salmon and trout. Other insect larvae and aquatic worms tolerate a wider range of environmental conditions. Appendix 1 describes the pollution tolerance of many common types of invertebrates.

Shortcut Sampling Procedure

This alternate method is useful if you are interested in a quick look at invertebrates in a stream. However, many organisms, including those that live deeper in the stream bed are overlooked. Choose a shallow riffle area with moderately fast flow and stones about 5 to 25 cm in diameter. Pick up several rocks and brush or rub the surfaces into a small bucket of water. Pick up the invertebrates carefully with a spoon or eye dropper and examine them. Use the Identification Chart in Appendix 1 to identify them and sort them into pollution tolerance categories. Return the invertebrates, unharmed, to the stream. If most organisms you examine are pollution intolerant, your site probably is healthy. If there are very few pollution intolerant organisms, your site probably has some problems. The complete sampling procedure described below is better for answering these questions.

Complete Sampling Procedure

SELECT THE SAMPLING STATION(S)

Sample invertebrates at any reference sites you have established in Module 2, the Advanced Habitat Survey. If you have not established reference sites already, consider the purpose of your study when you choose sampling locations. For example, establish two or more stations to study the impact of a suspected pollution problem. Sample at an upstream control site, a site within the impact area, and further downstream, if possible, to check for recovery. When you sample more than one station on a stream, start downstream and work your way upstream. If you are interested in a general survey or long term monitoring, you will want to establish a reference site (Module 2).

Consider safety, stream conditions, and location of fish spawning habitat when you choose the sampling location. Do not sample near bridges, obstructions, or artificially modified areas, unless you are interested in these areas specifically. Avoid salmonid redds, which are elliptical depressions of newly cleaned gravel.

Sample a shallow riffle area with moderately fast flow and cobble substrate (rocks 5 to 25 cm in diameter). Choose an area typical of the riffles in this part of the stream. You will take three 30 cm by 30 cm (1 ft2) samples at each sampling station.

Describe your site on the Locations and Conditions section of the Data Sheet. Include stream name, date, station location, air and water temperatures, and recent weather conditions.

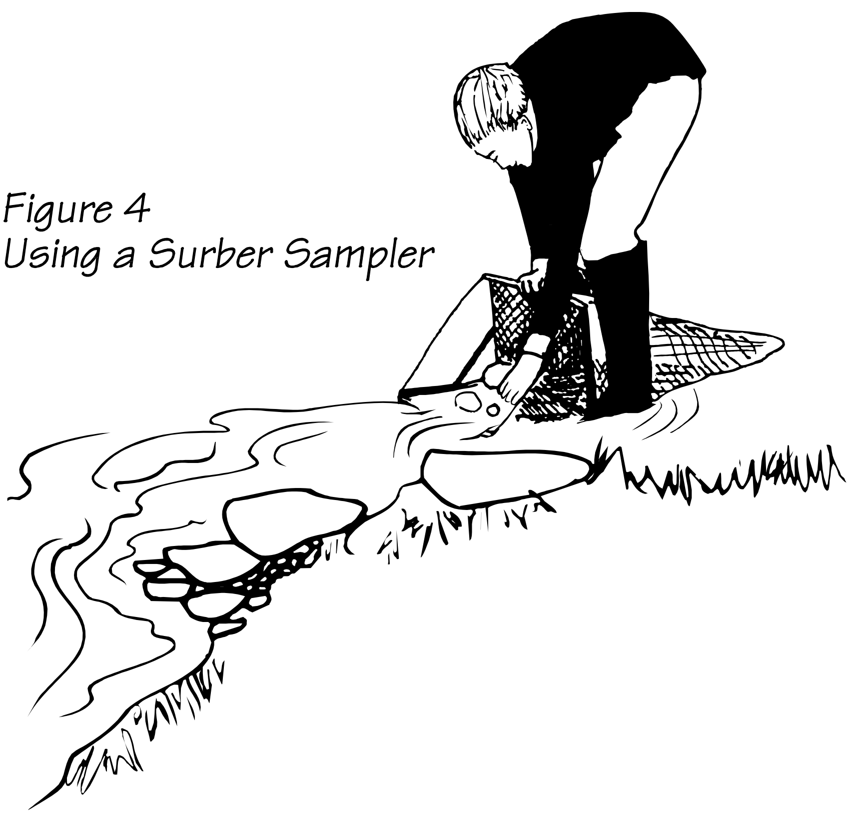
COLLECT THE SAMPLES

Approach the first sampling area from downstream. Do not disturb the sampling area by walking in it or upstream of it. Place the Surber sampler or D-net on the downstream edge of the sample area, so the opening faces into the flow. Push the frame a little way into the stream substrate. If you use a D-net you will need to measure the sampling area. The D-net is 30 cm wide (1 foot), so you can use it to measure the four sides of a 30 cm by 30 cm sampling area. Use large boulders to mark the corners of the square. The Surber sampler encloses an area 30 cm x 30 cm or 1 ft2 in size. Figure 4 shows a surber sampler.

Brush all stones and debris 5 cm or larger within the sampling area. Pick up a stone, hold it under water in front of the net and rub it gently with a brush or your hands. The loosened invertebrates will be swept into the net. Place the cleaned rocks outside the sampling area. Starting at the upstream end, gently agitate the streambed to a depth of 2 to 5 cm to loosen any remaining invertebrates.

Take the net to stream bank and turn it inside out in a bucket, half full of cool stream water. Transfer the invertebrates and debris into the bucket by carefully rinsing or shaking the net, then scraping it with a plastic spoon. Gently pick off organisms that cling to the net. Handle them carefully to avoid injuring them and keep them in the shade. Make sure the entire sample is in the bucket. Check larger pieces of debris in the bucket for bugs, then discard the debris.

