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The Macrozoobentos of Lake Durowskie

Benthic macroinvertebrates, Good indicators of watershed health

- live in the water for all or most of their life
- are easy to collect
- differ in their tolerance to amount and types of pollution
- are easy to identify in a laboratory
- often live for more than one year
- have limited mobility
- are integrators of environmental condition

Some bugs can't tolerate water pollution, we call these bugs pollution sensitive.

- Mayfly
- Caddisfly
- Water Penny
- Planarian
- Dobsonfly
- Stonefly

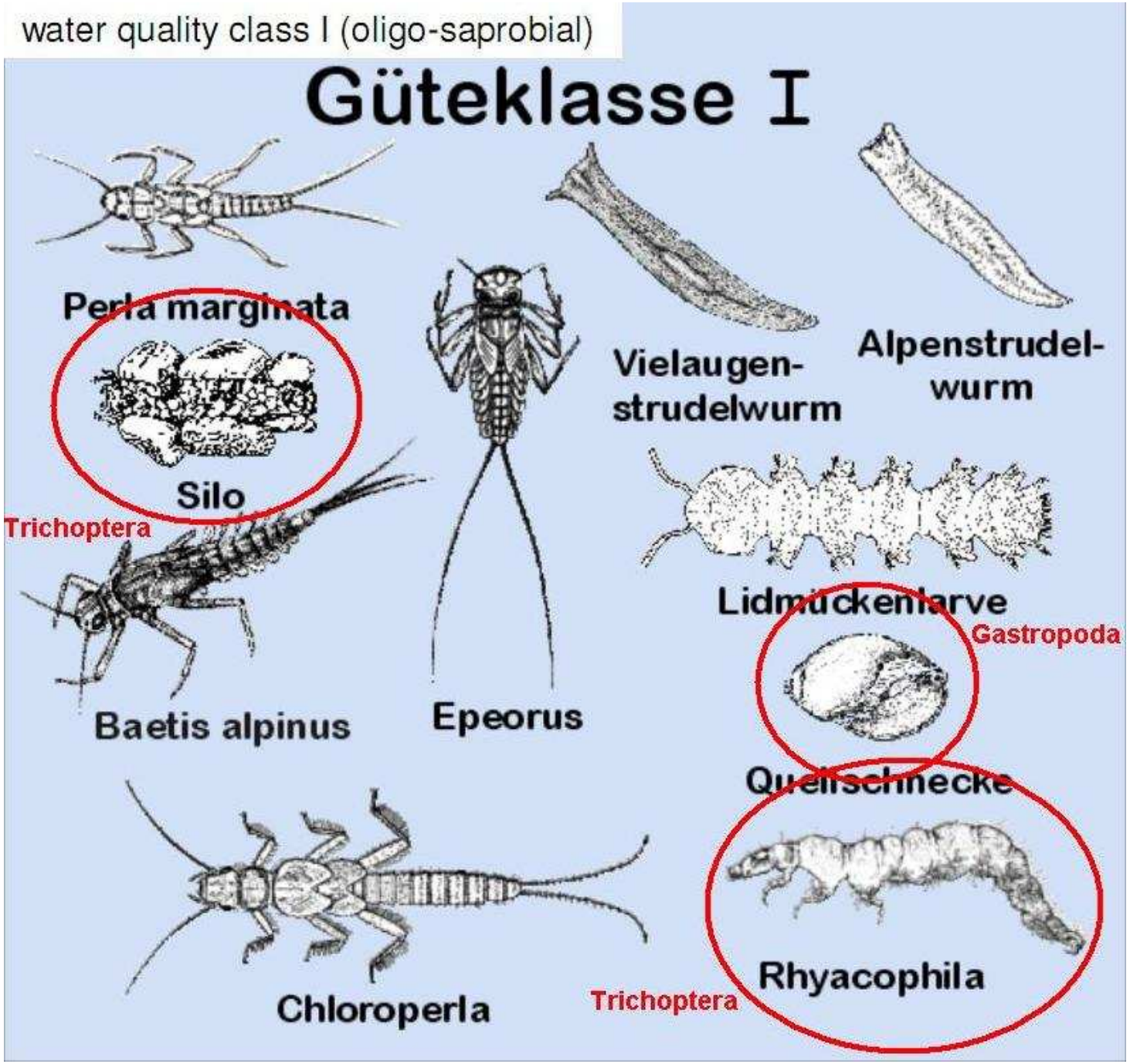
Other bugs are less sensitive to pollution...

