

Annex 2.5.1 NATIONAL INDEXES

Country	Bulgaria
Region	entire Bulgaria
Altitude range	0 - >800 m
Stream range	applied to all stream types
Elements	Benthic Invertebrates, Macrophytes
Name of method	Biotic Index based on 'Quality Rating System'
Stressors detected	Organic Pollution, General Degradation (stressor not specified)
Status of method	in current usage since 1993
The method covers	field sampling, lab procedure, calculation, presentation

General Description

In the national monitoring network of Bulgarian watercourses a Biotic Index is in use which is adapted from the Irish '[Quality Rating System](#)'. The index relates the relative abundance of five key groups of macroinvertebrates (*sensitive forms* to *most tolerant forms*) to water quality. The scheme uses five basic water quality classes (Q-values).

Brief description Saprobity is determined by PANTLE & BUCK (1955) Index for the eight Bulgarian Transnational Monitoring Network (TNMN) sites only. The German [DIN norm](#) is used to calculate the Saprobic Index.

Macrophytes are not part of the assessment procedure, only species occurrence and percent coverage are recorded.

References

- MCGARRIGLE, M.L.; LUCEY, J.; CLABBY, K.C. (1992): Biological assessment of river water quality in Ireland. In: NEWMAN, P.J.; PIAVAUX, M.A.; SWEETING, R.A. (eds.): River Water Quality. Ecological Assessment and Control. Brussels (Commission of the European Community): 371-385.
- MINISTRY OF ENVIRONMENT AND WATER (since 1985): Annual report on the state of the environment - The Green Book. Sofia (MOEW). (in Bulgarian and English)
- PANTLE, R. & H. BUCK (1955): Die biologische Überwachung der Gewässer und die Darstellung der Ergebnisse. Gas- und Wasserfach 96: 604.

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Sampling

Sampling procedure

Samples are taken from all major habitats proportionally according to their presence within a sampling reach. Where possible, preference is given to riffled sites with turbulent flow conditions. Hand-net sampling is carried out according to ISO Standard 7828 (1985). Substratum is kicked for approx. 2 to 5 minutes.

Organisms are separated from other materials at sampling site by sieving through meshes of 8 mm, 2 mm, 500 µm and 200 µm in size. Organisms are picked from sieved material and preserved.

length of sampling site:

10 to 20 m (up to 50 m)

width of sampling site:

depending on width of watercourse

Danube specification:

10 to 20 m

Sampling site

rationale of the selection of sampling sites:

accessibility; location of pollution sources; presence of riffle sites

Danube specification:

accessibility; location of pollution sources; presence of riffle sites

Sampling season

each season excluding spring (high water level)

Danube specification:

period of lowest water level (usually August to September)

Sampling device

Benthic Invertebrates:

hand-net - mesh-size: 500 µm; net-opening: 30 * 30 cm²

Fixative used

formaldehyde (4 - 10 %)

Sampling reference

- ISO 7828 (1985): Water Quality - Methods for biological sampling - Guidance on handnet sampling of aquatic benthic macroinvertebrates.

Record of abundance

abundance classes, percent coverage

Abundance specification

Benthic Invertebrates	
abundance class	number of individuals
I	1-5
II	6-20
III	21-50

IV	51-100
V	>100
Macrophytes	
abundance class	percent coverage
1	< 1
2	1 - 5
3	6 - 15
4	16 - 25
5	26 - 50
6	> 50

Level of determination

species, species groups, genus, family

Determination specification

Benthic Invertebrates are identified to different taxonomic levels depending on organism group. For example, Ephemeroptera are identified to species groups and genus level, Diptera to family level.

fieldwork: 30 to 40 minutes 3 € 2 persons

laboratory: 2 hours 4 € 1 person

Expenditures per sample

additional costs: consumables - 1 to 2 €per sample; travel and accommodation - depending on sampling region

Assessment: calculation, classification, presentation

Specifications

- assessment is related to reference conditions based on existing sites and expert judgement

Calculation method

single metric(s): decision tables representing five groups of macroinvertebrates and their relative abundances

To which spatial scale do metrics refer?

catchment, river

Number of quality classes

5

Conversion into classes

Bulgarian Classification				EC Classification		
Quality Class	Q-Value	Description	Colour Code	Quality Class	Description	Colour Code
I	5; 4-5; 4	unpolluted	blue	I	high	blue
II	3-4	slightly polluted	green	II	good	green

III	3; 2-3	moderately polluted	yellow	III	moderate	yellow
				IV	poor	orange
IV	2; 1-2; 1	heavily polluted	red	V	bad	red

Species lists used to calculate index • MINISTRY OF ENVIRONMENT AND WATER (since 1985) - *comprises about 400 taxa*

Comments on calculation Bulgarian Classification will soon be adapted to the EC recommendations.