Figure 4
Using a Surber Sampler



Take two more samples and combine them with the first one. Analyse and report the results for the three combined samples. Invertebrates are not distributed evenly in streams, so, even at one station, you can expect to find some samples with very few invertebrates and others with many.

IDENTIFY AND COUNT THE INVERTEBRATES

Sort the sample:

Pour some invertebrates from the bucket into a shallow white tray of water. Fill the compartments of two ice cube trays with stream water. Handle the invertebrates gently with tweezers, spoons, or eye droppers. Many will be active. Sort them into separate compartments of the ice cube trays based on obvious differences in appearance. Continue sorting until there are no invertebrates left in the bucket.

Identify the invertebrates:

Use the Invertebrate Field Identification Chart in Appendix 1 to identify the organisms. Appendix 2 contains a key to invertebrates, for those people who are familiar with keys. Figure 5 illustrates the terms for various parts of their bodies. The chart identifies major taxa or groups (classes, orders, families), not species. There are thousands of species and most are difficult to identify. Taxon (plural taxa) is a general term referring to identifiable groups like species, genera, families, orders, or classes. Two different looking organisms usually are different taxa, although sometimes they are two life stages (e.g., larva, pupa) of the same species.

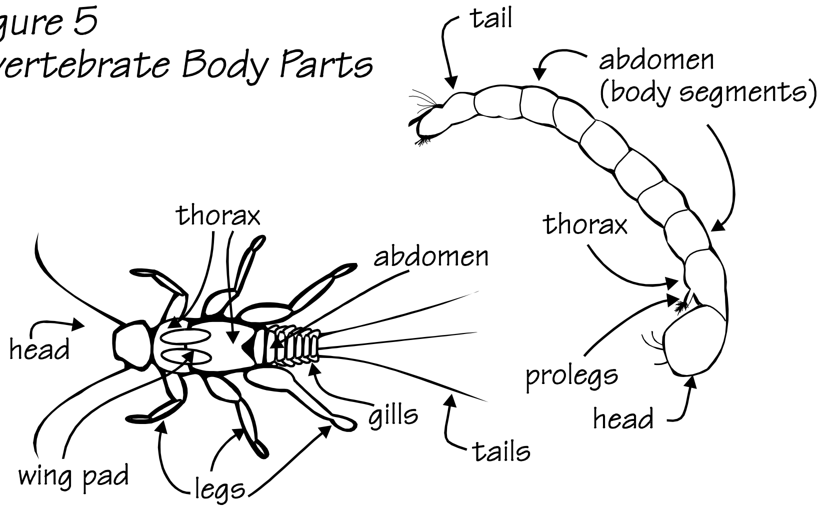
Within each broad taxonomic group, distinguish as many kinds of organisms as possible, based on appearance. For example, there may be a few obvious types of caddisflies in a sample. You do not need to name them, just recognize them as different. Use a hand lens (10X magnification) or magnifying glass to examine small organisms.

Count the invertebrates:

Record the numbers counted (Column B) and the number of identifiable taxa (Column C) for each broad taxonomic group on the Invertebrate Survey Field Data Sheet. Record the total number and calculate the density (number per m2) in Part A of the Interpretation Sheet. Record the most abundant or predominant taxon in Part B. Return the organisms to the area of the stream you sampled. Occasionally, you may want to preserve a sample for future analysis or teaching, but we usually do not recommend it. To prepare a sample, remove as much water as possible and add concentrated isopropyl or ethyl alcohol to make a 70% solution of alcohol in water. Transfer the sample to a labeled bottle.

You can use a tray marked with a grid on it if you find high

Figure 5
Invertebrate Body Parts



numbers of one type of organism in the sample. First, remove all the different looking invertebrates, then spread the remaining ones on the gridded tray. Examine a few grid squares and count the average number of individuals per square. Multiply the average number per square by the total number of squares on the tray to get the total number.

ASSESS THE WATER QUALITY

Pollution Tolerance Index:

The Identification Chart and Field Data Sheet (Column A) categorize the broad taxonomic groups according to their tolerance of organic pollution. Category 1 includes pollution sensitive species found only in high quality water. Category 2 includes species that tolerate some pollution and are found in high or fair quality water. Category 3 includes pollution tolerant species that are found in a wide range of conditions. Find the number of broad taxonomic groups in Column D in each Pollution Tolerance Category. Record the numbers in Part C of the Interpretation Sheet. Calculate the water quality rating using the formula provided in that section.

EPT Index:

Members of the insect groups Ephemeroptera, Plecoptera, and Trichoptera (mayflies, stoneflies, caddisflies, or EPT) often are grouped together because they all require clean water. Calculate the total number of EPT taxa (from column C, Field Data Sheet) and record the total as the EPT index in Part C of the Interpretation Sheet. Use caution to interpret your results, since results can be biased: experienced workers can distinguish more taxa than inexperienced ones.

EPT To Total Ratio:

This is the total number of EPT organisms counted (column B, Field Data Sheet), divided by the total number of all invertebrates counted. Write the value in Part C of the Interpretation Sheet.

Assess Diversity:

Streams with good habitat and water quality have high diversity (many taxa). Low diversity (very few taxa) in a stream may suggest water quality or habitat problems. However, there are exceptions, such as pristine alpine streams with very few species and low food supply. Record the total number of taxa (bottom of Column C, Field Data Sheet) in Part D of the Interpretation Sheet.

Predominant Taxon Ratio:

The predominant taxon is the group with the highest number of organisms. Divide the number of organisms in the predominant taxon by the total number counted (Column B of the Field Data Sheet). Record this value in Part D of the Interpretation Sheet.

