BMWP – PL

Biological Monitoring Working Party index adapted to the Polish conditions

Country	**POLAND**
General description	The BMWP method provides a score for each macroinvertebrate family that is primarily dependent on **its sensitivity to organic pollution.** This method was intended to be applied in Poland [1], operating with a modified **BMWP** discrimination table. To verify the results obtained by calculating the BMWP score, **a diversity index** expressed as the ratio of number of families to macrofauna abundance was determined.
Sampling procedure applied to the river systems studied	At each sampling section (reach: transect 100m) **four quantitative samples** are taken, using **core sampler -** from different substrate patches and morphodynamic units (runs, riffles, pools). The investigated bottom surface per quantitative sample covers an area of **95** cm^2. **Each quantitative sample is kept and analysed separately**. At each sampling section (reach: transect 100m) **one qualitative sample** is collected from all dominated types of river channel habitats. The kick-net sampling method is used (**mesh size 300 µm**). Studied reaches are mapped for a variety of physical and morphological variables (e.g. organic debris, LWD, erosional and depositional areas, habitat modifications, etc. *see below: a list of environmental variables*). The precise locations of sampling microhabitats for quantitative samples are marked. Samples are preserved with **4% formalin** in the field and transported to the laboratory.
Laboratory procedures	In the laboratory, the biological material is **sieved**, by using hand-net or sieve (**300 µm mesh-size**). Each sample should be **completely sorted**. In the case of high abundance of Oligochaeta and/or Chironomidae, the **sub-sampling** of the whole sample is applied. The whole sample is portioning by **grid system** (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*). All sorted animals are counted and transferred to **70% ethanol**. Macroinvertebrates are counted and identified to the family level (except Oligochaeta and some Diptera families).
Assessment procedures	The method of assessment is based on **2 components.** **I. The first component constitutes BMWP score -adapted to Polish conditions**. **One common taxa list** (generally on family level, excluding Oligochaeta which is considered as one taxon and Heptageniidae which requires distinguishing genera *Epeorus* and *Rhitrogena* from the rest) is prepared: list from quantitative samples is supplemented by new taxa occuring in qualitative sample. This list forms the basis for the calculation of so called BMWP-PL (adapted to Polish

[1] **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^2.

Example:

Taxon	*Quant. Sample 1 (ind/m^2)*	*Quant. Sample 2 (ind/m^2)*	*Quant. Sample 3 (ind/m^2)*	*Quant. Sample 4 (ind/m^2)*	*Mean density (ind/m^2)*	*Qualit. Sample (presence +)*
A	*500*	*600*	*1000*	*400*	*625*	+
B	*300*	*100*	*200*	*350*	*237,5*	+
C	*30*	*10*	*0*	*20*	*15*	+
D	*20*	*0*	*30*	*0*	*12,5*	+
E	*0*	*0*	*10*	*0*	*2,5*	
….						
M	*0*	*0*	*0*	*0*	*1*	+
N	*0*	*0*	*0*	*0*	*1*	+
P	*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/m2 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	*Ameletidae* *Glossosomatidae, Molannidae, Beraeidae, Odontoceridae, Leptoceridae* *Blephariceridae, Thaumaleidae*	10
Ephemeroptera Plecoptera Odonata Trichoptera	*Behningiidae* *Taeniopterygidae* *Cordulegastridae* *Goeridae, Lepidostomatidae*	9
Crustacea Ephemeroptera Plecoptera Trichoptera Diptera	*Astacidae* *Oligoneuriidae, Heptageniidae (only genus Epeorus and Rhithrogena)* *Capniidae, Perlidae, Chloroperlidae* *Philopotamiidae* *Athericidae*	8
Ephemeroptera Plecoptera Odonata Trichoptera Coleoptera Heteroptera Gastropoda Bivalvia	*Siphlonuridae, Leptophlebiidae, Potamanthidae, Ephemerellidae, Ephemeridae, Caenidae,* *Perlodidae, Leuctridae* *Calopterygidae, Gomphidae,* *Rhyacophilidae, Brachycentridae, Sericostomatidae, Limnephilidae* *Elmidae* *Aphelocheiridae* *Viviparidae* *Unionidae, Dreissenidae*	7
Hirudinea Crustacea Ephemeroptera) Plecoptera Odonata Trichoptera Diptera Gastropoda	*Piscicolidae* *Gammaridae, Corophiidae* *Baetidae, Heptageniidae (except for genus Epeorus and Rhitrogena)* *Nemouridae* *Platycnemididae, Coenagrionidae* *Hydroptilidae, Polycentropodidae, Ecnomidae* *Limoniidae, Simuliidae, Empididae* *Neritidae, Bithyniidae*	6
Crustacea Trichoptera Coleoptera Heteropera Diptera Gastropoda	*Cambaridae* *Hydropsychidae, Psychomyidae* *Gyrinidae, Dytiscidae, Haliplidae, Hydrophilidae* *Mesoveliidae, Veliidae, Nepidae, Naucoridae, Notonectidae, Pleidae, Corixidae* *Tipuliidae* *Hydrobiidae*	5
Diptera Gastropoda Bivalvia	*Ceratopogonidae* *Valvatidae, Planorbidae* *Sphaeriidae*	4
Hirudinea Crustacea Megaloptera Diptera Gastropoda	*Glossiphonidae, Erpobdellidae, Hirudinidae* *Asellidae* *Sialidae* *Chironomidae* *Ancylidae, Physidae, Lymnaeidae*	3
Oligochaeta Diptera	All Oligochaeta *Culicidae*	2
Diptera	*Syrphidae, Psychodidae*	1