Presentation reports (paper); maps (paper and digital); internet (<http://nfp-bg.eionet.eu.int>)

Monitoring and Database

Status of monitoring program in current usage

Name of monitoring program National Environmental Monitoring Program of Bulgaria

Period of monitoring since 1993 (in some river basins)

Geographical coverage entire Bulgaria

Coverage of monitoring about 18 to 20 sampling sites per 1000 km² - 1200 sampling points, located along rivers at a distance of 5 to 10 km

Monitoring interval annual for representative sites and biannual for reference sites

Name of database National Automated System for Environment Monitoring / NASEM / Subsystem "Water" - functional subsystem "Surface water biological monitoring"

Type of database desktop-database

Program used MS Word; MS Access; paper format

Organisation responsible Ministry of Environment and Water, Executive Environmental Agency

Place of database storage Ministry of Environment and Water, Executive Environmental Agency

Country	Czech Republic
Region	entire Czech Republic
Altitude range	0 - > 800 m
Stream range	applied to all stream types
Elements	Benthic Invertebrates
Name of method	Saprobiological Monitoring
Stressors detected	Organic Pollution
Status of method	in current usage
The method covers	field sampling, lab procedure, calculation, presentation
It is combined with the following methods	combination of results (5 quality classes) including PERLA and the Czech version of AQEM is under development (all outputs should be based on standard samples and measurements according to the AQEM/PERLA methodologies)

General Description

Brief description The method is used for standard assessment of organic pollution in Czech rivers. It is applied in a large monitoring network and evaluates the degree of pollution according to PANTLE and BUCK (1955), modified by MARVAN (1969). Results are expressed in 8 grades, which are converted into 5 different classes.

- CSN 757716 (1998): Water quality, biological analysis, determination of saprobic index. - Czech Technical State Standard. Czech Standards Institute, Prague, 174 pp.
- SLADECEK, V. (1973): System of Water Quality from the Biological Point of View. Arch. Hydrobiol. Beih.; Ergeb. Limnol. 7: 1-218.
- MARVAN, P. (1969): Notes to the application of statistical methods in evaluation of saprobiology. Symposium SMEA on Questions of Saprobity: 19-43.
- PANTLE, R.; BUCK, H. (1955): Die biologische Überwachung der Gewässer und die Darstellung der Ergebnisse. Gas- und Wasserfach 96: 604.

References

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Sampling

Sampling procedure

Sampling is done in accordance with the European standard EN 27 828. Samples are taken at a homogenous stretch, preferably in a riffle section. Each sample comprises a fixed distance and a defined sampling time. In flowing shallow water hand-sampling is carried out disturbing the substratum by hand and picking organisms from stones. Deeper but wadable streams are kick-sampled. In slow flowing waters sweep-sampling is applied: Substratum is disturbed with the feet and the dislodged fauna is caught by repeated sweeps of the net through the water above the disturbed area. All different types of sampling are made by utilisation of a hand-net (mesh-size: 500 µm).

Sampling reference

- EN 27 828 (1994): Water Quality - Methods for biological sampling - Guidance on handnet sampling of aquatic benthic macroinvertebrates. (ISO 7828: 1985)
- MRAZEK, K. et al. (1995): Začlenění saprobiologického monitoringu SVHB do systému sledování a hodnocení jakosti vody. 1. část: Průručka saprobiologického monitoringu SVHB; 2. část: Praktický determinací klíč. ('An integration of saprobiological monitoring into water quality monitoring and assessment. Part 1: Handbook of saprobiological monitoring of water quality balance system; part 2: Practical identification key of benthic invertebrates.') Brno (T.G.M. Water Research Institute Prague). (in Czech)

Record of abundance

number of individuals

Level of determination

species, species groups, genus

Expenditures per sample

80 €

Additional environmental data

physiographic characteristics,

Assessment: calculation, classification, presentation

Specifications

- assessment is not related to a reference condition

Calculation method

single metric(s): $SI = \text{sum of } (s_i * h_i * I_i) / \text{sum of } (h_i * I_i)$

SI: Saprobic Index

S_i : individual saprobic index of species i ($s_i = (0 \cdot x_i + 2 \cdot b_i + 3 \cdot a_i + 4 \cdot p_i) / 10$)

h_i : abundance of species i

I_i : individual indicator weight of species i

To which spatial scale do metrics refer?

reach

Number of quality classes

5

Saprobic Grades according to Water Quality Balance System	
grade	Saprobic Index
1	0 - 1.0
2	1.01 - 1.50
3	1.51 - 2.00
4	2.01 - 2.50
5	2.51 - 3.00
6	3.01 - 3.50
7	3.51 - 4.00
8	> 4.00

Conversion into classes

Approximative Conversion to Classes according to Czech State Norm 757221		
grade	class	Saprobic Index
1 - 2	I	< 1.5
3 - (4)	II	1.51 - 2.19
(4) - 5	III	2.20 - 2.99
6	IV	3.00 - 3.49
7 - 8	V	>= 3.5

Reference on calculation

- CSN 757221 (1998): Water quality - Classification of surface water quality. Czech Technical State Standard, Czech Standards Institute, Prague, 10 pp.