Assess the Site:

Assign a score of 1 (poor) to 4 (good) to each water quality and diversity index or ratio, using Part E of the Interpretation Sheet. Add the numbers and calculate the average. This average gives a general rating of stream health at the site, from 1 (poor) to 4 (good). Sometimes individual indices or ratios may suggest contradictory stream conditions. The general site rating helps even out such results. For example, both species presence and water quality measurements may show good water quality conditions, while species diversity may be low because of physical problems.

Collecting, Reporting, and Evaluating Information

Send copies of your results to the Streamkeepers Database. The current address is in the Handbook.

Invertebrate surveys detect moderate to severe degradation of stream habitat. Table 2 lists common responses to pollution. For example, organic pollution usually results in low numbers of pollution-sensitive organisms and high numbers of a few species of pollution-tolerant species.

Information collected from several locations in the area provides baseline data that can help you identify habitat concerns and choose appropriate restoration projects. When you survey the same stations over several years, you can recognize changes in water quality. If the results of your invertebrate survey are inconclusive or suggest poor conditions, you may wish to examine habitat (Module 2) and water quality (Module 3) to find answers to the problem.

Before you react strongly to evidence of poor water quality, remember that your survey uses simplified versions of scientific techniques. Although the results of your tests usually are reliable, there are exceptions to any rule. Sometimes stream conditions appear abnormal, but are natural in a particular area. Make sure you have reliable background data to compare with data from problem sites.

TABLE 2
Correlating Invertebrate Data with Sources of Pollution.

WARNING SIGN	PROBLEM
high diversity, lots of pollution sensitive invertebrates	no problem, good water quality
low diversity, high numbers, lots of scrapers and collectors	organic enrichment/pollution or lots of algal growth resulting from nutrient enrichment
high diversity and low numbers; or no insects, but the stream appears clean	toxic pollution (e.g. chlorine, acids, heavy metals, pesticides, oil) or another severe problem of unknown origin
reduced numbers of all types of invertebrates	physical problem (e.g., downstream of dam, sediment from erosion) or sometimes streams are unproductive for natural reasons (glacier-fed streams, spring-fed streams)

References And Useful Resources

Adopt-A-Stream Foundation. 1991. *Streamkeeper's Field Guide: Watershed Inventory and Stream Monitoring Methods, Macroinvertebrate Survey.* Everett, WA

Friends of Environmental Education Society of Alberta. 1990. *Adopt-A-Stream Aquatic Invertebrates: Identification Key to River Invertebrates.* Edmonton, AB.

Kellogg, L.L. 1992. *Save Our Streams: Monitoring Guide to Aquatic Macroinvertebrates.* Izaak Walton League of America, Arlington, VA.

Merritt, R.W. and K.W. Cummins (editors). 1984. *An Introduction to the Aquatic Insects of North America*. Kendall/Hunt, Inc., Dubuque, Iowa. 722 pp.

Oregon Department of Fish and Wildlife. 1990. *The Stream Scene: Watershed, Wildlife and People*. Portland, OR

