FIELD PROCEDURES FOR ANALYSIS OF FUNCTIONAL FEEDING GROUPS OF STREAM MACROINVERTEBRATES

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INTRODUCTION

Procedures outlined in this manual provide an approximate separation of stream macroinvertebrates into Functional Feeding Groups. The objective is to permit a quick initial assessment of the food base of a stream ecosystem by focusing on the functional roles played by the macroinvertebrates present. From 80 to 90% of the organisms encountered can be classified accurately in this way. But it definitely is not meant to replace the need for completing a thorough taxonomic and ecological study of any stream under investigation. For more detailed information relating taxonomy and functional groups see: R. W. Merritt and K. W. Cummins. 1984. An Introduction to the Aquatic Insects of North America. Kendall/Hunt Publishing Company, Dubuque, Iowa. 722 p.

Stream macroinvertebrates are separated into four broad Functional Feeding Groups. SHREDDERS are dependent on large pieces of organic matter such as leaves, needles, wood, and other plant parts derived primarily from the riparian zone. COLLECTORS utilize small particles of organic matter (generally less than 1mm in size), either by filtering from the passing water or gathering from deposits in the sediments on the stream bottom. SCRAPERS are adapted for removing attached algae, especially where it grows on rock or log surfaces in the current. PREDATORS are adapted through behavior and specialized body parts for the capture of prey. Because they feed somewhat non-selectively on all functional groups, they do not directly reflect the riparianinfluenced food base of a stream ecosystem.

The best seasons for conducting this analysis are mid winter through early spring, when individuals in the fall-winter populations are largest in size, and mid to late summer, when individuals in the summer populations are at maximum size.

PROCEDURES

Macroinvertebrates are sorted from qualitative samples representing three to five general habitat types. These habitat types should correspond approximately to the following basic categories of organic resources in stream ecosystems:

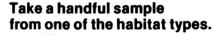
1) CPOM—Coarse Particulate Organic Matter (particles greater than 1mm in size). Litter accumulations of leaves, needles, bark, twigs, other plant parts, and coarse fragments of these materials.

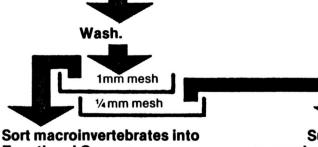
- 2) LARGE WOOD—Large branches and logs. If soft punky wood accumulations are present, this may constitute a distinct category separate from the other CPOM.
- 3) FPOM—Fine Particulate Organic Matter (particles less than 1mm and greater than 0.5μm in size).
- 4) PERIPHYTON—Predominantly attached algae (especially diatoms) on rock and wood surfaces.
- 5) ATTACHED VASCULAR PLANTS—Only if extensive plant beds or moss cover are present should this be considered a separate sampling category.

For each category to be analyzed, an amount of material equal to one large handful is collected. For example: 1) a handful of CPOM litter from a riffle or other well aerated site, 2) a 15-25cm (6-10 inch) section of soft waterlogged wood, 3) a handful of fine organic-rich sediment scooped from the top 2-3 cm (1 inch) of substrate in a pool or alcove (a dip net is useful here), 4) one or two large rocks about double fist size or larger, and 5) a large handful of rooted aquatic plants and/or moss.

The sample from each category is washed onto a 1mm mesh sieve nested on top of a ¼ mm mesh sieve. Tyler soil sieves can be used. Material from each sieve is washed into a separate enamel tray. Macroinvertebrates from the 1mm sieve are separated into Functional Groups according to the key below, individuals are counted, and numbers are recorded on the data sheet. A white multiple-cup muffin tin makes an excellent tray for holding material in categories prior to counting. Material on the ¼mm sieve is used to evaluate the relative abundance of animals so tiny that they may be overlooked when the sample is taken. A small portion (approximately 1/10) of this material is examined with a hand lens and the relative percentages of animals in each Functional Group are estimated. These estimates are recorded under Recruitment Factor (F) on the data sheet. Animals not easily classified by group should be categorized as Gathering Collectors because the early stages of many species initially belong in this group.

