

# BMWP - PL

Biological Monitoring Working Party index adapted to the Polish conditions

Country	POLAND
General description	<p>The <u>BMWP method</u> provides a score for each macroinvertebrate family that is primarily dependent on <b>its sensitivity to organic pollution</b>. This method was intended to be applied in Poland <sup>1</sup>, operating with a modified <b>BMWP</b> discrimination table.</p> <p>To verify the results obtained by calculating the BMWP score, <b>a diversity index</b> expressed as the ratio of number of families to macrofauna abundance was determined.</p>
Sampling procedure applied to the river systems studied	<p>At each sampling section (reach: transect 100m) <b>four quantitative samples</b> are taken, using <b>core sampler</b> - from different substrate patches and morphodynamic units (runs, riffles, pools).</p> <p>The investigated bottom surface per quantitative sample covers an area of <b>95 cm<sup>2</sup></b>. <b>Each quantitative sample is kept and analysed separately.</b></p> <p>At each sampling section (reach: transect 100m) <b>one qualitative sample</b> is collected from all dominated types of river channel habitats. The kick-net sampling method is used (<b>mesh size 300 µm</b>).</p> <p>Studied reaches are mapped for a variety of physical and morphological variables (e.g. organic debris, LWD, erosional and depositional areas, habitat modifications, etc. <i>see below: a list of environmental variables</i>). The precise locations of sampling microhabitats for quantitative samples are marked. Samples are preserved with <b>4% formalin</b> in the field and transported to the laboratory.</p>
Laboratory procedures	<p>In the laboratory, the biological material is <b>sieved</b>, by using hand-net or sieve (<b>300 µm mesh-size</b>).</p> <p>Each sample should be <b>completely sorted</b>. In the case of high abundance of Oligochaeta and/or Chironomidae, the <b>sub-sampling</b> of the whole sample is applied. The whole sample is portioning by <b>grid system</b> (4x4 squares), and sub-samples are selected randomly. The organisms from each sub-sample are put into vial separately with detailed description (e.g. 1/16 of the sample number X, vial no. n).</p> <p>All sorted animals are counted and transferred to <b>70% ethanol</b>. Macroinvertebrates are counted and identified to the family level (except Oligochaeta and some Diptera families).</p>
Assessment procedures	<p>The method of assessment is based on <b>2 components</b>.</p> <p><b>I. The first component constitutes BMWP score -adapted to Polish conditions.</b></p> <p><b>One common taxa list</b> (generally on family level, excluding Oligochaeta which is considered as one taxon and Heptageniidae which requires distinguishing genera <i>Epeorus</i> and <i>Rhitrogena</i> from the rest) is prepared: list from quantitative samples is supplemented by new taxa occurring in qualitative sample.</p> <p>This list forms the basis for the calculation of so called BMWP-PL (adapted to Polish</p>

<sup>1</sup> 1999-2000 Project "Biological Assessment of Water Quality: Revision of Polish Biomonitoring Method to the European Standards" – Institute of Environmental Protection (Warsaw) & Polish Academy of Sciences (Cracow) in cooperation with 19 Polish research institutions.

conditions British BMWP score: see table below).

**II. The second component of biological assessment is fauna density** - as an important characteristic of community structure. As result, The BMWP-PL score is verified by **diversity index**, regarding to formula:

$$d = s / \log N$$

where d – diversity index, s – number of families found at sampling site (both in quantitative and qualitative samples), N – mean density of all taxa occurring at sampling site. Rare taxa found only in qualitative sample are assigned density 1 ind/m<sup>2</sup>.

*Example:*

Taxon	Quant. Sample 1 (ind/m <sup>2</sup> )	Quant. Sample 2 (ind/m <sup>2</sup> )	Quant. Sample 3 (ind/m <sup>2</sup> )	Quant. Sample 4 (ind/m <sup>2</sup> )	Mean density (ind/m <sup>2</sup> )	Qualit. Sample (presence +)
<b>A</b>	500	600	1000	400	625	+
<b>B</b>	300	100	200	350	237,5	+
<b>C</b>	30	10	0	20	15	+
<b>D</b>	20	0	30	0	12,5	+
<b>E</b>	0	0	10	0	2,5	
....						
<b>M</b>	0	0	0	0	1	+
<b>N</b>	0	0	0	0	1	+
<b>P</b>	0	0	0	0	1	+

Taxa A,B,C,D,E were found in quantitative samples. For them mean density was calculated from quantitative samples..