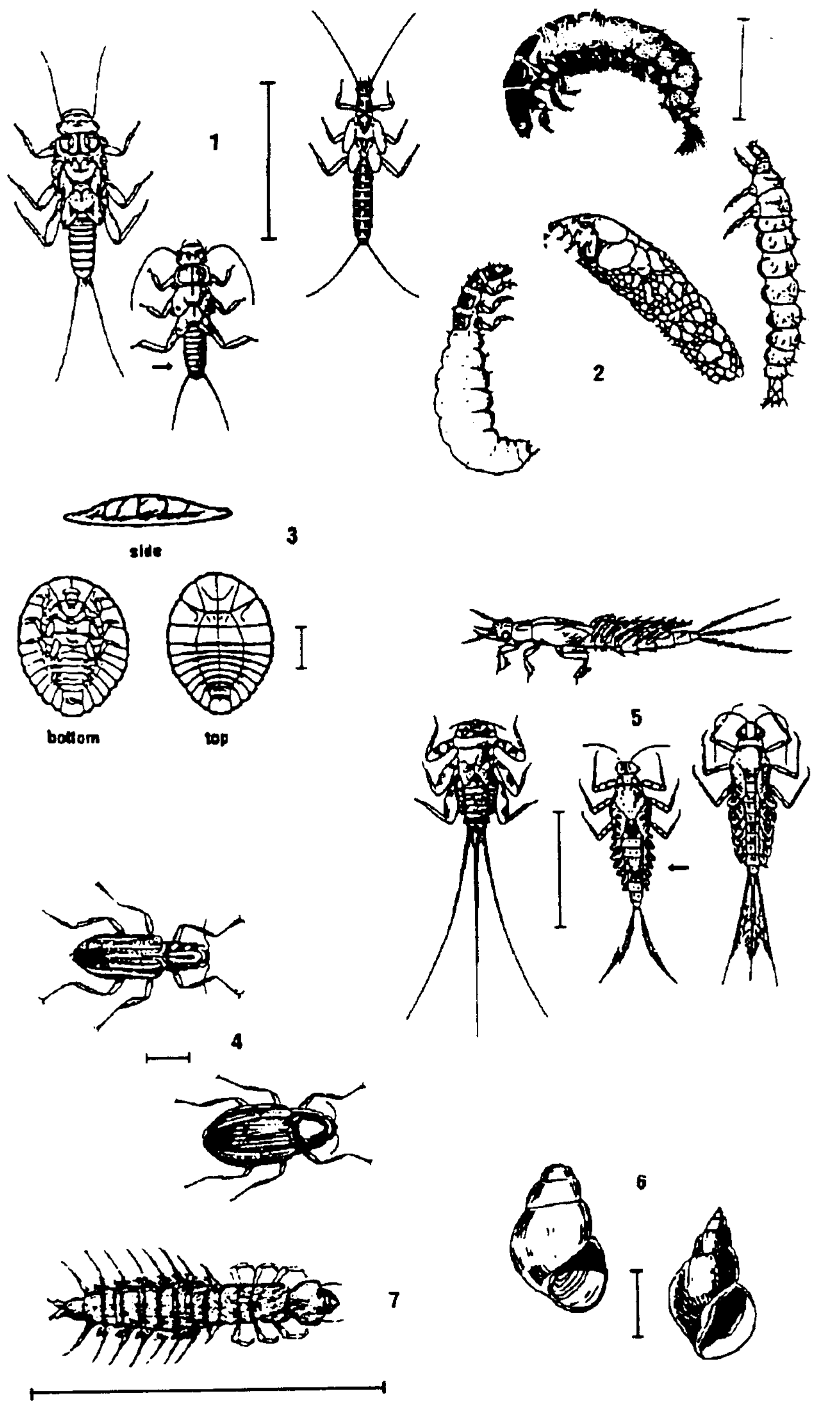
Appendices

Appendix 1: Invertebrate Field Identification and Pollution Tolerance

Appendix 2: Key to Invertebrate Groups

Appendix 1
Field Identification and Pollution Tolerance Chart

adapted from Save our Streams, Izaak Walton League of America



1 Stonefly:
Order Plecoptera
1/2" - 1 1/2", 6 legs with hooded tips, antennae, 2 hair-like tails. Smooth (no gills) on lower half of body. (see arrow)

2 Caddisfly:
Order Trichoptera
up to 1", 6 hooked legs on upper third of body, 2 hooks at back end. May be in a stick, rock or leaf case with its head sticking out. May have fluffy gill tufts on lower half.

3 Water Penny:
Order Coleoptera
1/4", flat saucer-shaped body with a raised bump on one side and 6 tiny legs on the other side. Immature beetle.

4 Riffle Beetle:
Order Coleoptera
1/4", oval body covered with tiny hairs, 6 legs, antennae. Walks slowly underwater. Does not swim on surface.

5 Mayfly:
Order Ephemeroptera
1/4 - 1", brown, moving, plate-like or feathery gills on sides of lower body (see arrow) 6 large hooked legs, antennae, 2 or 3 long, hair-like tails. Tails may be webbed together.

6 Gilled Snail:
Class Gastropoda
Shell opening covered by thin plate called operculum. Shell usually opens on right.

7 Dobsonfly (Helgrammite):
Family Corydalidae