The key is organized in two levels of resolution. The first level can be achieved without taxonomic skill and permits accurate separation of 80-85% of the material. The second level of resolution may add another 5-10% by categorizing those macroinvertebrates that either do not seem to fit into first level groupings or are likely to be misclassified. The amount of taxonomic effort and skill required increases with the second level of resolution.





Sort macroinvertebrates in Functional Groups using the following key, and place in multiple depression trays or muffin tin. Subsample approximately 1/10 into small dish for observations using hand lens.



and totals on data sheet.



Shredders + total

Collectors + total

Shredders + Collectors

Scrapers + Collectors

Scrapers + total

Estimate percentage of total in each Functional Group (Recruitment Factor, F).

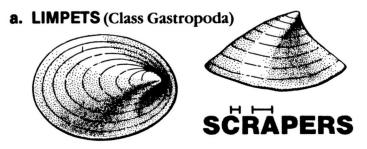
Enter on data sheet.

Filtering Collectors + Gathering Collectors.

KEY TO FUNCTIONAL FEEDING GROUPS

I indicates size or range of sizes

1. ANIMALS IN HARD SHELL (Phylum Mollusca)



b. SNAILS (Class Gastropoda)



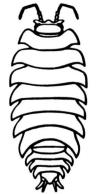
Snails are generalized (facultative) feeders and can also function as Shredders.

c. CLAMS OR MUSSELS (Class Pelecypoda)



2. SOW BUG OR SHRIMP-LIKE ANIMALS

(Class Crustacea)





SHREDDERS

Generalized, can also function as Gathering Collectors.

3. LARVAE IN PORTABLE CASE OR "HOUSE"

Go to page 6.

4. LARVAE IN FIXED RETREAT

WITH CAPTURE NET

Note: Care must be taken when collecting to observe nets.

Go to page 8.

5. WITHOUT CASE OR FIXED RETREAT

a. WORM-LIKE LARVAE

WITHOUT JOINTED LEGS

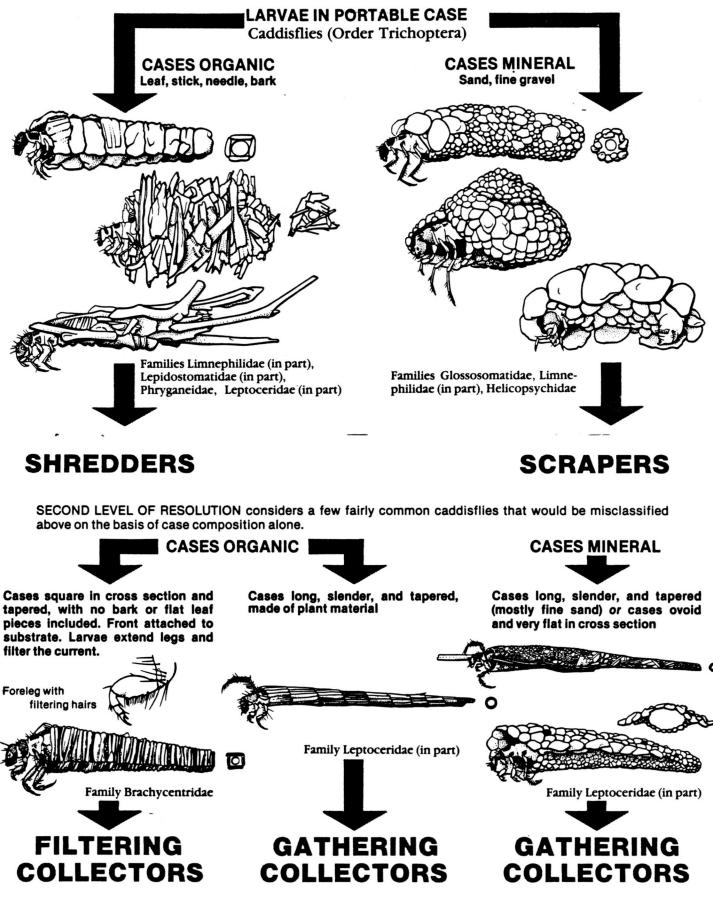
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b. NYMPHS OR ADULTS

