



Sampling and processing

Benthic invertebrates

Benthic invertebrates



- most frequently used biological quality element (BQE) for monitoring and ES assessment purposes
- reflect long-term conditions, overall degradation
- inhabiting the river bed (visible, up to 0,5 mm)



Assessment of benthic invertebrates

Included in

STN 757715 Biological analysis of surface water

- quantitative „multihabitat“ sampling (AQEM), subsampling, sorting, selection
- quantitative and qualitative assessment

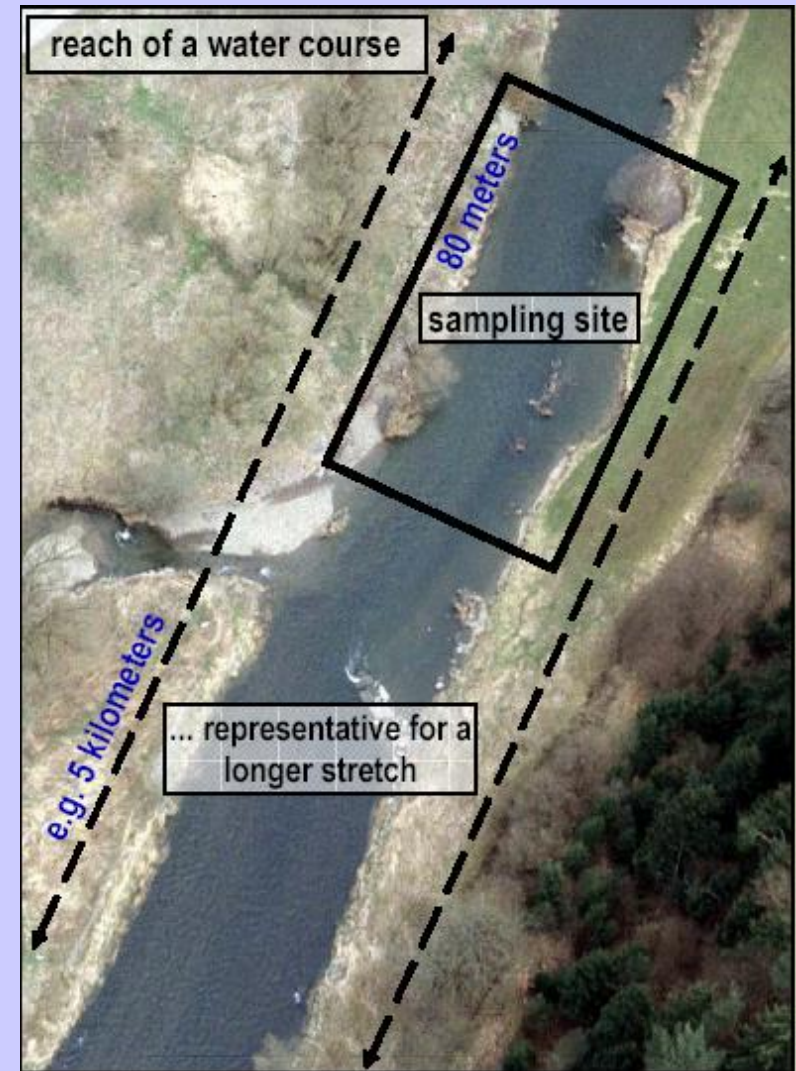
Objective: assessment of water body ES

- standardized sampling method for biomonitoring

Result: list of taxa + density per bed-surface 1,25 m²

Selection of proper sampling site

- representativeness for given reach
- assessed stretch:
 - small streams: 100m
 - medium and large rivers: 500 m
- sampling – depends on size and depth
- Wadable rivers – pro-rata Multi-Habitat sampling (hand-net)- stony substrate, shallow water (STN EN 16150)
- Selection of sampling methods and devices (STN EN ISO 10870)



Multi-habitat sampling (wadable rivers)

Selection of sampling site

boulder-chute
and rocky
submerged
dyke – not
representative



Selection of sampling site

**Do not sample
at bridges!**



Multi-habitat estimation

- Substrate assessment

! Correct – from stream-bank!

(stretch of 100m)

- Sampling on substrates with minim. 5% coverage (record in protocol):
 - surface area: assessed bed / substrates

Microhabitats recognition !