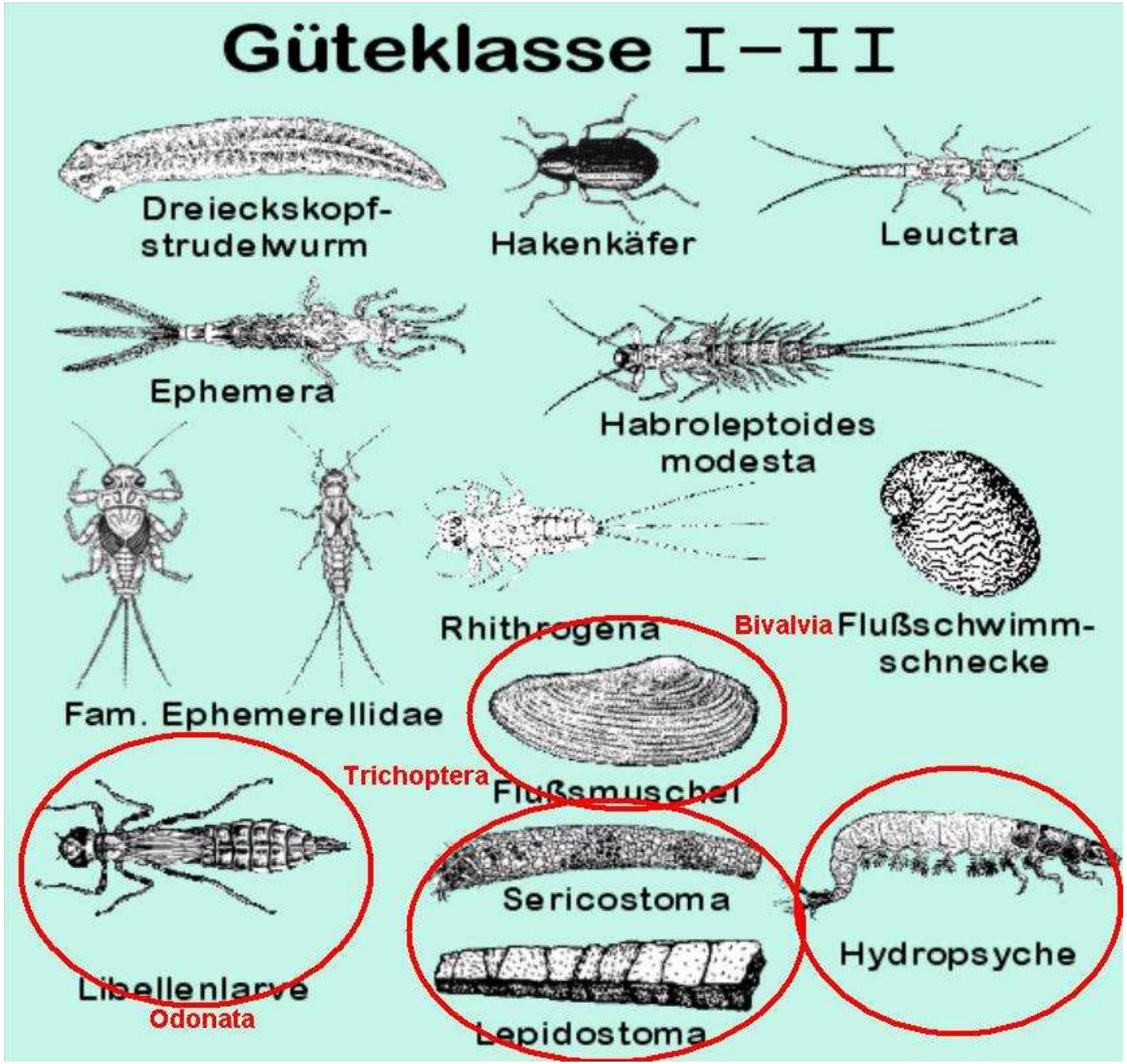
- Crayfish
- Clam
- Fishfly
- Sowbug
- Scud
- Riffle Beetle Larva
- Alderfly
- Cranefly
- Dragonfly
- Mussel
- Riffle Beetle Adult
- Whirligig
- Damselfly

Some bugs can live in any kind of water. (bugs pollution tolerant)

- Leech
- Midge
- Aquatic Worm
- Gilled Snail
- Black Fly
- Lunged Snail

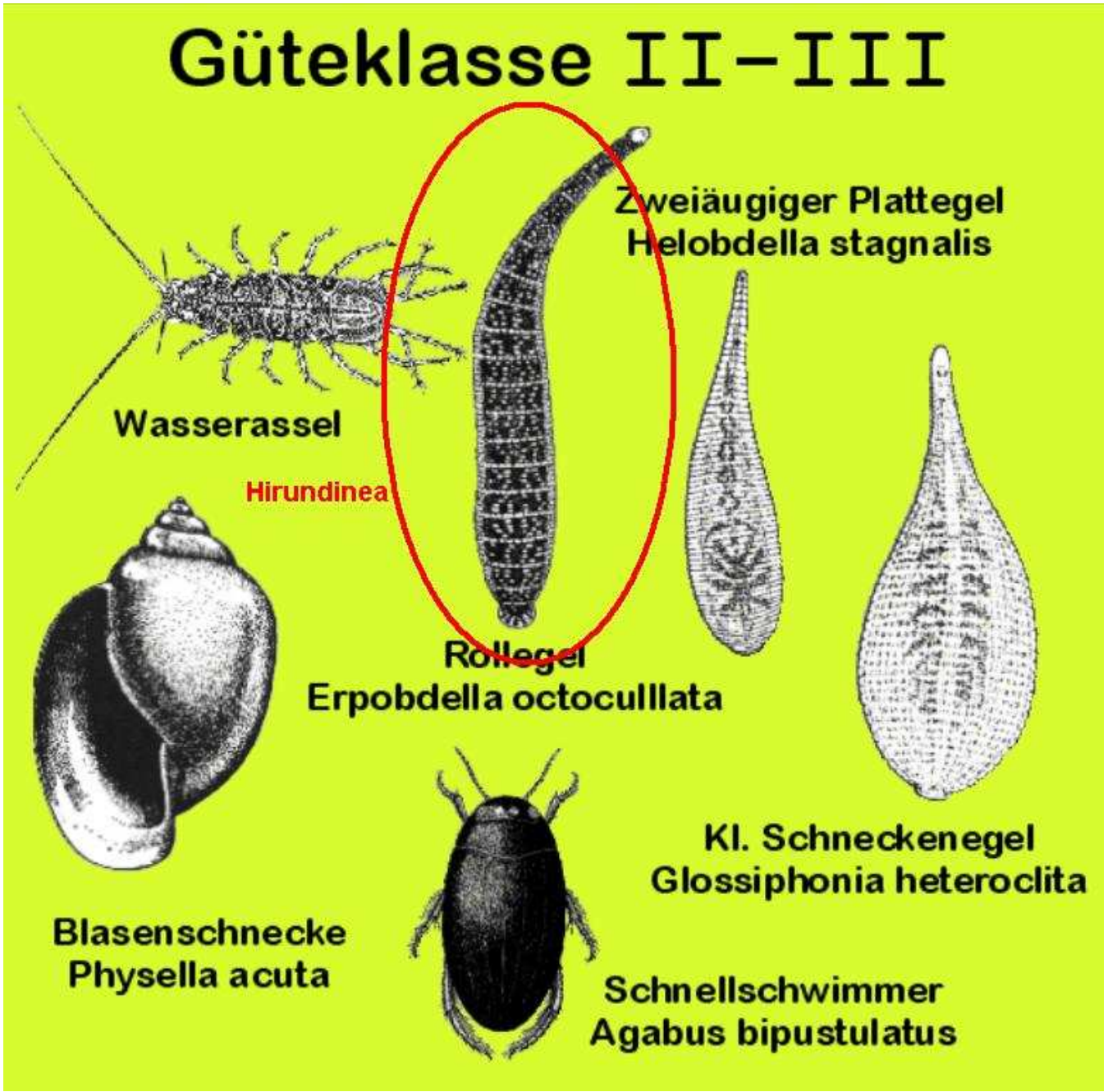
water quality class I (oligo-saprobial)