WITH JOINTED LEGS

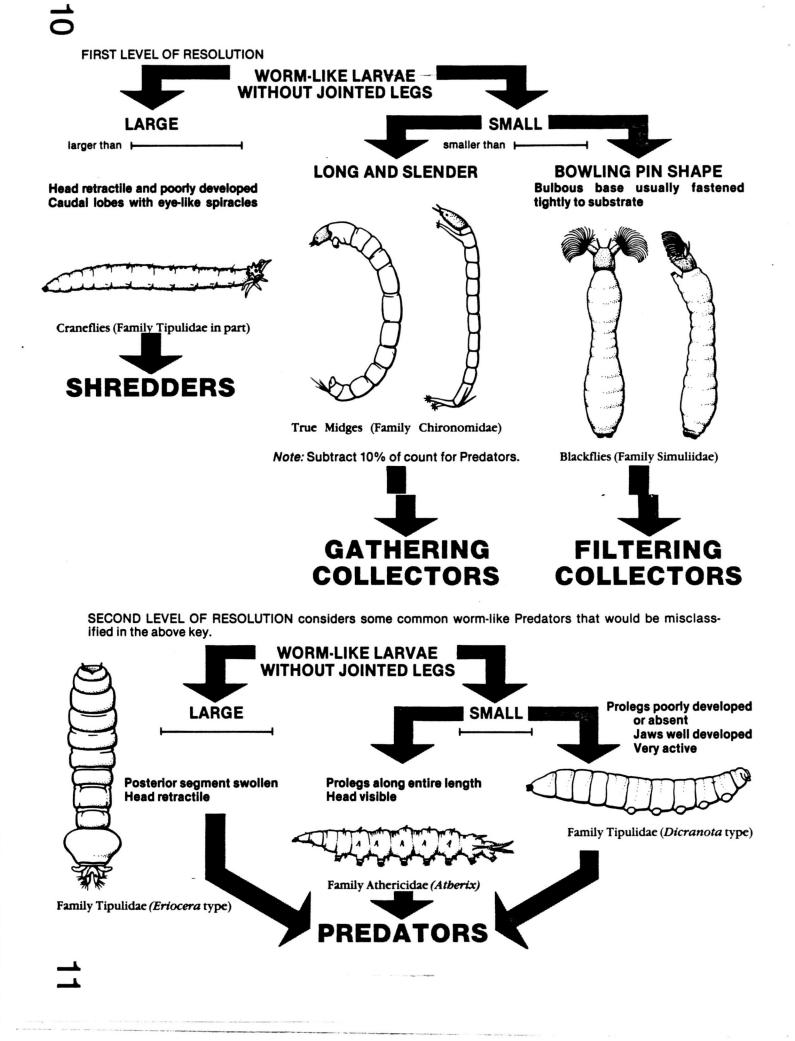
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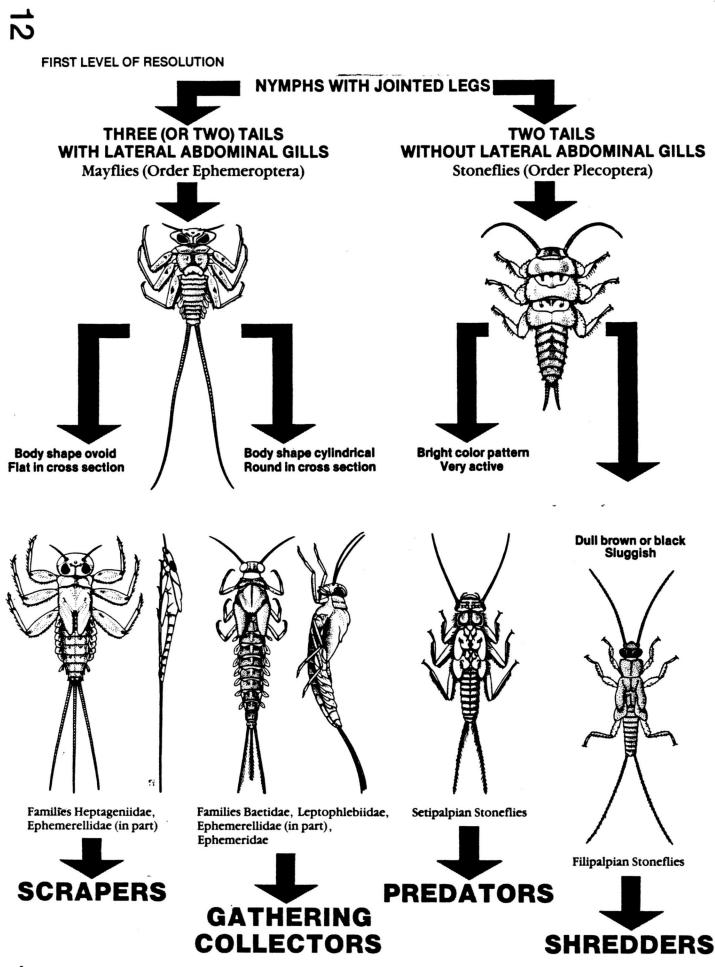