Presentation reports (paper); maps (paper)

Monitoring and Database

Status of monitoring program	existent
Name of monitoring program	(1) Water Quality Balance System; (2) Monitoring Program of the Czech Hydrometeorological Institute
Geographical coverage	entire Czech Republic
Coverage of monitoring	(1) 1200 sites; (2) 250 important sites
Monitoring interval	(1) repeated every five years; (2) two times per year in spring and autumn

Name of database	BROUCI
Type of database	desktop-database; data older than 10 years: only hard copy
Program used	FoxPro
Organisation responsible	Water Research Institute Prague, branch Brno
Place of database storage	Water Research Institute Prague, branch Brno

Country	Hungary
Region	entire Hungary
Altitude range	0 - 800 m
Stream range	applied to all stream types
Elements	Benthic Invertebrates
Name of method	BMWP - HU (adapted to Hungarian conditions)
Stressors detected	Organic Pollution
Status of method	in current usage and under development to be finished in December 2004
The method covers	field sampling, calculation, presentation
It is combined with the following methods	under development

General Description

Brief description For years Hungarian watercourse biomonitoring has solely been based on biomass and chlorophyll-a examinations of the planktonic river community. Since 2002 a modification of the British BMWP/ASPT score system is applied featuring newly included taxa and modified scores (see [score table](#)). Combination of total score and average score per taxon results in a Quality Index (QI) value which is assigned to one of five classes of watercourse quality. The method is in preliminary phase and practical experience and taxonomic expertise are advancing.

- References**
- ARMITAGE, P.D.; MOSS, D. et al. (1983): The performance of a new biological water quality score system based on macroinvertebrates over a wide range of unpolluted running-water sites. *Water Research* 17: 333-347.
 - BIOLOGICAL MONITORING WORKING PARTY (1978, unpublished report): Final report of the Biological Monitoring Working Party: assessment and presentation of the biological quality of rivers in Great Britain. London (Department of the Environment Water Data Unit).
 - CSÁNYI in NÉMETH, J. (1998): A biológiai vízminőség mérése (Methods of biological water quality assessment). *Vízi Természet- és Környezetvédelem sorozat* 7. Bp.: Környezetgazdálkodási Intézet: 1-304. (in Hungarian)
 - JUST, I.; SCHÖLL, F. & T. TITTIZER (1998): Versuch einer Harmonisierung nationaler Methoden zur Bewertung der Gewässergüte im Donaauraum am Beispiel der Abwässer der Stadt Budapest. UBA-Texte 53-98. Berlin (UBA).

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Sampling

Sampling procedure Kick-Sampling:
Multi habitat sampling is carried out: proportional sampling of all major habitats according to their presence within a sampling reach. In total, a five meter section is sampled for approx. 15 minutes time. In addition, organisms are picked from hard surfaces using pincers.

"Turbo-kicking" method (Danube):
One driver stands in water of 2 to 2.5 m depth and makes mixing up movements with his fins above the bottom. In the mean time eight sweeping movements are carried out by the hand net close to the bottom. Even large crayfishes can be moved out from heavily stony substrate by this way.

Diving:

special way of collecting mussels from the bottom because large surface area is under investigation. Using only fins and mask the bottom is touched continuously by hands and mussels are picked up.

Dredging method (Danube):

Dredging is done from a motorboat moving downstream direction slowly in order to allow the forks of the dredge to take the surface area of the bottom. Several meters are dredged pulling the sampler on rope and keeping it by hands in order to feel the roughness and the carving of the instrument. Two sizes of the dredge are in usage: 25 cm and 40 cm opening on a triangle shaped and forked surface. The dredge has an inside net with the mesh size of 500 µm. It can also be operated without this net. In this case an iron grid with mesh size of 150 mm collects rough sized bed material (e.g. mussel species are collected by this way).

Whole sample is preserved in the field and organisms are picked out in the laboratory. Samples are sieved through a net of 950 µm prior to sorting and identification. If the volume of the sample exceeds 2 litres, a smaller part is taken to identify organisms (max. 500 ml).

rationale of the selection of sampling sites:

identical to former monitoring network; representativeness

Sampling site

Danube specification:

identical to former monitoring network; representativeness

Benthic Invertebrates:

hand net - mesh-size: 950 µm; net-opening: 25 * 20 cm²

Sampling device

Danube specification:

custom-made dredge - mesh-size: 950 µm or 150 mm; sampled area: 25 or 40 cm * few meters

Fixative used

ethyl alcohol (70 %)

Record of abundance

number of individuals, abundance classes

Abundance specification

abundance class	percentage of individuals in sample (5 m à 15 min)
5	> 50
4	25 - 50
3	12.5 - 25
2	6.25 - 12.5
1	< 6.25

Level of

species, genus, family, higher taxonomical level

determination**Determination specification**

Chironomids are identified to family level, Oligochaets to higher taxonomical level.

