POLLUTION TOLERANCE INDEX (PTI)

(Adapted from Volunteer Stream Monitoring: A Methods Manual, United States Environmental Protection Agency, Office of Water, Draft Document #EPA 841-B-97-003, November 1997; AND Mitchell and Stapp, Field Manual for Water Quality Monitoring,1996)

This Pollution Tolerance Index is currently used in Pennsylvania for all volunteer citizen monitoring groups, as well as by the Department of Environmental Protection for their stream organism sampling. It is based on the concept of indicator organisms and tolerance levels. The procedures are designed to be done quickly and easily; they provide a rapid means of sampling riffle and other shallow areas to detect moderate to severe stream quality degradation.

The advantages of the PTI are that it provides a relatively rapid means of assessing stream quality; it is useful in developing an information base; and it develops concepts of tolerance ranges for organisms. However, to determine the true health of a stream, you should also conduct chemical tests and perform a land use/habitat assessment.

Organisms are collected and identified by comparing them with the drawings on the attached chart or by using a key. They are then divided into three groups based on their tolerance for pollution. Each of the three groups is given an index value, with the least tolerant group having the highest value. The general abundance of each kind of organism is also noted and figured into the index.

Procedure

1. Choose a 1 meter by 1 meter area that is representative of the riffle or shallow area being sampled. Use the kick screen method to sample this area.

2. Three samples (each 1m x 1m) should be taken at a site to be sure a representative sample is collected. Samples may also be taken from different microhabitats at the site, such as rocks in slow-moving water or near banks; different organisms may be found there.

3. Samples can be placed in containers of 70 percent alcohol solution for later identification. Be sure to pick clinging organisms off the net. If you do not want to preserve the organisms, and if time allows, you may be able to identify and release them at the site.

4. Using the enclosed data sheet, record the number and kind of each organism on the data sheet. Assign each organism an abundance code, as follows:
   R (Rare) = 1 to 9 organisms found in the sample
   C (Common) = 10 to 99 organisms found in the sample
   D (Dominant) = 100 or more organisms found in the sample
   Record the code next to the actual count on the field data sheet.

5. Note that the field data sheet divides the macroinvertebrates into three groups based on their ability to tolerate pollution. The three tolerance groups are as follows:
   Group I – Organisms that are sensitive to pollution and are typically found in good-quality water.
   Group II – Organisms that are somewhat sensitive to pollution and are typically found in fair-quality water.
   Group III – Organisms that are tolerant of pollution and are typically found in poor-quality water.

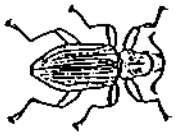
6. Follow the instructions on the data sheet to calculate the stream water quality rating.

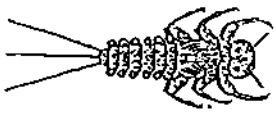
Macroinvertebrates Grouped by Level of Pollution Tolerance

(Adapted from EASI and the Senior Environmental Corps, Volunteer Water Quality Monitoring Field Manual)
(Images from: McCafferty. Aquatic Entomology, 1981. AND Kellogg. Monitor's Guide to Aquatic Macroinvertebrates, 1994.)

Group I: Generally sensitive to pollution. Large numbers of these types of organisms normally indicate GOOD WATER QUALITY.


Water Penny Beetle Larva

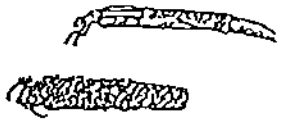

Riffle Beetle Adult


Mayfly Nymph

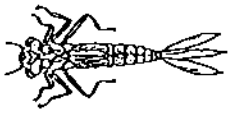

Stonefly Nymph


Dobsonfly Larva
(Hellgrammite)

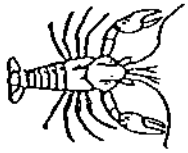

Gilled Snail
(has a thin, horny plate to seal shell opening)

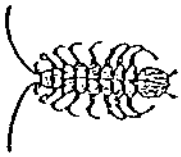

Non-Net-Spinning Caddisfly Larva

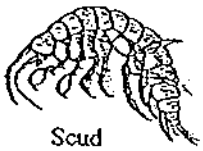
Group II: Can exist under a wide range of water quality conditions. Large numbers of these organisms, in the absence of Group I organisms, normally indicate MODERATE WATER QUALITY.