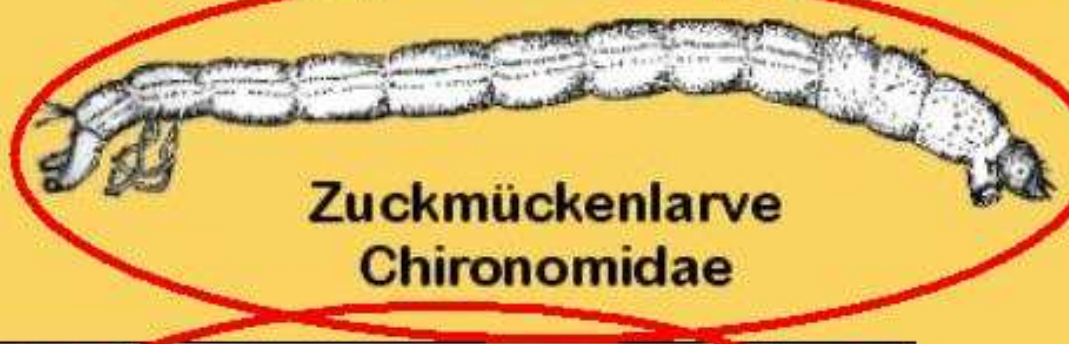

Güteklasse I–II
Dreieckskopf-
strudelwurm
Hakenkäfer
Leuctra
Ephemera
Habroleptoides
modesta
Rhithrogena
Fam. Ephemerellidae
Bivalvia
Flußschwimm-
schnecke
Flußmuschel
Trichoptera
Sericostoma
Hydropsyche
Libellenlarve
Odonata
Lepidostoma


Güteklasse II
Polycelis nigra
Dendrocoeleum lacteum
Dugesia tigrina
Viviparus viviparus
Valvata piscinalis
Gyraulus albus
Gastropoda
Unio tumides
Anodonta cygnea
Großer Schneckenegel
Gammarus roeseli
Hirundinea
Bivalvia
Baetis rhodani
div. Käfer
Schlammfliege Sialis
Potamanthus
Aeschna-Larve
Lestes-Larve
Libellen-Larven
Trichoptera
Polycentropus
water quality class II

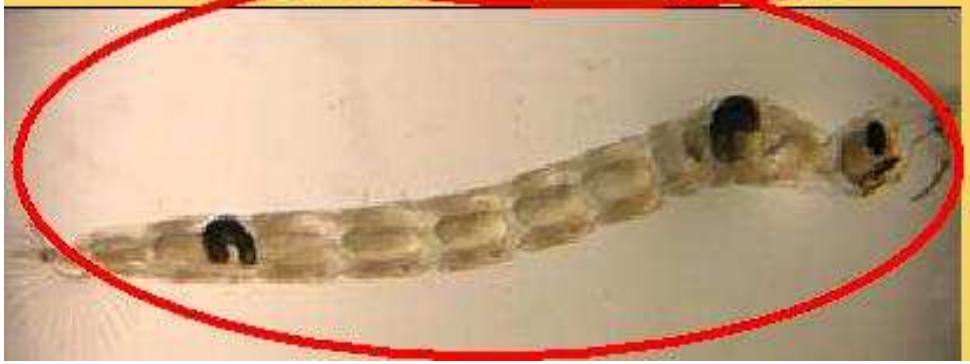
Güteklasse II–III



Güteklasse III-IV



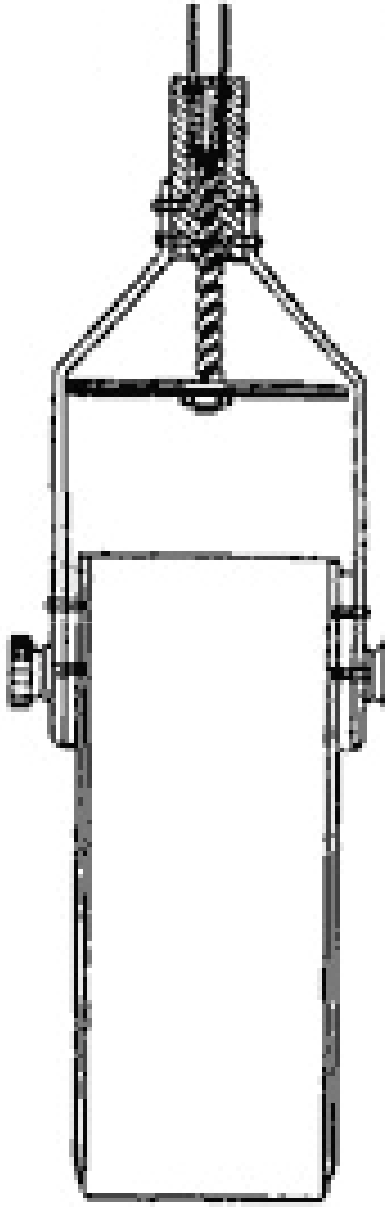
Zuckmückenlarve
Chironomidae



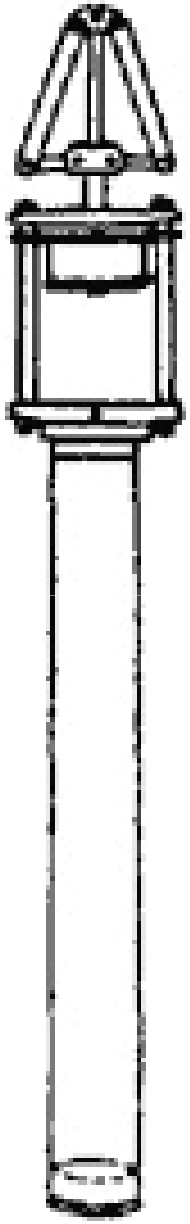
Chaoborus

METODOLOGY

- 14 diffrent places of lake and 2 places in the Struga Gołaniecka River
- Two cor samplers : „Czapla” for litoral zone <2m The second sampler called „Kajak” for deeper parts of the lake (also 14,6 m)
- Samples washed on a sieve, separated in plastic boxes filled with water. living organisms >2mm counted and weighed.
- 5 sample from each pelagial, and 8 sample from each litoral, 10 from each river
- Estimation of condensation and biomass of the living organisms per one square metre.