Expenditures per sample

fieldwork: 1 to 2 hours 40 to 80 € 1 person

laboratory: 1 to 3 hours 40 to 120 € 1 person

Additional environmental data

chemical/physical water quality,

Assessment: calculation, classification, presentation**Specifications**

- assessment is not related to a reference condition

Calculation method

single metric(s): sum of BMWP scores and calculation of the Average Score Per Taxon

To which spatial scale do metrics refere?

habitat

Number of quality classes

5

Conversion into classes

Assignment of Quality Index according to BMWP score and ASPT of riffle and pool section					
Scoring System for Riffles			Scoring System for Pools		
BMWP score	ASPT	Quality Index (QI)	BMWP score	ASPT	Quality Index (QI)
> 150	> 6.0	7	> 120	> 5.0	7
121 - 150	5.5 - 6.0	6	101 - 120	4.5 - 5.0	6
91 - 120	5.1 - 5.4	5	81 - 100	4.1 - 4.4	5
61 - 90	4.6 - 5.0	4	51 - 80	3.6 - 4.0	4
31 - 60	3.6 - 4.5	3	25 - 50	3.1 - 3.5	3
15 - 30	2.6 - 3.5	2	10 - 24	2.1 - 3.0	2
0 - 14	0.0 - 2.5	1	0 - 9	0.0 - 2.0	1

Quality classification of watercourses based on Quality Index

quality class	description	mean Quality Index according to Total Score and ASPT of riffle and pool section
I	high	> 5.0
II	good	> 4.0 - 5.0
III	moderate	> 3.0 - 4.0
IV	poor	> 2.0 - 3.0
V	bad	<= 2.0

Species lists used to calculate index

- [score table](#)

Reference on calculation

- CSÁNYI in NÉMETH, J. (1998)

Presentation

reports (paper and digital)

Monitoring and Database

Status of monitoring program

in current usage

Name of monitoring program

Monitoring of Surface Waters

Period of monitoring

since 2001

Geographical coverage

entire Hungary

Coverage of monitoring

100 sites

Monitoring interval

two times per year

Status of database

no database existing

Slovak Multimetric Index

For the implementation of the EC GIG intercalibration exercise Slovakia has developed a multimetric index for the assessment of rivers using benthic macroinvertebrates. Several single metrics [Saprobic Index (Zelinka & Marvan),

oligo [%] (scored taxa = 100%), BMWP Score, [%] metarhithral (scored taxa = 100%), Rhithron Typie Index, Index of Biocoenotic Region, [%] Type Aka+Lit+Psa (scored taxa = 100%), Diversity (Margalef Index), [%] Shredders (scored taxa = 100%), [%] Gatherers/Collectors (scored taxa = 100%), EPT Taxa, Number of Families] are combined to a multimetric index via simple averaging. National class boundaries are given in EQR values (high-good: 0,8, good-moderate: 0,6).

The method is under development.

Country	Slovakia
Region	entire Slovakia
Altitude range	0 - 800 m
Stream range	applied to all stream types
Elements	Benthic Invertebrates, Macrophytes, Phytobenthos, Phytoplankton, Zooplankton
Name of method	National Surface Water Quality Monitoring System
Stressors detected	Organic Pollution, Eutrophication
Status of method	in current usage
The method covers	field sampling, lab procedure, calculation, presentation
It is combined with the following methods	under development

General Description

Biomonitoring of Slovakian watercourses comprises investigations of Benthic Invertebrates, Phytobenthos, and Phyto- and Zooplankton. Qualitative (*diversity*) and (semi-) quantitative (*abundance*) parameters are taken into account. Macrophytes are investigated as part of the ['Macrophyte Inventory Danube - Corridor and Catchment'](#). The degree of Organic Pollution is separately assessed by determination of the Saprobic Index (SLOVAK NATIONAL STANDARD 757221 1989) based on taxa lists of Benthic Invertebrates and Phytobenthos, and *Bioseston* (all planktonic organisms). In addition, chlorophyll-a concentration is used to assess water quality.

References

- STN (Slovenská Technická Norma) 83 0532 – 1 to 8 (1978/79):

Biologický rozbor povrchovej vody. (Biological analysis of surface water quality). Úrad pro Normalizaci a Mereni, Praha.

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Sampling

Sampling procedure Multi habitat sampling is carried out for Benthic Invertebrates, Phytobenthos and Macrophytes: All major habitats are sampled proportionally according to their presence within a sampling reach. Sampling of Benthic Invertebrates is done in accordance with the European Standard EN 27 828. Kick-sampling is performed not exceeding 10 to 15 minutes. Whole sample is preserved in the field and organisms are picked out in the laboratory. Prior to sorting and identification samples are sieved through 300 µm meshes.