- avoid high water level, floods, extremely dry period ...
- The best period - spring (autumn)

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Mineral microhabitats



megalithal (> 40 cm) blocks



macrolithal (20-40 cm) cobbles



mesolithal (6-20 cm) coarse gravel



microlithal (2-6 cm) medium gravel



akal (0,2-2 cm) fine gravel



psammal (6 μ m-2 mm) sand

Organic microhabitats I.



filamentous algae



submerged macrophytes



emergent macrophytes



floating riparian vegetation



living parts of terrestrial plants



fine roots

Organic microhabitats II.



xylal (large wood: trunks, branches)



CPOM – Coarse Partic. Organic Matter



FPOM – Fine Partic. Organic Matter

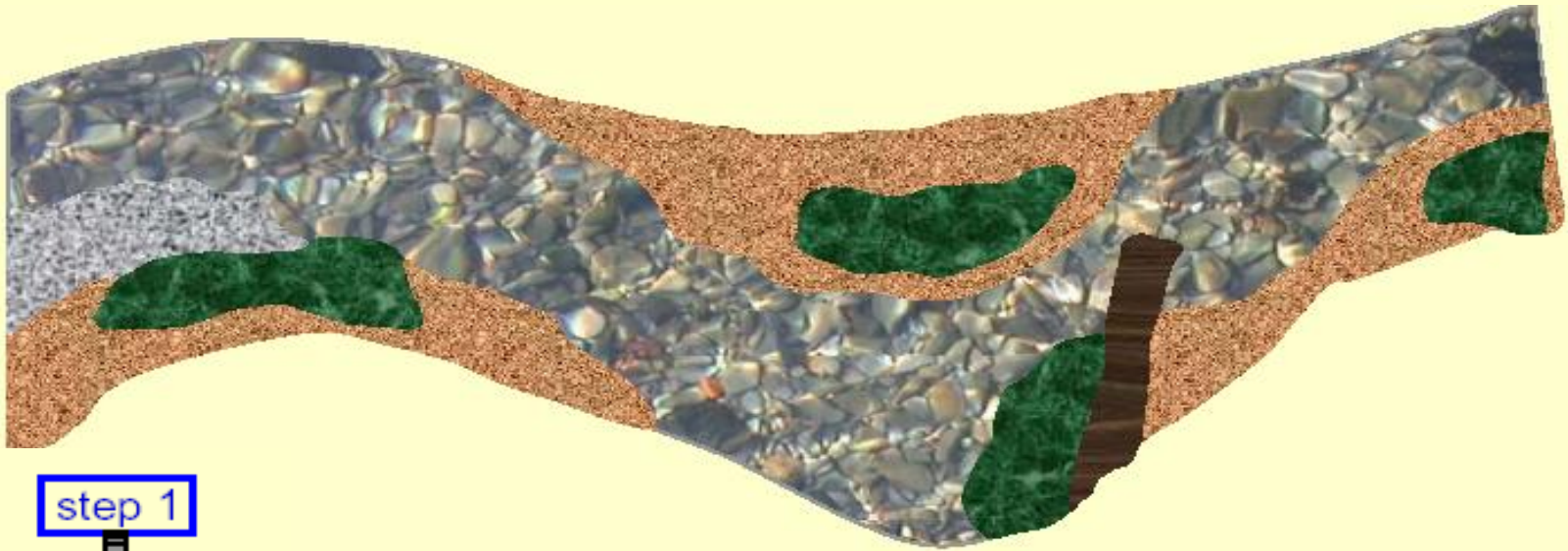


sewage bacteria



debris within the splash zone


Microhabitat estimation



step 1

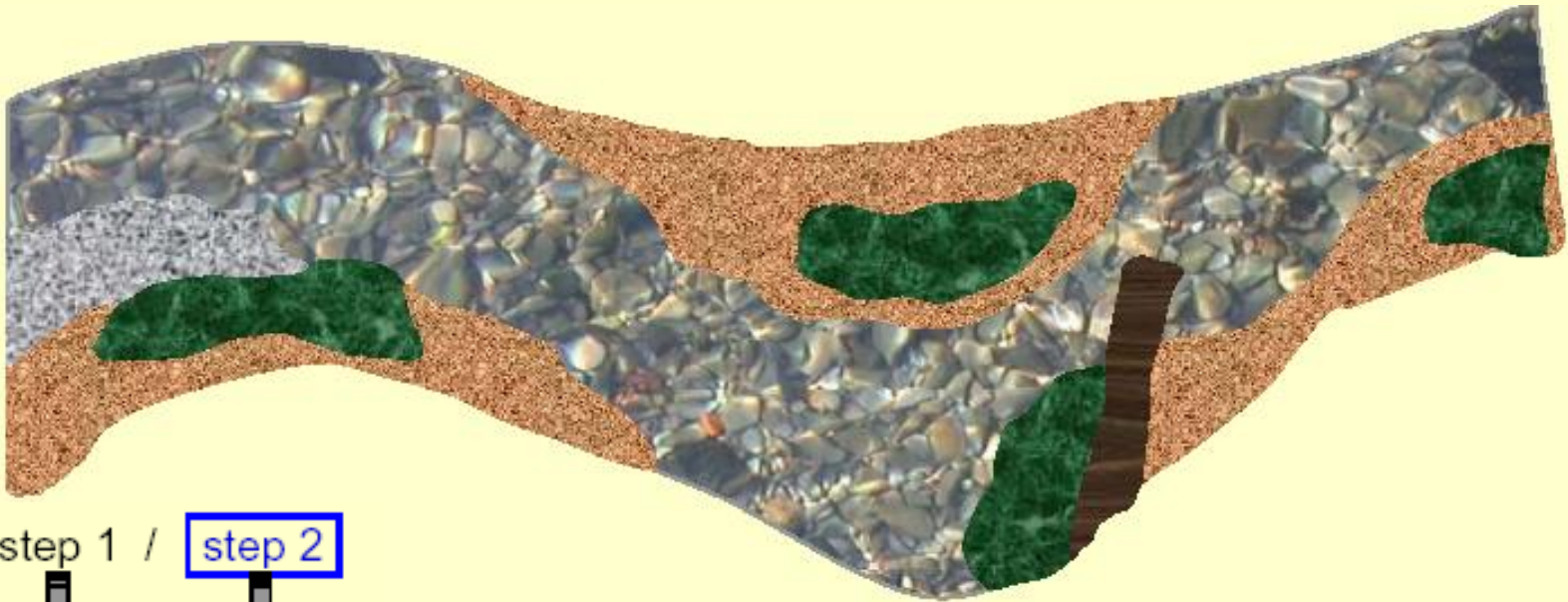


-  mesolithal
-  akal
-  psammal

-  algae
-  xylal




1. step: designation of microhabitats



Microhabitat estimation



step 1 / **step 2**

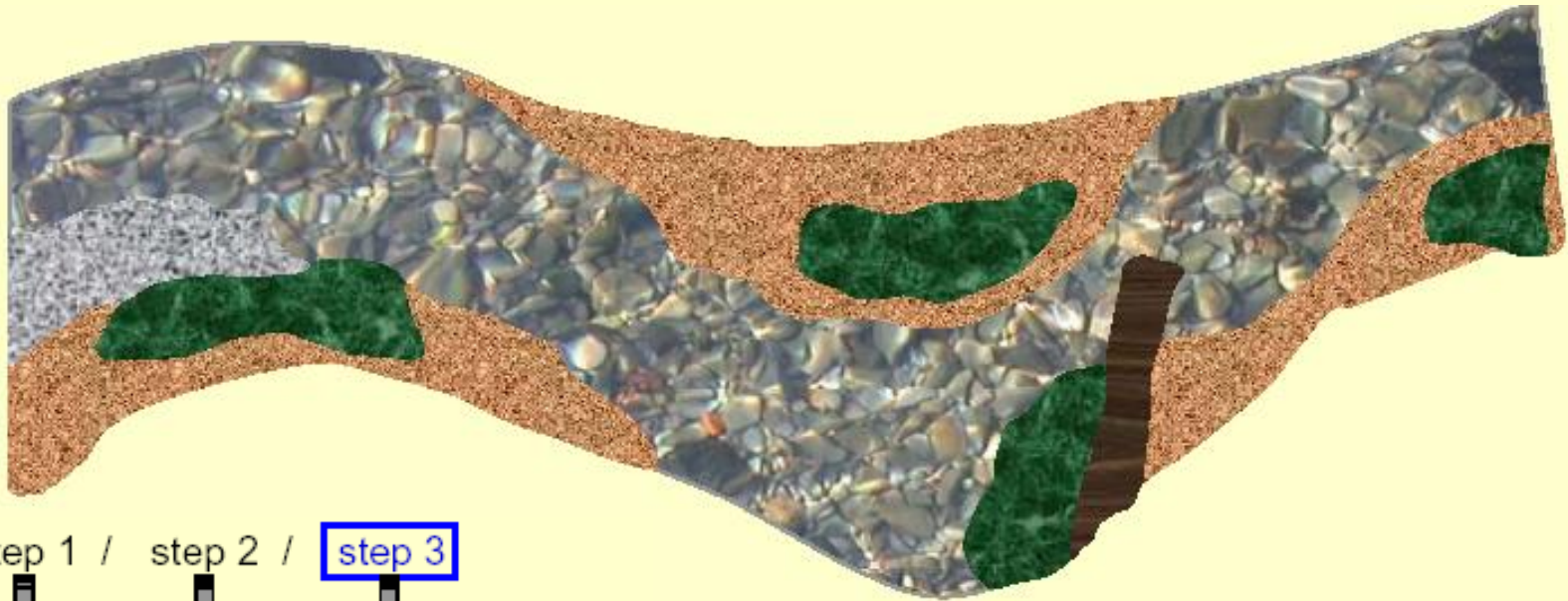


	mesolithal: 55 %
	akal: 5 %
	psammal: 25 %

	algae: 15 %
	xylal: < 5 %

- 1. step: designation of microhabitats**
- 2. step: estimation of macrohabitats ratio (< 5 % not considered)**

Microhabitat estimation



step 1 / step 2 / **step 3**



mesolithal: 55 % = 11 sampling units
akal: 5 % = 1 sampling units
psammal: 25 % = 5 sampling units



algae: 15 % = 3 sampling units
xylal: < 5 % = no sampling units

1. step: designation of microhabitats
2. step: estimation of microhabitats ratio (< 5 % not considered)
3. step: setting of sampling units number from considered microhabitats (20 in total, 1 sampling unit = 5 %)

