

EVALUATING WATER QUALITY USING PROTOZOA AND SAPROBITY INDEXES

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INTRODUCTION

The main objective of this protocol is to make familiar protozoologists and instructors with the saprobic classification of heterotrophic protists (Table 1). Many are useful bioindicators in aquatic ecosystems, especially for the load of running waters with easily degradable organic wastes and for habitats devoid of, or significantly depleted in, molecular oxygen. Protozoa, thus, play a major role in the so-called "saprobic system" which is widely used for evaluating and assessing water quality in Central Europe and in the former Soviet Union. Detailed discussions about the pros and cons of the saprobic system and of water quality assessment in general were provided by, e. g., Amavis & Smeets (2), Moog (8) and Sladecek (11). The most widely used classification scheme distinguishes four zones of pollution using specific chemical (e. g., oxygen content) and biological (saprobic organisms) parameters (2, 8, 10, 11, 16):

- (1) Polysaprobity. A zone of gross pollution with organic matter, very little or no dissolved oxygen. Few species, especially bacteria and heterotrophic protists, occur with high individual numbers.
- (2) Alpha-mesosaprobity. A zone where some oxygen is present and mineralization commences. More species are present than in the polysaprobic zone. Bacteria and protists still dominate.
- (3) Beta-mesosaprobity. A zone where decomposition products approach mineralization and the oxygen deficit is small. A great variety of protists, plants and animals occur in considerable numbers.
- (4) Oligosaprobity. Mineralization of organic matter is completed and the water is saturated with oxygen. A great variety of plants and animals occur with low individual numbers. Protists are scarce in this zone.

Usually, many indicator organisms (often > 40 species) from various groups of animals (heterotrophic protists, macro-invertebrates ...) and plants (bacteria, autotrophic protists ...) are used for water quality surveys. Such large assemblages can be hardly assessed by simply looking at the saprobic classification of the individual species. Thus, many "biotic indexes" have been suggested to reduce the complexity of organism communities to simple, quantitative measures (see [14] for an excellent review). In this protocol two indexes are shown; both are widely used in Europe and are, in our experience, excellent tools for assessing the quality of running waters.

THE SAPROBITY INDEX OF PANTLE & BUCK

$$\text{SIPB} = \frac{\sum (N \cdot SI_i)}{\sum N}$$

- N estimated individual number for each species; 1 = few, 3 = many, 5 = very many (mass occurrence)
- SI_i saprobity index of species i (take it from table 3)
- SIPB saprobity index of Pantle & Buck (10)

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Calculation example (for a community with 7 species)

Species	N	SI	N . SI _i
A	1	2.8	2.8
B	3	1.9	5.7
C	3	3.5	10.5
D	5	3.8	19.0
E	1	2.1	2.1
F	3	3.0	9.0
G	3	4.8	14.4
Σ	19		63.5

$$\text{SIPB} = \frac{63.5}{19} ;$$

SIPB = 3.3

Classification

- SIPB 1.0 - 1.5 clean = oligosaprobity = water quality class I; signal colour: blue
 1.5 - 2.5 slightly to moderately polluted = beta-mesosaprobity = water quality class II; signal colour: green
 2.5 - 3.5 heavily polluted = alpha-mesosaprobity = water quality class III; signal colour: yellow
 3.5 - ≥ 4.0 very heavily polluted = polysaprobity = water quality class IV; signal colour: red

THE SAPROBITY INDEX OF ZELINKA & MARVAN

$$\text{SIZM} = \frac{\sum (N \cdot I \cdot r_i)}{\sum (N \cdot I)} ; \quad \text{to be calculated separately for each saprobic class (oligosaprobity, beta-mesosaprobity ...)}$$

N counted or estimated individual number for each species; if estimated, a similar (e. g., 1, 2, 3, 5, 7, 9) or the same ranking scale can be used as for Pantle & Buck's index

I indicative weight of species (take it from table 3)

r_i relative number (proportion) of a species in a saprobic class (saprobic valencies in table 3)

SIZM saprobity index of Zelinka & Marvan (16)

Calculation example (for a community with 7 species and counted individual numbers)

Species	N	l	r_i (saprobic valency) ¹					Calculation ($N \cdot l \cdot r_i$)					N . l
			x	o	b	a	p	x	o	b	a	p	
A	69	1	0	1	4	4	1	0	69	276	276	69	69
B	31	3	0	6	4	0	0	0	558	372	0	0	93
C	30	5	0	0	0	1	9	0	0	0	150	1350	150
D	42	2	0	0	2	5	3	0	0	168	420	252	84
E	8	1	0	2	4	3	1	0	16	32	24	8	8
F	120	4	0	0	1	8	1	0	0	480	3840	480	480
G	5	3	0	0	5	5	0	0	0	75	75	0	15
Σ								0	643	1403	4785	2159	899
$\text{SIZM} = \frac{\Sigma (N \cdot l \cdot r_i)}{\Sigma (N \cdot l)}$								0	0.7	1.6	5.3	2.4	

¹ x, xenosaprobity; o, oligosaprobity; b, beta-mesosaprobity; a, alpha-mesosaprobity; p, polysaprobity.