Damselfly Nymph


Crane Fly Larva


Crayfish


Aquatic Sowbug

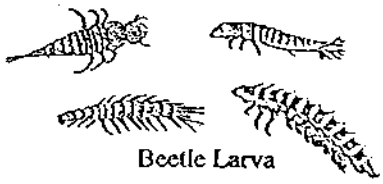

Scud


Clams


Net-Spinning Caddisfly Larva


Fishfly Larva


Alderfly Larva


Beetle Larva

Group III: Generally tolerant of pollution. Large numbers of these types of organisms normally indicate POOR WATER QUALITY.


Blackfly Larva


Midge Fly Larva


Leech


Aquatic Worms


Other Snails (Not Gilled)

NOTE: These organisms are the only macroinvertebrates used to calculate the PTI. Other organisms will be found – for identification, refer to the other macroinvertebrate identification sheets in this section of the handbook.

Macroinvertebrate Survey

Sample Date: __/__/__ Sampling time ____:____
Site Name_____ School_____
Names of Testers_____

Observations: *Creek Appearance (velocity, color, frozen, etc.)_____

*Weather in past 24 hrs (rain, snow, cats & dogs, etc.)_____

*Relative Depth (higher/lower than normal, etc.)_____

Macroinvertebrate Count

Identify the macroinvertebrates (to order) in your sample using the identification card. We are only concerned with organisms that appear on the identification card. Record the number of organisms below and then assign them letter codes based on their abundance:

R (rare) = 1-9 organisms; C (common) = 10-99 organisms; or D (dominant) = 100 plus organisms

example: 20 (C) Water penny larvae

Group I - Sensitive

_____ (____) Water penny larvae
_____ (____) Hellgrammites
_____ (____) Mayfly nymphs
_____ (____) Gilled snails
_____ (____) Riffle beetle adults
_____ (____) Stonefly nymphs
_____ (____) Non net-spinning caddisfly larvae

Group II - Somewhat Sensitive

_____ (____) Beetle larvae
_____ (____) Clams
_____ (____) Cranefly larvae
_____ (____) Crayfish
_____ (____) Damselfly nymphs
_____ (____) Scuds
_____ (____) Sowbugs
_____ (____) Fishfly larvae
_____ (____) Alderfly larvae
_____ (____) Net-spinning caddisfly larvae

Group III - Tolerant

_____ (____) Aquatic worms
_____ (____) Blackfly larvae
_____ (____) Leeches
_____ (____) Midge larvae
_____ (____) Snails

Based on PTI form in the Volunteer Water Quality Monitoring Field Manual developed for the Senior Environmental Corps and Environmental Alliance for Senior Involvement in Pennsylvania. 1998.

Water Quality Rating

To calculate the index value, add the number of letters found in the three groups above and multiply by the indicated weighing factor.

Group I - Sensitive

(# of R's) x 5.0 =_____

(# of C's) x 5.6 =_____

(# of D's) x 5.3 =_____

Sum of the Index Value for Group I =_____

Group II - Somewhat Sensitive

(# of R's) x 3.2 =_____

(# of C's) x 3.4 =_____

(# of D's) x 3.0 =_____

Sum of the Index Value for Group II =_____

Group III - Tolerant

(# of R's) x 1.2 =_____

(# of C's) x 1.1 =_____

(# of D's) x 1.0 =_____

Sum of the Index Value for Group III =_____

To calculate the water quality score for the stream site, add together the index values for each group. The sum of these values equals the water quality score.

Water Quality Score =_____

Compare this score to the following number ranges to determine the quality of your stream site

☐ Good >40 ☐ Fair 20 - 40 ☐ Poor <20

Note: The tolerance groupings (Group I, II, III) and the water quality rating categories were developed for streams in the Mid-Atlantic states.