Microhabitat estimation

Percentage of estimated habitat – rounded to 5%

- Each 5 % = 1 sampling unit

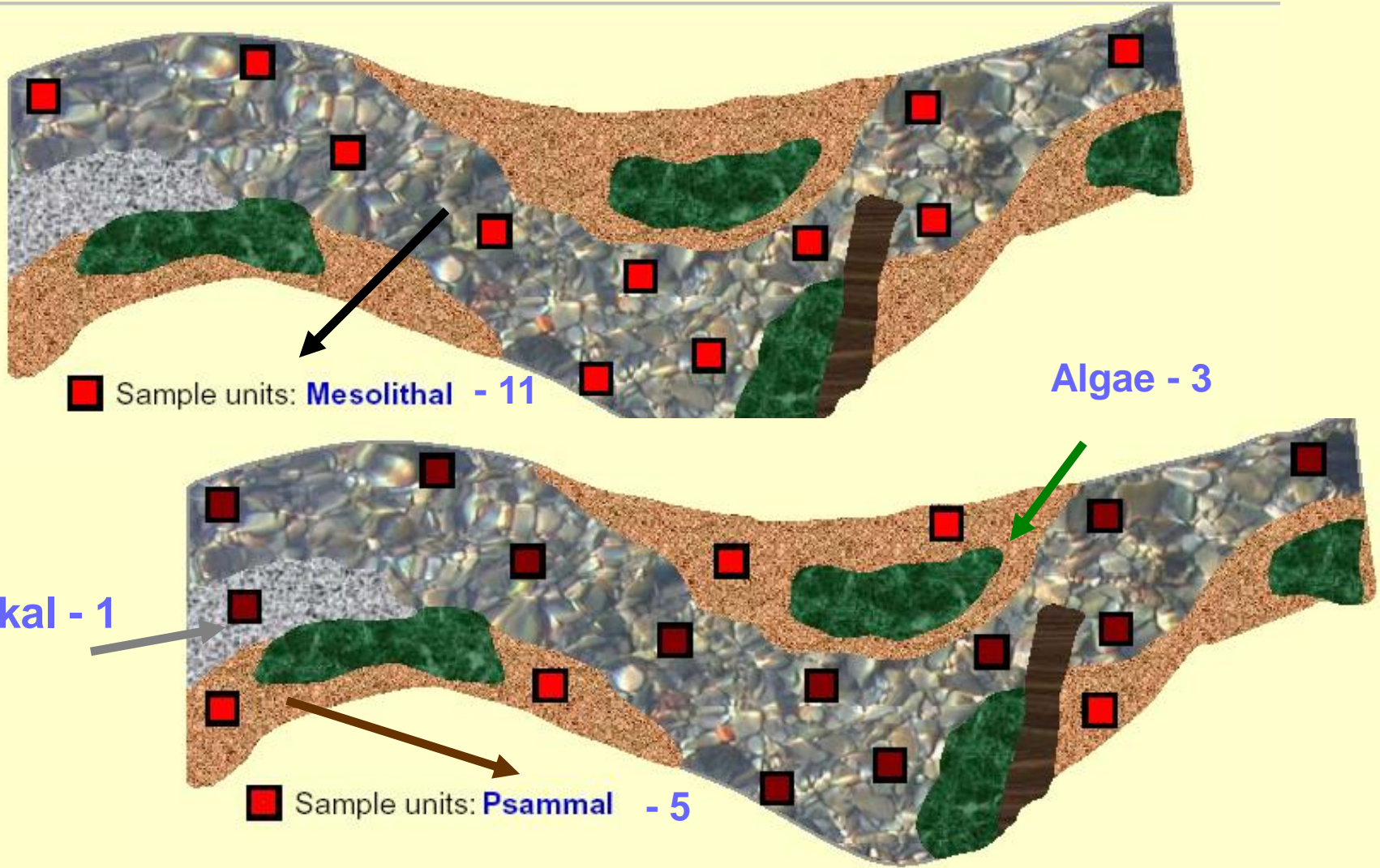
- Considering riffles /pools

Microhabitats of coverage < 5 % marked by X

Distribution of sampling units
site protocol to define the sample units
 macroinvertebrate multi-habitat-sampling

site name	date	Investigator	
data in 5% steps, mark the occurrence of rare microhabitats with „x“			
MINERAL SUBSTRATES	coverage (5% steps)	no. of sampling units	remarks
megallithal (> 40 cm) upper sides of large cobbles, boulders and blocks, bedrock	↓	↓	
makroolithal (> 20 cm - 40 cm) coarse blocks, hand-sized cobbles, with a variable percentage of pebbles, gravel and sand	↓	↓	
mesolithal (> 6 cm - 20 cm) fist to hand-sized cobbles, with a variable percentage of gravel and sand	55%	11	
mikroolithal (> 2 cm - 6 cm) coarse gravel (size of a pigeon egg to child's fist), with variable percentages of medium to fine gravel			
akal (> 0,2 cm - 2 cm) fine to medium-sized gravel	5%	1	
psamminal / psammopetal (> 6 µm - 2 mm) sand and mud	25%	5	
argyllal (< 6 µm) silt, loam, clay (inorganic)			
technolithal 1 (artificial substrates) riprap, stones plastering with major interstices			
technolithal 2 (artificial substrates) stones plastering without interstices, concrete			
BIOTIC SUBSTRATES			
algae filamentous algae, algal tufts	15 %	3	
submerged macrophytes macrophytes, including moss and Characeae			
emergent macrophytes e. g. Typha, Carex, Phragmites			
living parts of terrestrial plants fine roots, floating riparian vegetation			
xylal (wood) tree trunks, dead wood, branches, roots	x	0	
CPOM deposits of coarse particulate organic matter (e.g. fallen leaves)			
FPOM deposits of fine particulate organic matter			
sewage bacteria and fungi and saprobel sewage bacteria and fungi, (Sphaerotilus, Leptothrix), sulfur bacteria (e. g. Beggiatox, mitchror), sludge			
debris organic and inorganic matter deposited within the splash zone area by wave motion and changing water levels (e. g. mussel shells, snail shells)			
sum	100%	20	