3/4 - 4", dark coloured, 6 legs, large pinching jaws, 8 pairs feelers on lower half of body with paired cotton-like gill tufts along underside, short antennae, 2 tails and 2 pairs of hooks at back end.

BAR INDICATES RELATIVE SIZE

Category One Taxa

Pollution sensitive organisms found in good quality water

Appendix 1
Field Identification and Pollution Tolerance Chart, *(continued)*

8 Crayfish: Order Decapoda
Up to 6", 2 large claws, 8 legs, resembles small lobster.

9 Sowbug: Order Isopoda
1/4 - 3/4", gray oblong body wider than it is high, more than 6 legs, long antennae.

10 Scud: Order Amphipoda
1/4", white to grey, body higher than it is wide, swims sideways, more than 6 legs, resembles small shrimp.

11 Alderfly larva: Family Sialidae
1" long, looks like small hellgrammite but has 1 long, thin, branched tail at back end (no hooks). No gill tufts underneath.

12 Fishfly larva: Family Corydalidae
Up to 1 1/2", looks like small hellgrammite but often a lighter reddish-tan colour, or with yellowish streaks. No gill tufts underneath.

13 Damselfly: Suborder Zygoptera
1/2 - 1", large eyes, 6 thin hooked legs, 3 broad oar-shaped tails, positioned like a tripod. Smooth (no gills) on sides of lower half of body (see arrow).

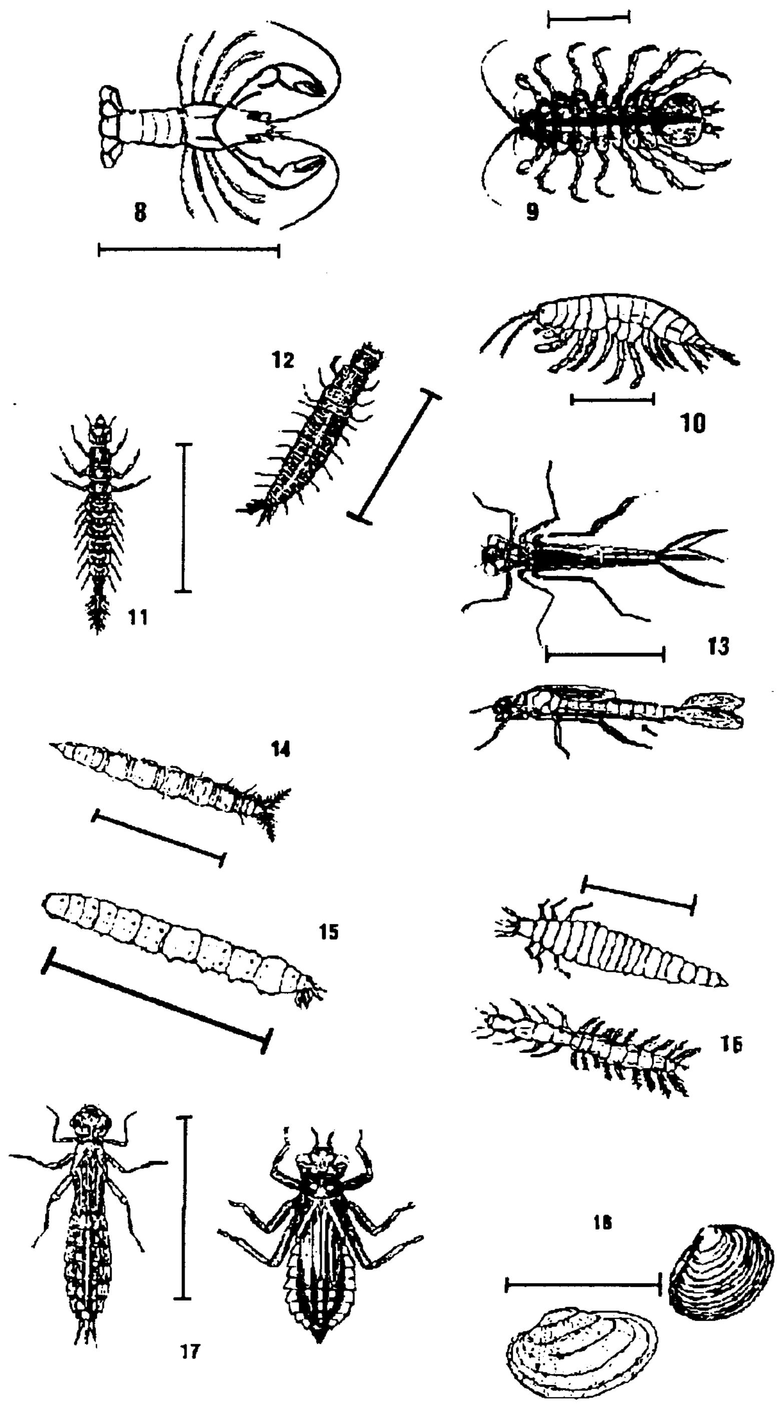
14 Watersnipe Fly Larva: Family Athercidae (Atherix)
1/4 - 1", pale to green, tapered body, many caterpillar-like legs, conical head, feathery "horns" at back end.