Macrophytes are sampled according to the protocol of the [Macrophyte Inventory Danube](#).

length of sampling site:
15 to 20 m

width of sampling site:
littoral

Sampling site

rationale of the selection of sampling sites:
depending on point sources of pollution;
Danube specification:
depending on point sources of pollution;

Sampling season Benthic Invertebrates and Phytobenthos: spring, summer and autumn
Phyto- and Zooplankton: monthly
Benthic Invertebrates:
hand net - mesh-size: 500 µm; net-opening: 25 * 25 cm²

Sampling device **Phytobenthos and Heterotrophic Periphyton:**
brushes and knives - scraped area: 10 * 10 cm²
Plankton:
plankton net - mesh-size: 10 µm (Phytoplankton) and 60 µm (Zooplankton); net-opening: 30 cm in diameter

Fixative used formaldehyde

Sampling • EN 27 828. Water Quality - Methods for biological sampling -

reference

Guidance on handnet sampling of aquatic benthic macroinvertebrates. (ISO 7828: 1985)

- JANAUER, G.A. (2002): Macrophyte Inventory Danube - Corridor and Catchment. Guidance on the Assessment of Aquatic Macrophytes in the river Danube, in waterbodies of the fluvial corridor, and in its tributaries. - http://www.midcc.at/Methodology/fluvial/methodology_kohler_en_V4.pdf
- KNOBEN, R.A.E; BIJLMAKERS, L. & P. VAN MEENEN (1999): Classification/characterisation of water quality, Water Quality Enhancement in the Danube River Basin, Phare Contract No. 98-0399.00. Brussels (IWACO).
- KOHLER, A. (1978): Methoden der Kartierung von Flora und Vegetation von Süßwasserbiotopen. Landschaft und Stadt 10: 73-85.
- STN (Slovenská Technická Norma) 83 0532 (1978/79)

Record of abundance

number of individuals, abundance classes, percent coverage, number of cells

Abundance specification

abundance class (Phytobenthos)	description
1	single
2	rare
3	rare to common
4	common
5	common to abundant
6	abundant
7	very abundant

Benthic Invertebrates: number of individuals
Phytoplankton, Zooplankton: number of cells
Macrophytes: plant mass estimates

Level of determination

species, species groups, genus, family

Determination specification

In some cases Benthic Invertebrates are determined to genus or family level (e.g. Oligochaeta, Chironomidae, juvenile organisms).

Expenditures per sample

fieldwork: approx. 60 € 5 persons
laboratory: approx. 100 € 7 persons

additional costs for consumables and equipment

Additional environmental

ecoregion, geology, channel form, bank and bed fixation, riparian vegetation, land use, temperature, discharge, pH, conductivity, dissolved

data oxygen content, oxygen saturation, COD (Chemical Oxygen Demand), BOD (Biological Oxygen Demand), nitrite, nitrate, ammonium, phosphorus, salinity, odour, mineral substrates, biotic microhabitats, water colour,

Assessment: calculation, classification, presentation

Specifications

- assessment is not related to the reference state concept (with regard to smaller watercourses, reference concept has been implemented in 2003)

single metric(s): $SI = \text{sum of } (s_i * h_i * I_i) / \text{sum of } (h_i * I_i)$

Calculation method

SI: Saprobic Index
 S_i : individual saprobic index of species i ($s_i = (0 * x_i + 2 * b_i + 3 * a_i + 4 * p_i) / 10$)
 h_i : abundance of species i
 I_i : individual indicator weight of species i

To which spatial scale do metrics reach?

reach

Number of quality classes

5

Conversion into classes

Class	Saprobic Index of Bioeston	Saprobic Index of Benthic Invertebrates	Saprobic Index of Phytobenthos	Chlorophyll-a (µg/l)
I	< 1.80	< 1.80	< 1.50	< 10
II	1.80 - 2.30	1.80 - 2.30	1.50 - 2.00	10 - 35
III	> 2.30 - 2.70	> 2.30 - 2.70	> 2.00 - 2.50	> 35 - 75
IV	> 2.70 - 3.20	> 2.70 - 3.20	> 2.50 - 3.00	> 75 - 180
V	> 3.20	> 3.20	> 3.00	> 180

Species lists used to calculate index

- STN (Slovenská Technická Norma) 83 0532-6 (1979): Biologický rozbor povrchovej vody. Stanovenie sapróbného indexu podľa Pantleho a Bucka. (Determination of Saprobic Index according to PANTLE and BUCK). Úrad pro Normalizaci a Mereni, Praha.

calculation:

Reference on calculation

- STN (Slovenská Technická Norma) 83 0532 (1978/79)

classification:

- STN (Slovenská Technická Norma) (1989): Klasifikace jakosti povrchových vod. Vyd. Úřad pro Normalizaci a Mereni, Praha.