Multihabitat sampling



Sampling



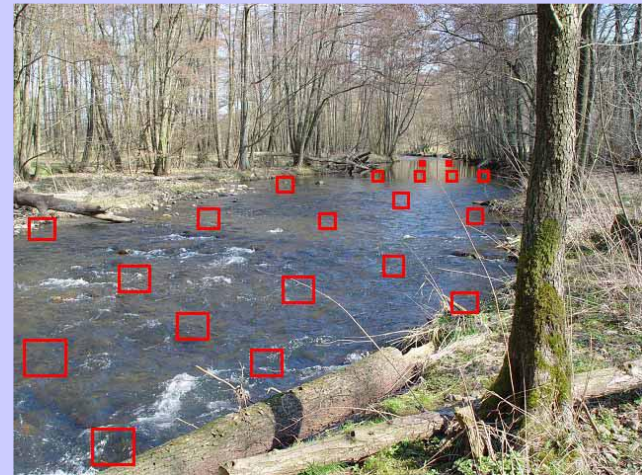
- against the stream
- sampling unit covers 25 x 25 cm (=1,25 m²)
- kicking = disturbing of substrate
(by foot, hand, brush, screwdriver ...)
- max depth – up to 15 cm
- net content – empty several times during sampling
(to avoid damage of the net)

Sampling

CONSIDER ! Ratio of riffles and pools

By low flow velocity:

- sampling of fine mineral habitats –2-5 cm surface layer directly into the net
- flow artificially generated by hand



Sampling of macrophytes

- bed surface - 25 x 25 cm area + corresponding water column
- Organisms are washed down from sampled vegetation (by means of hand-net)
- Mineral substrate from corresponding bottom included as well
- Floating vegetation sampled together with mineral substrate of bottom
- sampling of dominant vegetation



Large rivers (+ deep medium, non - wadable)



- depth and turbidity (estimation ???)
- representative stretch – up to 500 m
- Substrates estimation – only in riparian zone / stream-banks
- modified quantitative deep water sampler different sampling area !!!

By homogenous substrate – sufficient 10 sampling units

Modified quantitative deep water samplers

Modified sampling method and gear

Standard hand net
(Shovel sampler, 25 x 25 cm)

Grab sampler
(e. g., Van Veen, 25 x 25 cm, if possible)

(Dredge)

(Core sampler)



Birge-Ekman

sampling area **225 cm² (15cm x 15cm)**

Príklady hĺbkových odberových zariadení



Core sampler



Air-lift sampler



Van Veen grab



Dredge

Birge-Ekman grab



Sample processing

(reduction, selection, conservation,
sub-sampling)

Reduction of sampled material



selection

formaldehyd

Field selection of organisms

- protected and endangered species, which should be returned into the stream after determination (*Astacus astacus*, *Margaritifera margaritifera*, *Unio crassus*...)
- large and fragile individuals, which should be damaged during the transportation
- rare species of low abundance (*Perla*, *Perlodes*, *Ephemera*, *Anodonta*, *Unio*)
- max. 20 ind.



Conservation

- **Formaldehyd** (38 %) - final concentration - 4% (proportion 1:9)
- 95 % ethanol – selected ind./species

In ethanol stored organisms – determination features damaged – complicated identification