15 Crane Fly: Suborder Nematocera
1/3 - 2", milky, green, or light brown, plump caterpillar-like segmented body, 4 finger like lobes at back end.

16 Beetle Larva: Order Coleoptera
1/4 - 1", light-coloured, 6 legs on upper half of body, feelers, antennae.

17 Dragon Fly: Suborder Anisoptera
1/2 - 2", large eyes, 6 hooked legs. Wide oval to round abdomen.

18 Clam: Class Bivalvia

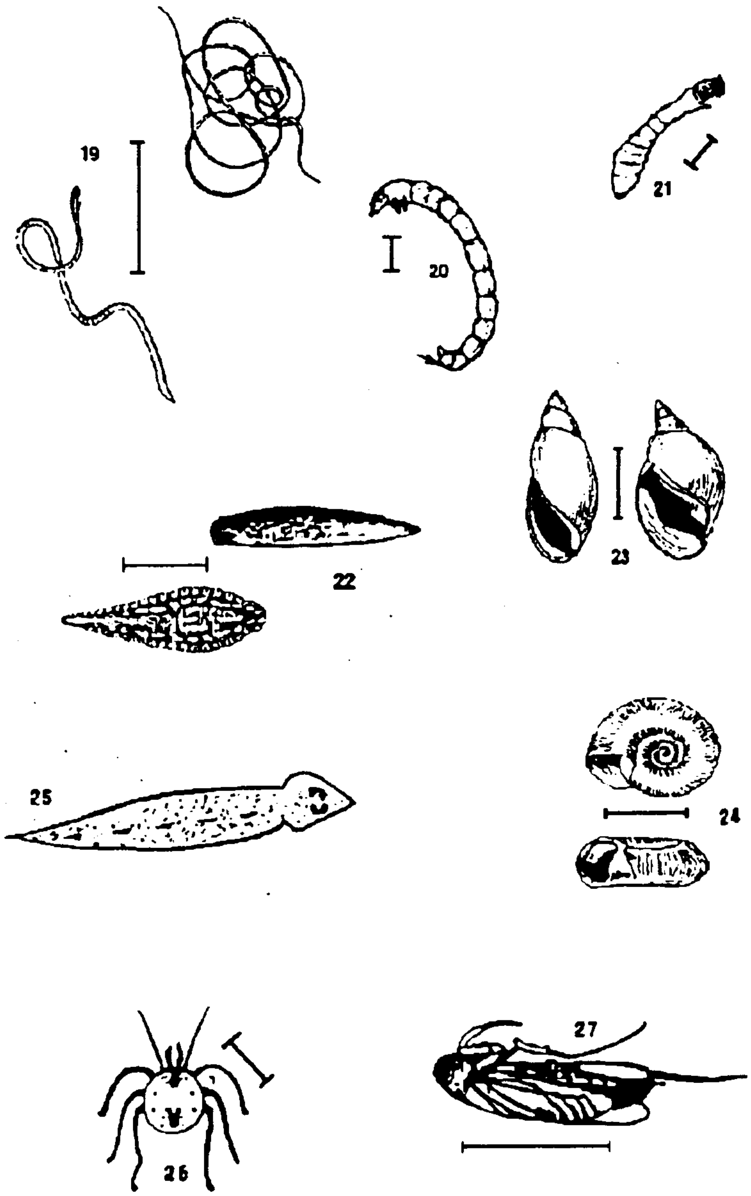


BAR INDICATES RELATIVE SIZE

Category Two Taxa

Somewhat pollution tolerant organisms can be in good or fair quality water

Appendix 1
Field Identification and Pollution Tolerance Chart, *(continued)*



19 Aquatic Worm:
Class Oligochaeta
1/4 - 2", can be very tiny, thin worm-like body.

20 Midge Fly Larva:
Suborder Nematocera
Up to 1/4", dark head, worm-like segmented body, 2 tiny legs on each side.

21 Blackfly Larva:
Family Simulidae.
Up to 1/4", one end of body wider. Black head, suction pad on end.

22 Leech:
Order Hirudinea
1/4 - 2", brown, slimy body, ends with suction pads.

23 Pouch Snail and Pond Snails: Class Gastropoda
No operculum. Breathe air. Shell usually opens on left.

24 Other Snails:
Class Gastropoda
No operculum. Breathe air. Snail shell coils in one plane.

25 Planarian:
Class Turbellaria
Flattened, unsegmented worm-like body, may have distinct eyespots, gliding movement.

26 Water Mite:
Order Hydracarina
Looks like spider, may be very tiny, has 8 legs.

27 True Bug Adult:
Order Hemiptera
Has short legs, swims or dives quickly.

Category Three Taxa

Pollution tolerant organisms can be in any quality of water

BAR INDICATES RELATIVE SIZE

Appendix 2: Key To Invertebrate Groups

This key was adapted from the Adopt-A-Stream Program, Everett, Washington

1a Segmented legs..go to 2

1b no segmented legs....................................go to 14

2a 6 legs..go to 3

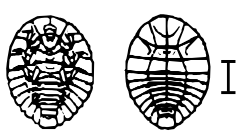
2b more than 6 legs.......................................go to 23

3a no wings, or wings not fully developed and do not cover abdomen completely on back side ....go to 4

3b wings cover abdomen; beetle-like body ....go to 26

4a body longer than it is wide ....go to 5

4b body oval and flat; head and legs totally concealed beneath.........................WATER PENNY ....(Order Coleoptera, Family Psephenidae)
scraper

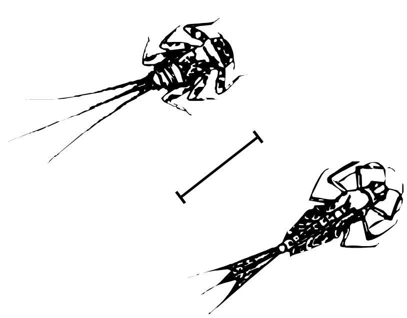


waterpenny

5a 2 or 3 distinct hairlike tails, not hooked, may be fringed with hairs.................................go to 6

5b not as above..go to 7

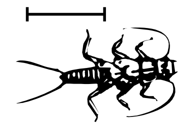
6a 2-3 tails; plate or hairlike gills along sides of abdomen....................................MAYFLY NYMPH ....(Order Ephemeroptera)
flattened - scraper
torpedo-shaped; hairs on front legs - filtering collector
torpedo-shaped; no hairs on front legs - gathering collector



mayfly larva (collectors - filtering or gathering)

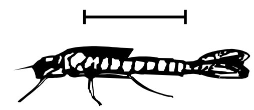
BAR INDICATES RELATIVE SIZE

6b 2 tails; may have hairy gills under thorax.......... ....STONEFLY NYMPH ....(Order Plecoptera)
dark and uniformly coloured, sluggish - shredder
brightly coloured or mottled, very active - predator



stonefly

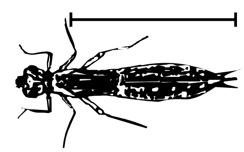
7a 3 oar-shaped tails; no gills along abdomen ....DAMSELFLY NYMPH ....(Order Odonata, Suborder Zygoptera)
predator



damselfly larva

7b not as above...go to 8

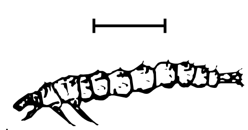
8a fat abdomen; large eyes, mask-like lower lip ....DRAGONFLY NYMPH ....(Order Odonata, Suborder Anisoptera)
predator



dragonfly larva

8b not as above...go to 9

9a may be hiding in a case made of gravel or plant parts; abdomen ends in pair of prolegs which may be hidden by hairs, each has single hook on end, sometimes fused together ....CADDISFLY LARVA ....(Order Trichoptera)
free living, head narrower than thorax - predator



caddisfly larva - predator

net spinning; if separated from net, will appear free-living, but head as wide as thorax - filtering collector

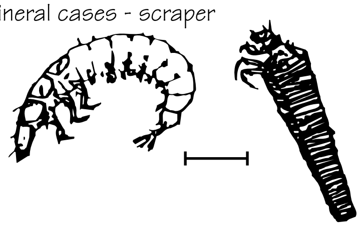
case organic (leaf, stick, etc.) and square, no bark or flat pieces included - filtering collector

case organic, long, slender, tapered - gathering collector

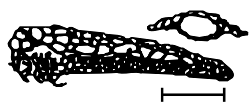
case mineral (sand or gravel); long, slender, tapered or oval and flattened - gathering collector

all other organic cases - shredder

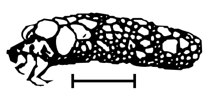
all other mineral cases - scraper



caddisfly larva (filtering collector)



caddisfly larva (gathering collector)

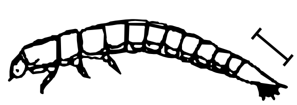


caddisfly larva (scraper)

9b not as above...go to 10

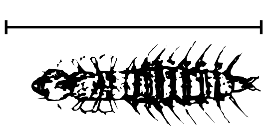
10a well developed lateral filaments extend from abdominal segments..................................go to 11

10b no lateral filaments along abdomen; body is hardened and stiff; lip of abdomen has ventral operculum with hooks and filaments ....RIFFLE BEETLE LARVA ....(Order Coleoptera, Family Elmidae)
gathering collector



riffle beetle larva

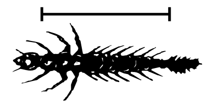
11a fluffy or branched gill tufts under abdomen ...........HELLGRAMMITE or DOBSONFLY LARVA ....(Order Megaloptera, Family Corydalidae)
predator



dobsonfly larva

11b not as above...go to 12

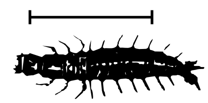
12a abdomen ends in single, unforked, long hair-like tail................................ALDERFLY LARVA ....(Order Megaloptera, Family Sialidae)
predator



alderfly larva

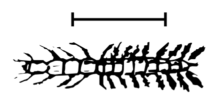
12b not as above...go to 13

13a abdomen ends in a pair of prolegs, each with 2 hooks...FISHFLY LARVA ....(Order Megaloptera, Family Corydalidae)
predator



fishfly larva

13b not as above.............AQUATIC BEETLE LARVA ....(order Coleoptera)
predator