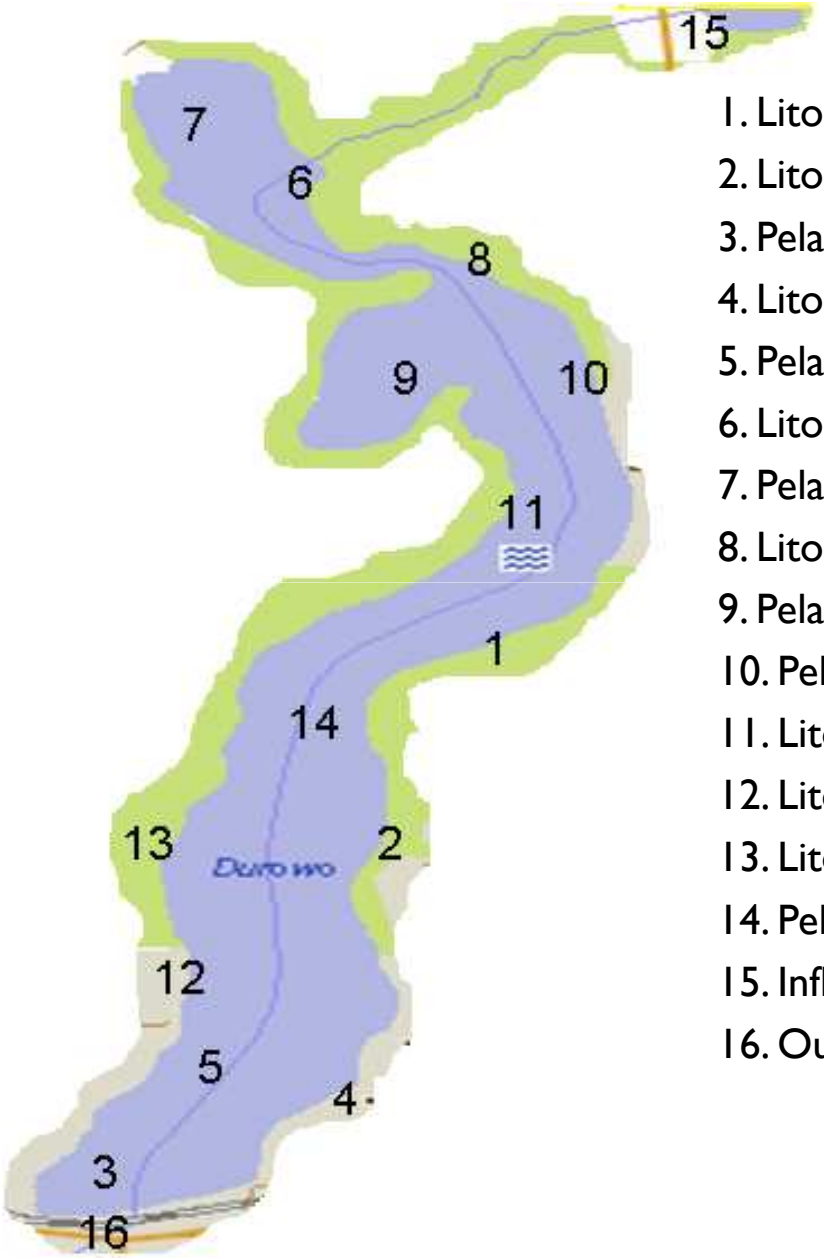


„Czapla”



„Kajak”

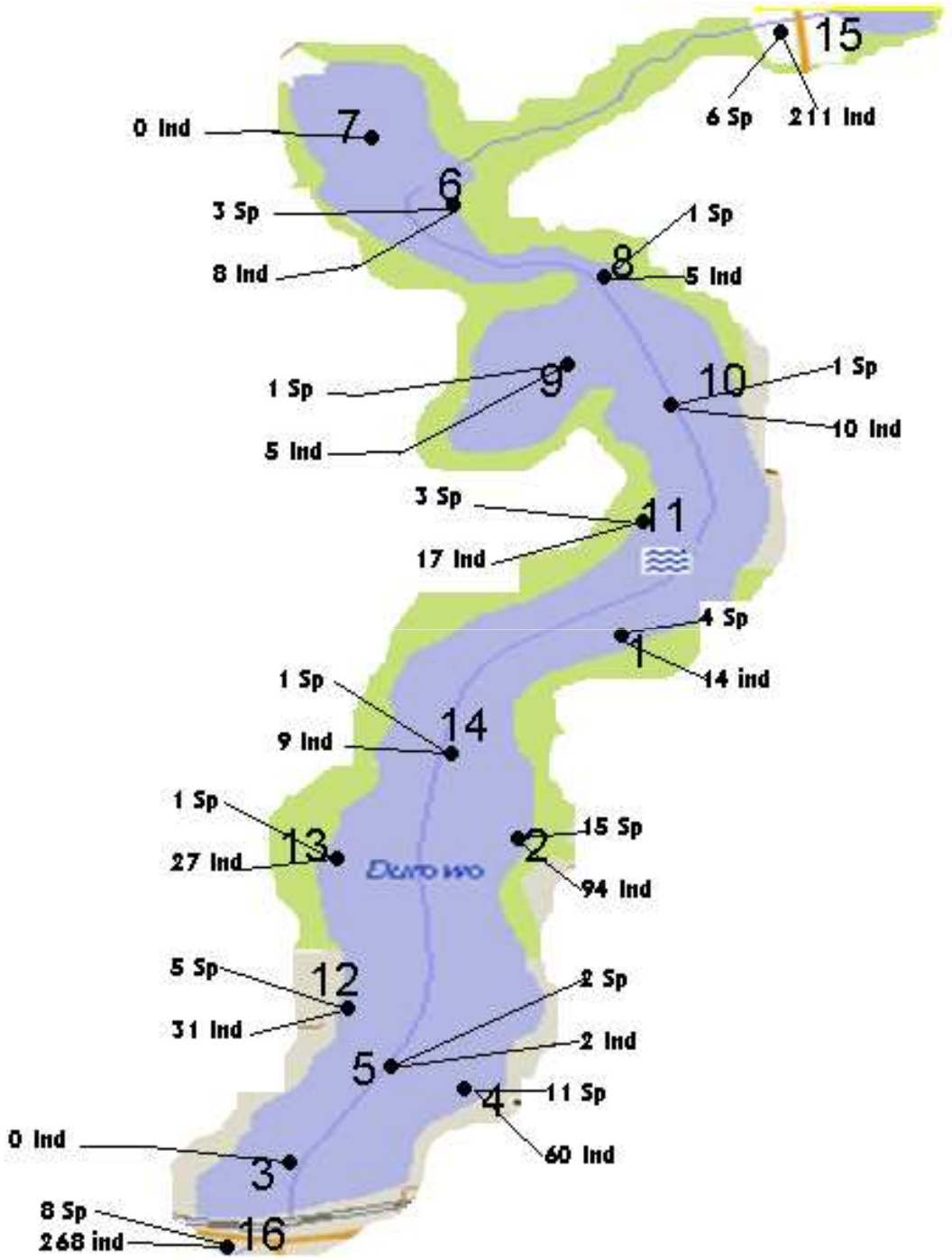
Stations (Stanowiska poboru prób zoobentosowych).