Presentation reports (paper)

Monitoring and Database

Status of monitoring program in current usage

Name of monitoring program National Surface Water Monitoring System
Transboundary Programs: Slovakia-Hungary; Slovakia-Austria;
TransNational Monitoring Network (TNMN)
since 1963

Period of monitoring at the Danube:
Benthic Invertebrates since 1996
Macrophytes since 2003
Phytobenthos since 1998
Phyto- and Zooplankton since 1992

Geographical coverage entire Slovakia

Coverage of monitoring National Surface Water Monitoring System: 250 sites; Transboundary Programs on the Danube: 11 sites; TNMN: 4 sites

Monitoring interval monthly; three times per year; once a year

Name of database OAV

Type of database multi-user client-server database; desktop-database; non-digital protocols

Program used MAGIC

Organisation responsible Slovak Hydrometeorological Institute, Bratislava

Place of database storage Slovak Hydrometeorological Institute, Bratislava

Country Romania

Region entire Romania

Altitude range	0 - >800 m
Stream range	applied to large watercourses
Elements	Benthic Invertebrates, Phytobenthos, Phytoplankton, Zooplankton
Name of method	Determination of Saprobic Index according to PANTLE & BUCK (1955)
Stressors detected	Organic Pollution
Status of method	in current usage
The method covers	field sampling, lab procedure, calculation, presentation

General Description

Brief description	To assess the biological quality of watercourses in Romania the Saprobic Index according to PANTLE & BUCK (1955) is determined and classified in a five-fold scheme.
References	<ul style="list-style-type: none"> • MALACEA, I. (1969): Biologia apelor impurificate (biology of polluted waters). Bucharest (Romanian Academy). (in Romanian) • MARCOCI, I. (1984): Analiza biologică a apelor (biological analysis of waters). Bucharest (Romanian Academy). (in Romanian)
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Sampling

Sampling procedure	<p>When sampling Benthic Invertebrates by hand-net 'kick and sweep' technique is applied. If possible, all major habitats are sampled proportionally according to their presence within a sampling reach (multi-habitat sampling).</p> <p>Whole sample is preserved in the field and organisms are picked out in the laboratory.</p>
Sampling site	<p>Plankton samples are concentrated by means of sedimentation, membrane filtration or centrifugation. Benthic Invertebrates are sieved through 475 µm meshes prior to sorting and identification.</p> <p>width of sampling site: 5 to 30 m <i>Danube specification:</i> 500 to 900 m</p>

	<p>rationale of the selection of sampling sites: representativeness; availability of data on flow dynamics; requirements of international conventions</p>
	<p>Phytoplankton, Zooplankton, Benthic Invertebrates: each season; Phytobenthos: summer</p>
Sampling season	<p><i>Danube specification:</i> Phytoplankton: monthly; Zooplankton: each season; Phytobenthos: summer</p> <p>Benthic Invertebrates: Surber sampler - mesh-size: 475 µm; sampled area: 35x35 cm² Ponar Grab - sampled area: 22x22 cm² Marinescu Dredge (Romanian version of Ekman type Dredge) - sampled area: 17x17 cm²</p> <p><i>Danube specification:</i> Ponar Grab - sampled area: 22x22 cm² Marinescu Dredge (Romanian version of Ekman type Dredge) - sampled area: 17x17 cm²</p>
Sampling device	<p>Phytobenthos and Heterotrophic Periphyton: scraping tool: spatula; scraped area: 6 to 20 cm²; petri dish and spatula for collecting soft sediment</p> <p>Plankton: plankton net - mesh-size: 126.5 µm; net-opening (diameter): 20 to 25 cm; sampling depth: 10 to 15 cm Phytoplankton: 1 litre plastic bottle and 'Kemmerer Water Sampler' (2 to 3 litres); Zooplankton: 5 buckets (10 litres each)</p>
Fixative used	<p>90 % alcohol</p> <ul style="list-style-type: none"> • SR-ISO - 5667-1: 1998 Water quality – Sampling –Part 1: Guidance on the design of sampling programs. • SR-ISO – 5667-2: 1998 Water quality – Sampling –Part 2: Guidance on sampling techniques. • SR-ISO – 5667-6: 1997 Water quality – Sampling –Part 6: Guidance on sampling of rivers and streams. • SR-ISO – 5667-12: 2001 Water quality– Sampling –Part 12: Guidance on sampling of bottom sediments. • SR-EN – 27828 (ISO 7828: 1985) Water quality - Method of biological sampling: Guidance on handnet sampling of aquatic benthic macro-invertebrate. • MARCOCI (1984)
Sampling reference	
Record of	<p>number of individuals</p>

abundance**Abundance specification**

Benthic Invertebrates, Phytobenthos, Phytoplankton, Zooplankton: number of individuals