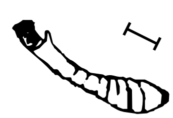


aquatic beetle larva

14a (from 1b), distinct head, body <1.2 cm long ....go to 15

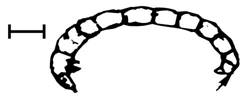
14b no distinct head...................................go to 16

15a body widens at bottom end, may be attached to substrate, dark head ....BLACKFLY LARVA ....(Order Diptera, Family Simuliidae)
filtering collector



blackfly larva

15b both ends of body about the same width; tiny pair of prolegs under head and at tip of abdomen...MIDGE LARVA
..................(Order Diptera, Family Chironomidae)
gathering collector

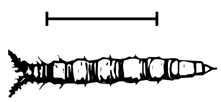


midge larva

16a caterpillar-like body................................go to 17

16b body not caterpillar-like.......................go to 18

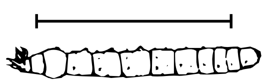
17a two feathered "horns" at back end, caterpillar like legs . WATERSNIPE FLY LARVA
......................(Order Diptera, Family Athericidae)
predator



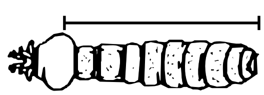
watersnipefly larva

17b may be up to 10 cm long; fleshy, finger-like extensions from one end
....CRANEFLY LARVA
............................(Order Diptera, Family Tipulidae)
well developed extensions, last segment not swollen - shredder

poorly developed extensions or last segment swollen - predator



cranefly larva (shredder)

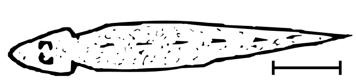


cranefly larva (predator)

18a body without hard shell..........................go to 19

18b body with hard shell................................go to 21

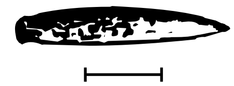
19a flattened, unsegmented worm-like body; may have distinct eyespots, gliding movement
....PLANARIAN
....(Class Turbellaria)
parasite or predator



planarian

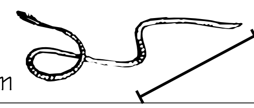
19b segmented body.....................................go to 20

20a flattened body with suckers at each end
....LEECH
....(Class Hirudinea)
parasite or predator



leech

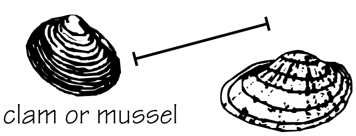
20b long earthworm or threadlike body
....AQUATIC WORM
....(Class Oligochaeta)
gathering collector



aquatic worm

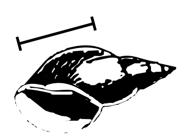
21a snail like..go to 22

21b body enclosed in two hinged shells
.........................FRESHWATER CLAM OR MUSSEL
....(Class Bivalvia)
filtering collector



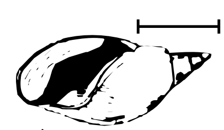
freshwater clam or mussel

22a has plate-like cover over opening; when spire is pointed up and opening faces you, opening usually is on right...........................GILLED SNAIL
....(Class Gastropoda)
scraper



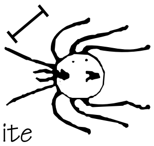
gilled snail

22b no plate-like cover over opening; when spire is pointed up and opening faces you, opening usually is on left
............................PULMONATE or LUNGED SNAIL
....(Class Gastropoda)
scraper



pulmonate or lunged snail

23a (from 2b), looks like spider, may be very tiny, has 8 legs..WATER MITE
.................(Class Arachnida, Order Hydracarina)
predator

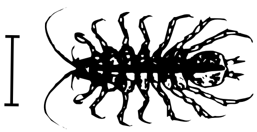


water mite

23b not as above...go to 24

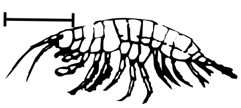
24a lobster or shrimp-like.............................go to 25

24b armadillo-shaped body, wider than high; crawls slowly on bottom
....AQUATIC SOWBUG
...............(Subphylum Crustacea, Order Isopoda)
shredder



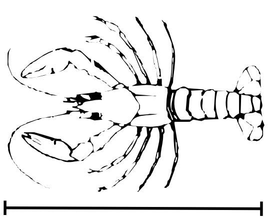
aquatic sowbug

25a looks like tiny shrimp; swims quickly on its side...SCUD
........(Subphylum Crustacea, Order Amphipoda)
shredder



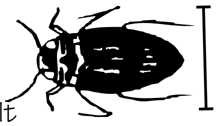
scud

25b looks like small lobster; 2 large front claws (10 legs total)..CRAYFISH
...........(Subphylum Crustacea, Order Decapoda)
predator



crayfish

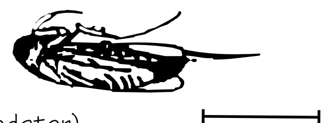
26a (from 3b), short legs, swims or dives quickly
....BEETLE ADULT
....(Order Coleoptera)
predator



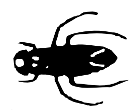
beetle adult

26b not as above...go to 27

27a longer legs, swims quickly
....TRUE BUG ADULT
....(Order Hemiptera)
swims on back - predator
swims on front, oar-like legs - shredder