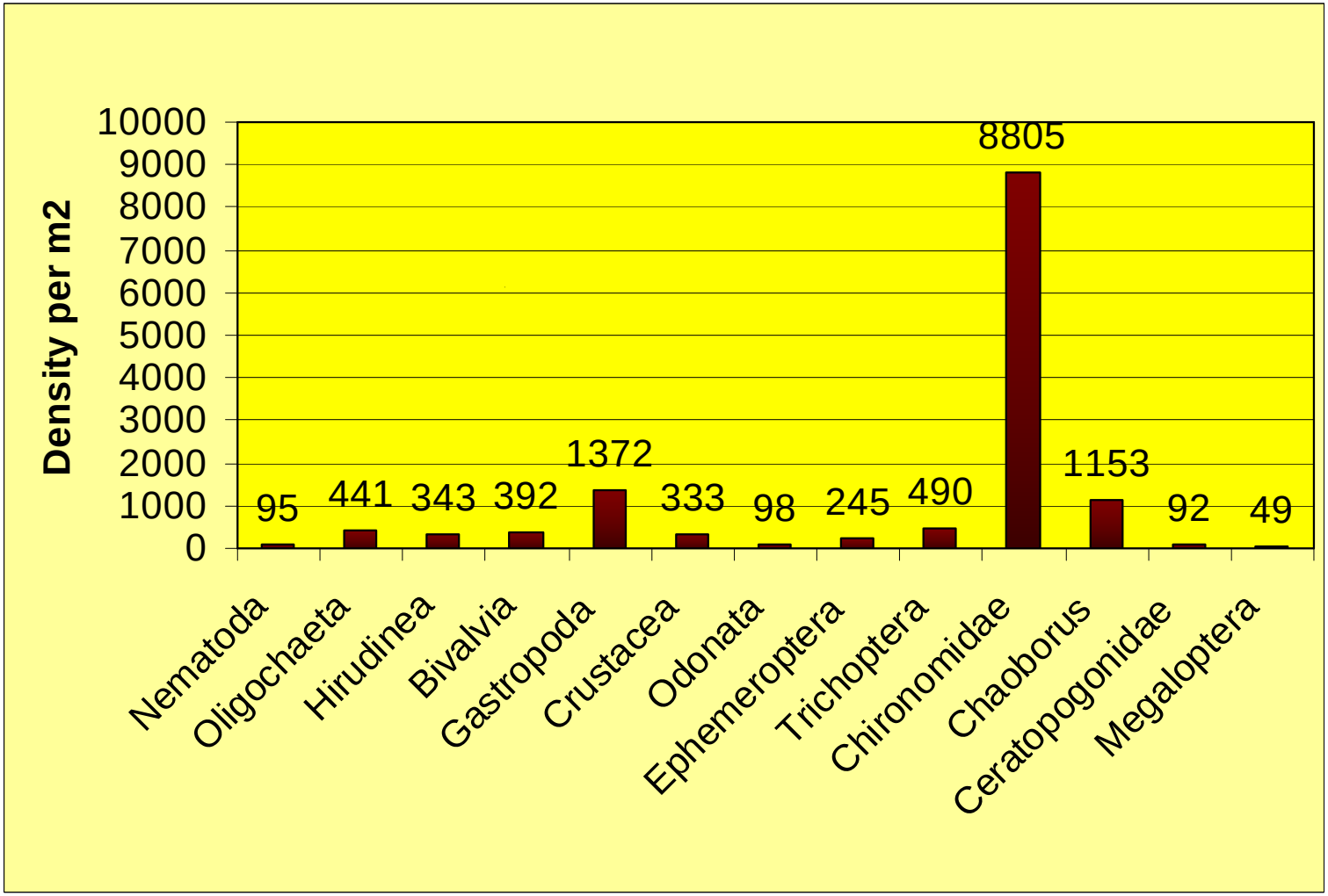
1. Litoral with reed near forest cover,
2. Litoral near urban area,
3. Pelagial near dam,
4. Litoral near urban area,
5. Pelagial (Aerator I)
6. Litoral near Struga Gołaniecka River,
7. Pelagial,
8. Litoral (Bulrush near forest cover),
9. Pelagial,
10. Pelagial (aerator II),
11. Litoral with reed,
12. Litoral near urban area,
13. Litoral with reed near forest cover,
14. Pelagial,
15. Inflow of Struga Gołaniecka River,
16. Outflow of Struga Gołaniecka River.