Taxa M,N,P were found only in qualitative sample so for them density 1 ind/m<sup>2</sup> was assigned.

**Conversion into classes**

Class	BMWP score	Range	Diversity Index
I	> 100	1	> 5,5
II	70-99	2	4,0-5,4
III	40-69	3	2,5-3,9
IV	10-39	4	1-2,4
V	< 10	5	< 1

If the class assigned according to BMWP-PL score is higher than the range according to diversity index, the final classification of water quality should be decreased by one class.

**Comments on calculation**

A numerical value has been assigned to each taxon based on its tolerance to organic pollution (specifically on the tolerance of the most tolerant species belonging to each taxon), **from one (tolerant) to ten (intolerant)**. The BMWP-score for a site is the sum of the values for each taxon present in a sample. The score is based on the presence of each taxon, regardless of the number of representatives of that taxon in the sample.

**Level of evaluation**

Family

**Additional environmental data**

Chemical water quality; physical & ecomorphological variables; type and intensity of human impact (multiple-scales: catchment, reach, microhabitat variables).

**Standard table of BMWP-PL**

Families		Score
Ephemeroptera Trichoptera Diptera	<i>Ameletidae</i> <i>Glossosomatidae, Molannidae, Beraeidae, Odontoceridae,</i> <i>Leptoceridae</i> <i>Blephariceridae, Thaumaleidae</i>	10
Ephemeroptera Plecoptera Odonata Trichoptera	<i>Behningiidae</i> <i>Taeniopterygidae</i> <i>Cordulegastridae</i> <i>Goeridae, Lepidostomatidae</i>	9
Crustacea Ephemeroptera  Plecoptera Trichoptera Diptera	<i>Astacidae</i> <i>Oligoneuriidae, Heptageniidae (only genus Epeorus and</i> <i>Rhithrogena)</i> <i>Capniidae, Perlidae, Chloroperlidae</i> <i>Philopotamiidae</i> <i>Athericidae</i>	8
Ephemeroptera  Plecoptera Odonata Trichoptera Coleoptera Heteroptera Gastropoda Bivalvia	<i>Siphonuridae, Leptophlebiidae, Potamanthidae, Ephemerellidae,</i> <i>Ephemeridae, Caenidae,</i> <i>Perlodidae, Leuctridae</i> <i>Calopterygidae, Gomphidae,</i> <i>Rhyacophilidae, Brachycentridae, Sericostomatidae, Limnephilidae</i> <i>Elmidae</i> <i>Aphelocheiridae</i> <i>Viviparidae</i> <i>Unionidae, Dreissenidae</i>	7
Hirudinea Crustacea Ephemeroptera) Plecoptera Odonata Trichoptera Diptera Gastropoda	<i>Piscicolidae</i> <i>Gammaridae, Corophiidae</i> <i>Baetidae, Heptageniidae (except for genus Epeorus and Rhithrogena)</i> <i>Nemouridae</i> <i>Platycnemididae, Coenagrionidae</i> <i>Hydroptilidae, Polycentropodidae, Ecnomidae</i> <i>Limoniidae, Simuliidae, Empididae</i> <i>Neritidae, Bithyniidae</i>	6
Crustacea Trichoptera Coleoptera Heteroptera  Diptera Gastropoda	<i>Cambaridae</i> <i>Hydropsychidae, Psychomyiidae</i> <i>Gyrinidae, Dytiscidae, Haliplidae, Hydrophilidae</i> <i>Mesoveliidae, Veliidae, Nepidae, Naucoridae, Notonectidae, Pleidae,</i> <i>Corixidae</i> <i>Tipuliidae</i> <i>Hydrobiidae</i>	5
Diptera Gastropoda Bivalvia	<i>Ceratopogonidae</i> <i>Valvatidae, Planorbidae</i> <i>Sphaeriidae</i>	4
Hirudinea Crustacea Megaloptera Diptera Gastropoda	<i>Glossiphonidae, Erpobdellidae, Hirudinidae</i> <i>Asellidae</i> <i>Sialidae</i> <i>Chironomidae</i> <i>Ancyliidae, Physidae, Lymnaeidae</i>	3
Oligochaeta Diptera	All Oligochaeta <i>Culicidae</i>	2
Diptera	<i>Syrphidae, Psychodidae</i>	1