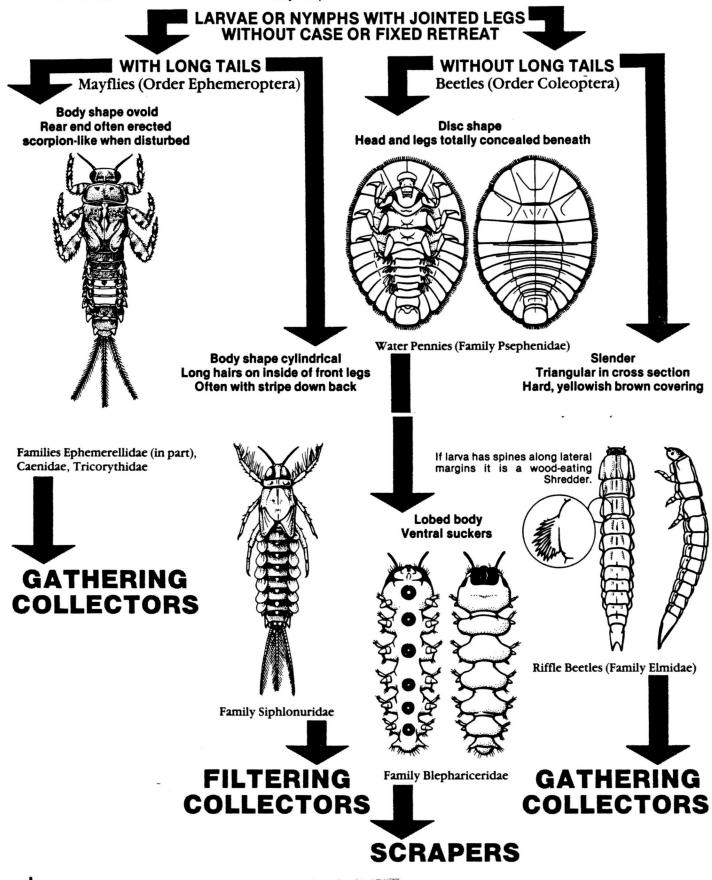


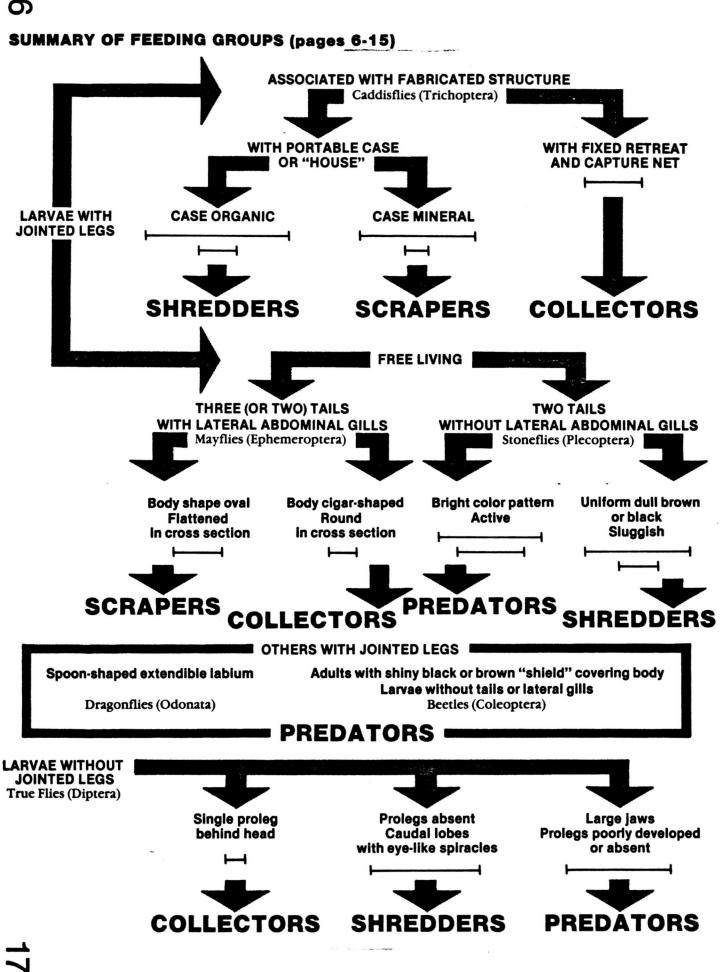


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Illustrations were drawn from specimens or redrawn from the following references:

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DATA FORM FOR ANALYSIS OF MACROINVERTEBRATE FUNCTIONAL GROUPS

This data form is provided for convenience. The ratio values given as examples are general guidelines only, based on totals of all habitat categorized. Values will vary with geographic-geologic region, season, stream size (roughly indexed to order) and degree of disturbance, particularly of the riparian zone. Although the ranges indicated for relatively undisturbed settings are based on a large number of observations covering a wide range of streams varying in riparian vegetation associations, users of this manual should develop their own criterion range. This will allow comparisons of relatively undisturbed (i.e., mature riparian zones) streams to those which have been variously altered, in the specific region where the observations are being made.

Data Sheet for Macroinver Site	rtebrate Functional Gro	-	Date ription		_Name		
Site				nic Resou	rce Categories		