Results

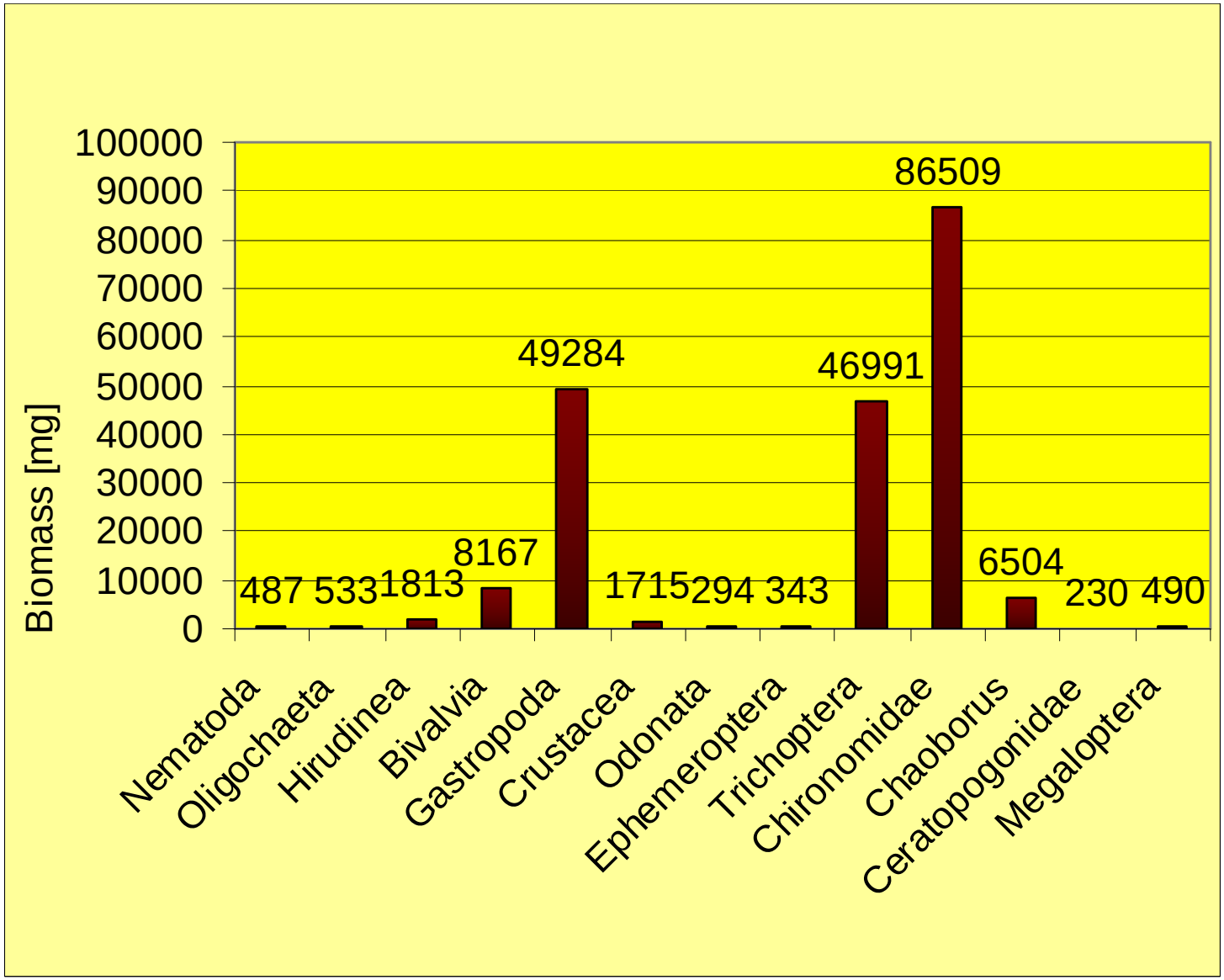
				20.07.09		21.07.09			22.07.09			23.07.09		23,07	24.07.09		24,07	25.07.09	
			Species	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9	Station 10	Station 1	Station 12	Station 13	Station 14	Station 15	Station 16
				Litoral, ne	Bridge	Dam	Litoral nea	Aerator I	Litoral with	Pelagal no	Litoral with	pelagial	Aerator II	Litoral with	urban bea	Litoral with	pelagal	River inlet	River outlet
Nemathelminthes	Nematomorpha		Gordius aquaticus Dujardin		1				1										
Annelida																			
	Oligochaeta		Tibificidae												1			35	
	Oligochaeta		Stylaria lacustris																
	Oligochaeta		Lumbriculidae		8														1
	Hirudinea		Glossiphonia				6	1											1
			Erpobdella																
			Haemopis sanguisuga																
			Hemiclepsis marginata																
Mollusca																			
	Bivalvia Lub	Bivalvia	Anodonta	1	1									1					
		Bivalvia	Unio	1	1		2								1				
		Bivalvia																	
	Gastropoda	Gastropoda	Gyraulus		1														
		Gastropoda	Theodoxus fluviatilis		3		1								1				9
		Gastropoda	Viviparus																
		Gastropoda	Valvata piscinalis		4													1	
		Gastropoda	Lymnaea (Galba)		1										1				
		Gastropoda	Bithynia				1												
		Gastropoda	Planorbis																1
Arthropoda			Potamopyrgus inkinsi		8		4												9
	Crustacea	Malacostraca	Isopoda (Asellus aquaticus Racov)		3		3											1	
	Crustacea	Branchiopoda	Anostraca																
Insecta																			
	Odonata		Coenagrion				1												
			Erythomma najas				1												
			Calopterix virgo				1												
	Ephemeroptera				4														
	Trichoptera																		
		Hydropsychidae	Hydropsyche	1	1		6											2	2
		Limnephilidae	Anabola nervosa Curtis		1														5
		Limnephilidae	Grammotaulius		1														
		Polycentropidae																1	
	Diptera																		
		Chironomidae	Chironomidae	11	56		34		5		5			15	27	27		171	240
		Culucidae	Chaoborus					1				5	10				9		
		Ceratopogonidae	Ceratopogonidae						2										
	Megaloptera																		
			Sialis											1					
			liczba gatunkow/ species	4	15	0	11	2	3	0	1	1	1	3	5	1	1	6	8
			liczebność/amount	14	94	0	60	2	8	0	5	5	10	17	31	27	9	211	268


15
6 Sp
211 Ind
0 Ind
7
6
3 Sp
8 Ind
1 Sp
8
5 Ind
1 Sp
9
5 Ind
10
1 Sp
10 Ind
3 Sp
11
17 Ind
4 Sp
1
14 ind
1 Sp
9 Ind
14
1 Sp
27 Ind
13
15 Sp
2
94 Ind
5 Sp
12
31 Ind
2 Sp
2 Ind
5
11 Sp
4
60 Ind
0 Ind
3
8 Sp
268 ind
16