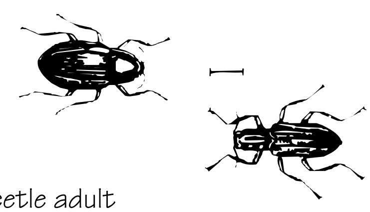


true bug adult (predator)



true bug adult (shredder)

27b beetle-like, crawls slowly on bottom..................
....RIFFLE BEETLE ADULT
....(Order Coleoptera)
scraper



riffle beetle adult

send the data to: Streamkeepers Database, Department of Fisheries and Oceans,
Suite 400, 555 W. Hastings Street, Station 321, Vancouver, B.C. V6B 5G3
fax to (604) 666-0292

Stream Location and Conditions

(use a new data sheet for each stream segment surveyed) **Module 4**

Stream Name/Nearest Town	Date Watershed code
Organization Name	Stream Segment # Stream Section #
Contact Name	Phone #

Survey Location

Mapsheet number	Type	Scale
Location (distance from known stream landmark)		
Time:______ Weather	‘ clear ‘ overcast	‘ shower (1-2.5 cm in 24 hr) ‘ storm (<2.5 cm in 24 hr) ‘ snow ‘ rain on snow
Water turbidity (cm visibility)	Temperature ^{o}C (leave thermometer 2 min.) air ___________ water _______________	
Bankfull Channel width __________(m)	depth _____________(m)	
Wetted Channel width __________(m)	depth _____________(m)	

First and Last Measurements taken .1 m from streambank edge

Left Bank									**Right Bank**
Wetted Depth									Wetted Depth
Bankfull Depth									Bankfull Depth

Take measurements every 0.5m in streams less than 5m. wide, every 1m in streams 5 to 15m.

send the data to: Streamkeepers Database

Invertebrate Survey Field Data Sheet

(use a new data sheet for each stream section surveyed) **Module 4**

Stream Name	Date
Stream Segment # Stream Section #	Sampling location
sampler used, mesh size, total area sampled	# of 30cm x 30cm samples

COLUMN A **Pollution Tolerance**	**COLUMN B** **Number Counted**	**COLUMN C** **Number of Taxa**	**COLUMN D** **Common Name**
CATEGORY 1 **(pollution intolerant)**			Caddisfly Larva (**EPT**)
			Dobsonfly (hellgrammite)
			Gilled Snail
			Mayfly Nymph (**EPT**)
			Riffle Beetle
			Stonefly Nymph (**EPT**)
			Water Penny
Sub-total			
CATEGORY 2 **(somewhat tolerant of pollution)**			Alderfly Larva
			Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
			Cranefly Larva
			Crayfish
			Damselfly Larva
			Dragonfly Larva
			Fishfly Larva
			Scud
			Watersnipe Larva
Sub-total			
CATEGORY 3 **(pollution tolerant)**			Aquatic Worm
			Blackfly Larva
			Leech
			Midge Larva (chironomid)
			Planarian
			Pouch and Pond Snails
			True Bug Adult
			Water Mite
Sub-total			
TOTAL			

send the data to: Streamkeepers Database

Invertebrate Survey Interpretation Sheet

(use a new data sheet for each stream section surveyed) **Module 4**

Stream Name	Date
Stream Segment # Stream Section #	Sampling location
sampler used, mesh size, total area sampled	# of 30cm x 30cm samples

A) ABUNDANCE AND DENSITY

ABUNDANCE: total number of organisms from **Column B** =

DENSITY: invertebrate density per square meter

(total # counted) ÷ (# of 30cm x 30cm samples x.09m^2) =

__________ ÷ (__________) = _______

B) PREDOMINANT TAXON

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANCE INDEX: use the **total number of broad** taxonomic groups found in each tolerance category, from Field Data Sheet (**Column D**)

POLLUTION TOLERANT INDEX			
Good	**Acceptable**	**Marginal**	**Poor**
>22	22-17	16-11	<11

3 x (# of category 1)
\+ 2 x (# of category 2)
\+ (# of category 3) =

EPT INDEX: total number of **EPT** taxa from **Column C**, Field Data Sheet

EPT INDEX			
Good	**Acceptable**	**Marginal**	**Poor**
>8	5-8	2-5	0-1

EPT are stonefly, caddisfly and mayfly =

EPT TO TOTAL RATIO: total number of **EPT** organisms from **Column B**, Field Data Sheet divided by the total number of organisms

EPT TO TOTAL RATIO			
Good	**Acceptable**	**Marginal**	**Poor**
0.75 - 1.00	0.5 - 0.75	0.25 - 0.50	0 - 0.25

\# of **EPT** _______ ÷ total =

send the data to: Streamkeepers Database

Invertebrate Survey Interpretation Sheet

(use a new data sheet for each stream section surveyed) **Module 4**

Stream Name	Date
Stream segment # Stream section #	sampling location
sampler used, mesh size, total area sampled	# of 30cm x 30cm samples

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: from **Column C**, Field Data Sheet

PREDOMINANT TAXON RATIO: divide the **number** of invertebrate in the **predominant taxon** by the **total number of invertebrates** counted:

__________ ÷ ________ = ______

predominant total

PREDOMINANT TAXON RATIO			
Good	**Acceptable**	**Marginal**	**Poor**
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

E) SITE ASSESSMENT RATING:

Assign a rating between 1 and 4 to each index or ratio, then average the results to produce a general site assessment.

SITE ASSESSMENT RATING			
Good	**Acceptable**	**Marginal**	**Poor**
4	3	2	1

General Comments -
Unknown Bugs

SITE ASSESSMENT RATING	
Index or Ratio	**Rating**
Pollution Tolerance Index	
EPT Index	
EPT to Total Ratio	
Predominant Taxon Ratio	
Total	
Average	

see page 13 and 14 of Module 4 for further information