Functional Group Shredders (SH)	Leaf Pack Count F*	Rock (Periphyton) Count F*	Fine Sediments (Pools) Count F*		Wood Count F*	Vascular Plants Count F [‡]	Σ
Collectors - Total (C)							
Filtering (FC)							
Gathering (GC)							
Scrapers (SC)							
Total w/o Predators (T)							
Predators (P)							
Total with Predators (PT)							
*F = Recruitmen	nt factor to indicate in	portance of new	generatio	ns enteri	ng a given group		
RATIOS (General ranges in parentheses) Riparian Habitat	Stream Orders 1-3 (Approx. 0.5-10 m wide)			Stream Orders 4-6 (Approx. 10-0 m wide)		Stream Orders ≯ 6 (Approx. > 30 m wide)	
	Shaded well developed, trees and/or shrubs	Open low shrubs herbs and/c		Open variable, trees and/or shrubs		Variable, flood plain or "green belt" forest	
Functional Group Ratios	Calculated (Examples)	Calculated ((Examples)	Calcul	ated (Examples)	Calculated (E	kamples)
SH/C	(> 0.30)	(> 0.15)		(< 0.10)		(< 0.05)	
sc/c	(< 0.25)	(> 0.25)		(> 0.25)		(< 0.10)	
FC/GC	(< 0.50)	(∿ 0.40)		(~ 0.50)		(~ 0.50)	
SH/T	(> 0.25)	(> 0.10)		(< 0.05)		(< 0.01)	
С/Т	(> 0.50)	(> 0.40)		(> 0.50)		(> 0.75)	
SC/T	(< 0.10)	(∿ 0.2 5)		(> 0.40)		(< 0.10)	
P/PT	(~ 0.10)		(~ 0.10)		(~ 0.10)	(*	0.10)

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