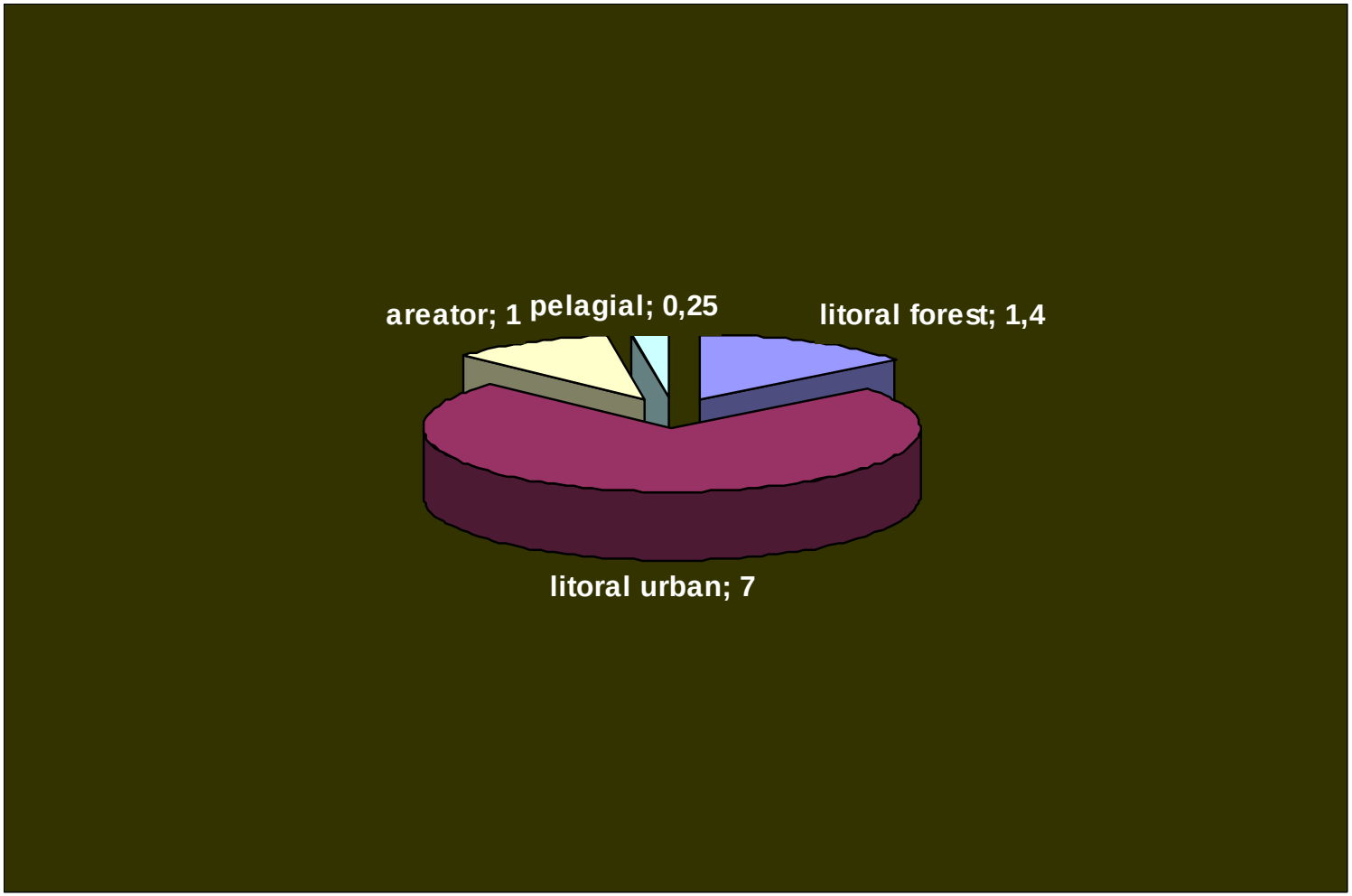
Density of macro-zoobenthos in lake (per m2)



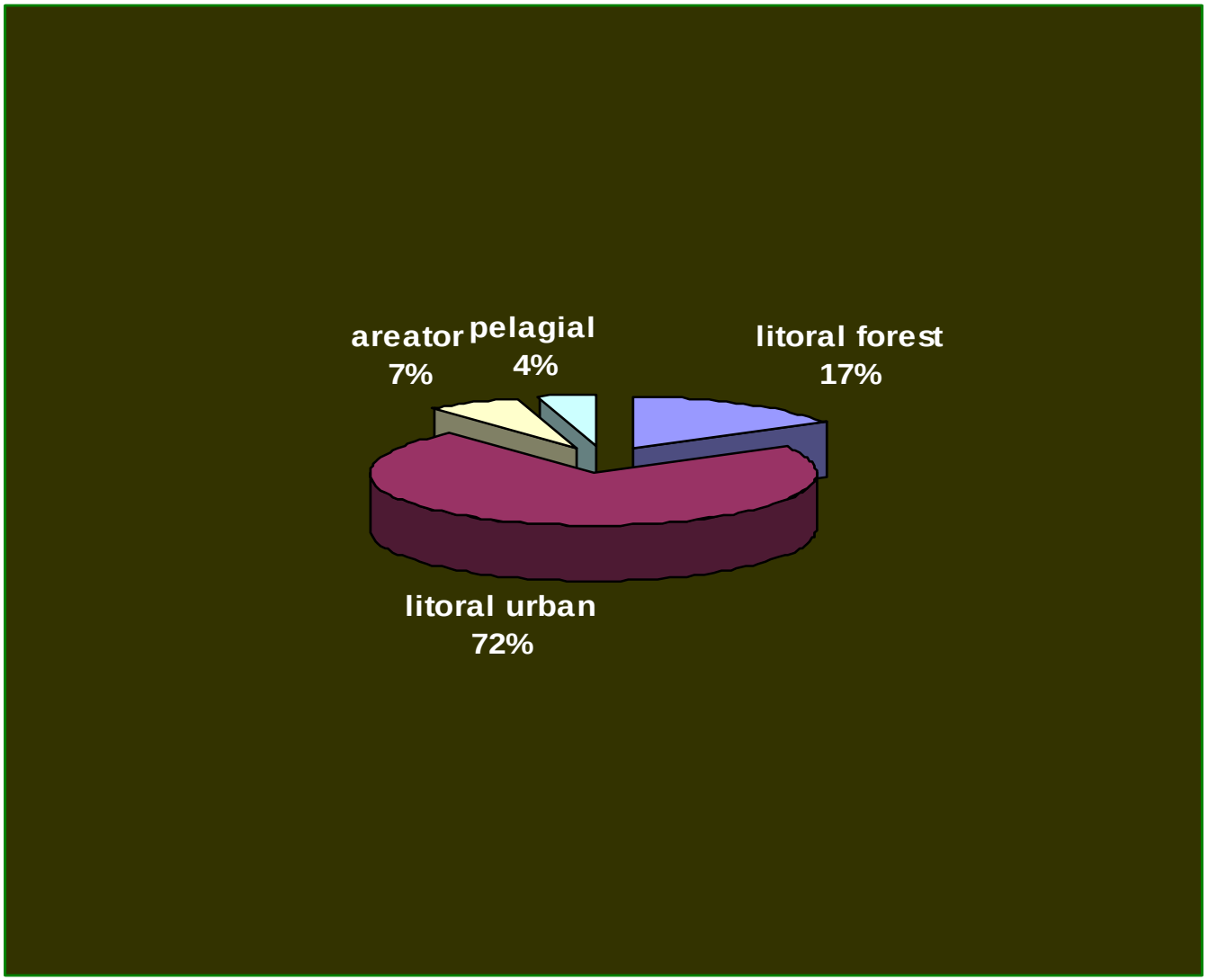
Biomass of macro-zoobenthos in lake (mg/m^2)