Level of determination

species, genus

Determination specification

Benthic Invertebrates, Phytobenthos, Phytoplankton, Zooplankton: species level represents the most common level of identification in biological monitoring; some groups are identified to genus level

fieldwork: 1 hour 5 US Dollar 1 biologist; 1 lab technician

laboratory: 16 hours 30 US Dollar 2 persons

Expenditures per sample

costs of transport: 10 US Dollar

Additional environmental data

All costs refer to sampling of Benthic Invertebrates.

height of source, distance from source, stream order, slope, altitude, catchment area, geology, river continuity (passability), cross section of the river bed and/or floodplain, land use, temperature, current velocity, discharge, pH, conductivity, dissolved oxygen content, oxygen saturation, COD (Chemical Oxygen Demand), BOD (Biological Oxygen Demand), nitrite, nitrate, ammonium, phosphorus, water colour, type and intensity of human impact,

Assessment: calculation, classification, presentation**Specifications**

- Within the classification scheme 'class I' represents the reference condition.
- Stream type-specific assessment is not existing. The establishment of a national stream typology is expected to be finished in June 2004.

single metric(s):**Calculation method**

$$SI = \text{Sum of } (s_i * h_i) / \text{Sum of } h_i$$

SI: saprobic index

s_i : saprobial valence of the i-th taxon

h_i : abundance of the i-th taxon

To which spatial scale do metrics refer?

habitat

Number of quality classes

5 (classification according to EU Water Framework Directive will be applied in 2004)

Conversion into classes

class	Saprobic Index based on Benthic Invertebrates	colour code
I	≤ 1.8	blue

II	1.81 - 2.3	green
III	2.31 - 2.7	yellow
IV	2.71 - 3.2	orange
V	> 3.2	red

- Species lists used to calculate index**
- MARVAN, P.; ROTHSCHEIN, J.; ZELINKA, M. (1980): Der diagnostische Wert saprobiologischer Methoden. Limnologica 12(2): 299-312.
 - SLÁDECEK, V. (ed.) (1977): Symposium on Saprobiology. Stuttgart (Schweizerbart).
 - SLÁDECEK, V. (1981): Biologický rozbor povrchové vody: komentár k CSN 83 0532, části 6 : stanovení saprobního indexu. Praha: Vydavatelství Úřadu pro normalizaci a měření: 186 p.
- Reference on calculation**
- PANTLE & BUCK (1955): Die biologische Überwachung der Gewässer und die Darstellung der Ergebnisse. Gas- und Wasserfach 96: 604.

Presentation reports (paper and digital), maps (paper)

Monitoring and Database

Status of monitoring program	in current usage
Name of monitoring program	National Water Monitoring System
Period of monitoring	since 1978
Geographical coverage	entire Romania
Coverage of monitoring	approx. 1 site per 1000 km ²
Monitoring interval	4 times per year
Name of database	Water Quality Component of the National Water Monitoring System
Type of database	desktop-database
Program used	<i>River Quality</i>
Organisation	National Administration 'Apele Romane'

responsible

Place of

database storage

National Administration 'Apele Romane'

General Comments

Comments

Until end of 2003 a multimetric method assessing the biological water quality will be finished regarding biodegradable substances, toxic substances and hydromorphological alterations. It is planned to combine the results of this method with the outputs of other methods in order to reach integrated appraisal of the aquatic environment by December 2004.

Additional monitoring of fishes and macrophytes starts in June 2004.

For sanitary water aspects planktonic bacteria are investigated (e.g. total coliforms, fecal coliforms, fecal streptococci etc.).

Country	AT
Classification System:	Austrian Quality Assessment System
General Description	<p>Selection of reference sites according to REFCOND Guidance, National Strategy paper (“Criteria for the identification of potential reference sites”) and criteria used by AQEM/STAR.</p> <p>The Austrian classification scheme consists of three modules (figure 1):</p> <ol style="list-style-type: none"> 1. Module “Organic Pollution” (Saprobic Index in relation to stream type specific reference value) 2. Module “General Degradation” consisting of two sub-modules (2 multimetric indices) 3. Module “acidification” index (Braukmann & Biss, 2004; applied only in bioregions at risk of acidification) <p>Metrics used for the multimetric indices are standardised in relation to the 95th percentile of metric values under stream type specific reference conditions. These standardized values are termed as “scores”. Indices are calculated by averaging these scores.</p> <p>The benchmark value between reference (High) and good status conditions is defined as the 25th percentile of index values under reference conditions and set to a value of 0.8. That means, observed index values are divided by the benchmark value and multiplied by 0.8. Values > 1 are set to 1.</p> <p>Class boundaries for the ecological quality classes are defined as follows:</p> <p>Quality Class 1: ≥ 0.8 Quality Class 2: $\geq 0.6 < 0.8$ Quality Class 3: $\geq 0.4 < 0.6$ Quality Class 2: $\geq 0.2 < 0.4$ Quality Class 2: < 0.2</p> <p>The Final Ecological Quality Class is determined by the worst case applying all relevant modules.</p>