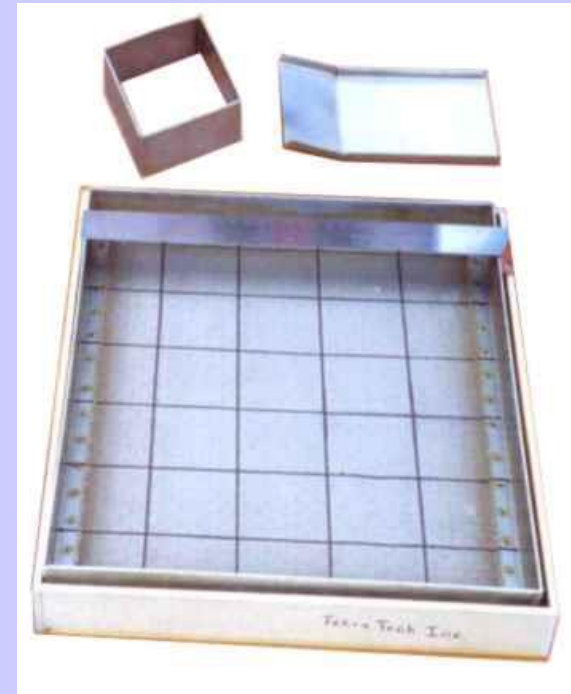
Formaldehyd smell – removed by washing before further processing (round sieve)



Sub-sampling

SUBSAMPLER

- 30 x 36 cm, rustless metal net (500 μm)
- split up into 5 x 6 square fields (30 in total)
- random selection of 5 square fields for sorting

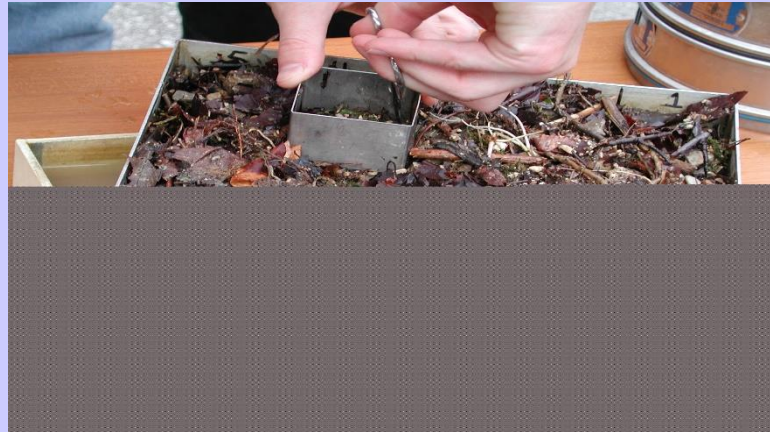


	A	B	C	D	E	
1						1
2						2
3						3
4						4
5						5
6						6
	A	B	C	D	E	

Sub-sampling

sample in subsampler

- put in water
- homogenized
- put out of water
- random selection of 5 square fields
(square frame, spoon, scissors, tweezers)



Sub-sampling

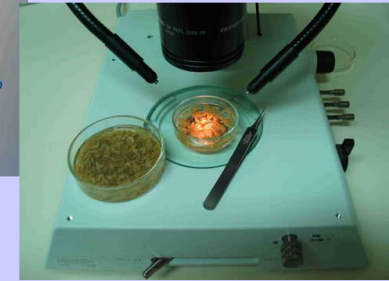
- preliminary estimation of individuals number – cca. $500 \pm 20\%$
- if more in 5 square fields – another subsampling (sediment again put to subsampler)
- if less – continuation (more square fields sorted) until cca. $500 \pm 20\%$ ind.

PRINCIPLE:

- Min. 1/6 of entire sample (5 square fields) – analyzed ! (record in protocol !)
- Min. 500 organisms! / entire sample
- each square field must be completely collected



Sample analysis and results expression



- Sorting to the systematic groups
- Identification of immediately determinable taxa
- Other and questionable / uncertain taxa -
conservate by 70% ethanol
- Determination of taxa (permanent slides) +
quantitative data

Result: taxa list + density /abundance per 1,25 m²

= Starting point for ES evaluation !!!

Assessment of ES based on benthic invertebrates

Starting point:

- qualitative and quantitative analyses of benthic invertebrates (taxa list + abundance/density)

Calculation of metrics - multimetric index
(information on overall ecological status)



Metrics /indices reflect the autecological characteristics of organisms

8 metrics - small streams

11 metrics - medium streams

8 metrics - large rivers (6 - Danube)

• Assessment of ES based on benthic invertebrates

Detection of different stressor:

- organic pollution
- degradation of morphology
- general degradation

Quality class	Ecological status
I	High
II	Good
III	Moderate
IV	Poor
V	Bad



Thanks for attention

Hydrobiologický kurz, VÚVH, 2007