Species types (average) in different lake zones



Individual species Counts (average) in different parts of the lake



EPT index

$$\frac{\textit{Ephemeroptera} + \textit{Plecoptera} + \textit{Trichoptera}}{\textit{Chironomids}}$$

EPT index for parts of the lake

- Station 1 (litoral forest): 0.09
- Station 2 (litoral urban): 0.125
- Station 4 (litoral urban): 0.176
- River inflow: 0.017
- River outflow: 0.03
- Other stations: 0

Shannon-weaver-index

$$H_S = -\sum_{i=1}^{S} p_i \cdot \ln p_i$$

- n_i The number of individuals in species i; the abundance of species i.
- S The number of species. Also called species richness.
- N The total number of all individuals
- p_i The relative abundance of each species, calculated as the proportion of individuals of a given species to the total number of individuals in the community:

Shannon's index of biodiversity in 4 parts of a lake.

Litoral forest	0,506
Litoral Urban	1,626
Pelagial	0
Aerator	0,287

BMWP-PL (Biological Working Party Score)

a national index for the quality of water in rivers.

2 parts:

1) BMWP-PL: using families of invertebrates to measure the water quality, giving certain score to each family

I Class BMWP-PL	over 100
II Class BMWP-PL	70 – 99
III Class BMWP-PL	40 – 69
IV Class BMWP-PL	10 – 39

- Station 16 : 21 scores (poor)
- Station 15 : 20 scores (poor)

BMWP Score table		
Group	**Families**	**Score**
Mayflies, Stoneflies, Riverbug, Caddisflies or Sedgeflies	Siphlonuridae, Heptageniidae, Leptophlebiidae, Ephemerellidae, Potamanthidae, Ephemeridae, Taeniopterygidae, Leuctridae, Caprniidae, Perlodidae, Perlidae, Chloroperlidae, Aphelocheridae, Phryganeidae, Molannidae, Beraeidae, Odontoceridae, Leptoceridae, Goeridae, Lepidostomatidae, Brachycentridae, Sericostomatidae	10
Crayfish, Dragonflies	Astacidae, Lestidae, Agriidae, Gomphidae, Cordulegasteridae, Aeshnidae, Corduliidae, Libelluiidae	8
Mayflies, Stoneflies, Caddisflies or Sedge flies	Caenidae, Nemouridae, Rhyacophilidae, Polycentropidae, Limnephilidae	7
Snails, Caddisflies or Sedge flies, Mussels, Shrimps, Dragonflies	Neritidae, Viviparidae, Ancylidae, Hydroptilidae, Unionidae, Corophiidae, Gammaridae, Platycnemididae, Coenagriidae	6
Bugs, Beetles, Caddisflies or Sedgeflies, Craneflies/Blackflies, Flatworms	Mesoveliidae, Hydrometridae, Gerridae, Nepidae, Naucoridae, Notonectidae, Pleidae, Corixidae, Haliplidae, Hygrobiidae, Dytiscidae, Gyrinidae, Hydrophilidae, Clambidae, Helodidae, Dryopidae, Elmidae, Chrysomelidae, Curculionidae, Hydropsychidae, Tipulidae, Simuliidae, Planariidae, Dendrocoelida	5
Mayflies, Alderflies, Leeches	Baetidae, Sialidae, Piscicolidae	4
Snails, Cockles, Leeches, Hog louse	Valvatidae, Hydrobiidae, Lymnaeidae, Physidae, Planorbidae, Sphaeriidae, Glossiphoniidae, Hirudidae, Erpobdellidae, Asellidae	3
Midges	Chironomidae	2
Worms	Oligochaeta (whole class)	

d index

2) calculating biodiversity

$$d = s/\log N$$

d : the index of biodiversity

s : the amount of families of invertebrates on a certain station

logN : average condensation of families per m2

A 5-scale water quality index:

Class I	> 5,50
Class II	4,00 – 5,49
Class III	2,50 – 3,99
Class IV	1,00 – 2,49
Class V	< 1

Station 15 :1,534052 – IV class of water

Station 16 : 1,253993 – IV class of water

- If BMWP-PL and d indexes show the same class of water it means the final result is just like the one gained in those indexes.

Struga Gołaniecka River (inflow and outflow of the lake) has IV class of water quality (poor)

Conclusion

Lake

- Higher biodiversity is found in litoral zone near urban areas than near forest cover.
- No obvious differences between pelagial zone near aerators and pelagial elsewhere.

River

- The level of main pollutants dissolved in the water of Struga Gołaniecka River is very high what puts the river in IV class of BMWP Index.
- There are huge differences in amounts of certain families of macroinvertebrates in the inflow and outflow. The inflow is much richer in Oligochaeta(35) which prefer polluted waters. And the outflow is richer in Trichoptera which normally live in cleaner and more oxygenated waters. According to this data the inflow is more polluted than the outflow.