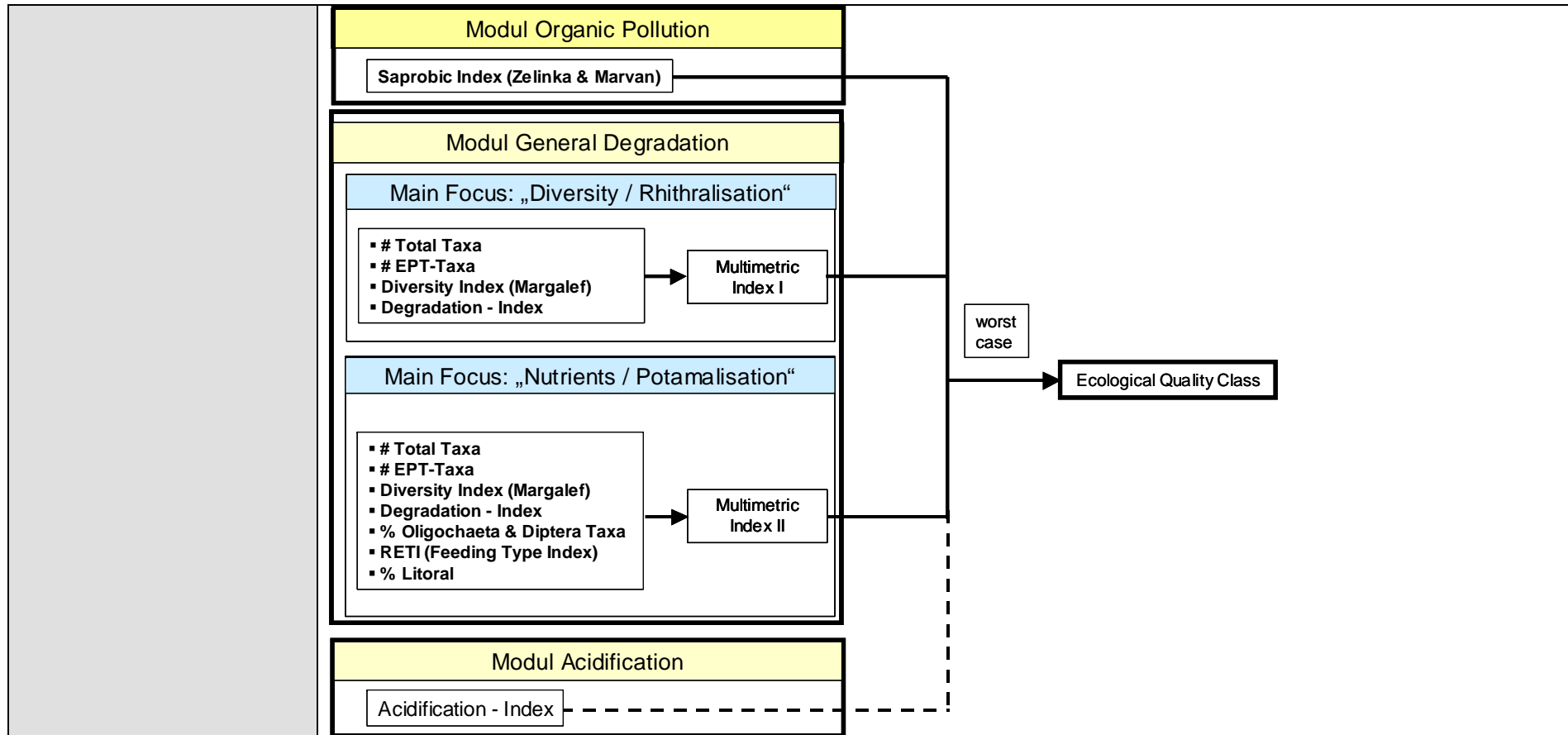


Figure 1: Scheme for the evaluation of ecological quality classes

Criteria for Boundary Setting	High/Good boundary	Good/Moderate boundary
Taxonomic composition	25 th percentile of reference sites	25% deviation (of indices) from reference

and abundance	taxonomic composition represented in indices by: # taxa, % Oligochaeta and Diptera taxa, # EPT Abundance included in Saprobic Index (# Individuals/m ²) and RETI	conditions <u>comment:</u> Major taxonomic groups (defined at the level of order - cannot be used for setting good/moderate boundary – see Appendix!): no groups missing
Ratio of disturbance sensitive to insensitive taxa	25 th percentile of reference sites sensitive to insensitive represented in MMI by: # EPT, % Oligochaeta and Diptera taxa, RETI, % litoral, degradation index, acidification index	25% deviation (of indices) from reference sites <u>comment:</u> crossover points sensitive/insensitive taxa were not used for setting good/moderate boundary (depending too much on which taxa are selected as sensitive/insensitive)
Level of diversity	25 th percentile of reference sites diversity is represented in indices by: Margalef diversity index, # taxa	25% deviation (of indices) from reference sites