Classification

The classification is the same as for Pantle & Buck's index. However, Zelinka & Marvan's method shows the pollution situation more detailed because the saprobity index is calculated separately for each saprobic class. The highest value, 5.3 in our example, determines the water quality class (III in our example = heavily polluted); the neighbouring values show how sharply the water quality class is circumscribed. The sum of all saprobic classes used gives always 10, like the sum of the proportions of the saprobic valency of each species. It is very impressive to illustrate the proportions of the saprobic classes (oligosaprobity ...) with a block diagram using the above mentioned signal colours (blue for oligosaprobity ...; Fig. 1).

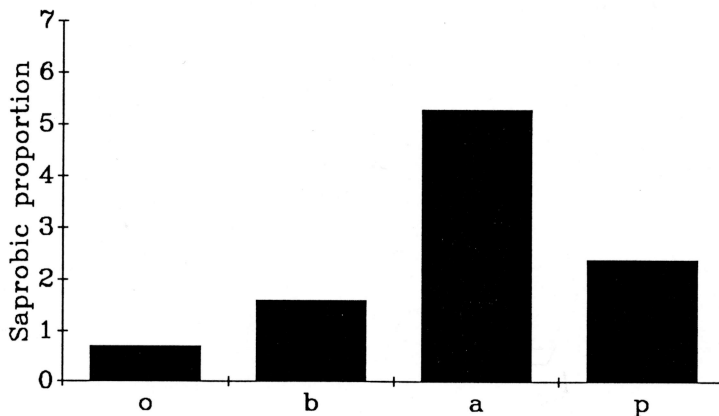


Fig. 1. Block diagram of the saprobic proportions shown in the calculation example.

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COMMENTS

1. Direct stream bed sampling is more efficient and practical than artificial substrate sampling (7).
2. A meaningful calculation of the saprobity index needs at least 15 well-identified indicator species.
3. Saprobity indexes are rather simple mathematical constructs and must thus be checked against other parameters, e. g. chemical indicators.
4. Tümping (13) describes a statistics for comparing saprobity indices in space and time.
5. Saprobity (= pollution with degradable organic wastes) should be assessed using several groups of indicator organisms (protists, macro-invertebrates ...) rather than single types which often prefer a certain saprobic level. Heterotrophic protists, for instance, are very useful indicators for alpha- and polysaprobity, whereas stone-flies are confined to oligo- and beta-mesosaprobic biotopes.
6. The saprobic system cannot be applied to waters which receive poisonous or non-biodegradable wastes.

Table 1. Saprobic classification of heterotrophic protists¹.

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
Flagellates								
<i>Actinomonas mirabilis</i> KENT	a	0	2	3	5	0	2	2.3
<i>Actinomonas vernalis</i> STOKES	b-a	0	2	4	4	0	2	2.2
<i>Actinomonas</i> sp.	b-a	0	2	4	4	0	2	2.2
<i>Amphidinium larvale</i> LINDQUIST	a	0	0	0	10	0	5	3.0
<i>Amphimonas globosa</i> KENT	b-a	0	0	5	5	0	3	2.5
<i>Ancyromonas sigmoides</i> KENT	a	0	0	2	8	0	4	2.8
<i>Anisonema acinus</i> DUJARDIN	b-a	0	0	5	5	0	3	2.5
<i>Anisonema ovale</i> KLEBS	b-a	0	0	5	5	0	3	2.5
<i>Anisonema striatum</i> KLEBS	b	0	0	8	2	0	4	2.2
<i>Anisonema truncatum</i> STEIN	b	0	0	7	3	0	4	2.3
<i>Anisonema variabile</i> KLEBS	b	0	0	8	2	0	4	2.2
<i>Anisonema</i> sp.	b-a	0	0	6	4	0	3	2.4
<i>Anthophysa vegetans</i> (MUELLER)	a	0	0	0	8	2	4	3.2
<i>Anthophysa steinii</i> SENN	a-b	0	0	4	6	0	3	2.6
<i>Astasia curvata</i> KLEBS	a-p	0	0	0	6	4	3	3.4
<i>Astasia dangeardii</i> LEMMERMANN	p-i	0	0	0	1	9	5	4.4 E
<i>Astasia granulata</i> PRINGSHEIM	a-b	0	0	4	6	0	3	2.6
<i>Astasia inflata</i> KLEBS	a	0	0	0	10	0	5	3.0
<i>Astasia inflata f.fusififormis</i> (SKUJA)	a	0	0	0	10	0	5	3.0
<i>Astasia klebsii</i> LEMMERMANN	p	0	0	0	3	7	4	3.7
<i>Astasia linearis</i> PRINGSHEIM	a	0	0	0	10	0	5	3.0
<i>Astasia longa</i> PRINGSHEIM	a	0	0	0	10	0	5	3.0
<i>Astasia quartana</i> (MOROFF)	a-p	0	0	0	5	5	3	3.5
<i>Astasia sagittifera</i> SKUJA	a	0	0	0	10	0	5	3.0
<i>Astasia torta</i> PRINGSHEIM	a-p	0	0	0	6	4	3	3.4
<i>Astasia</i> sp.	a	0	0	0	7	3	4	3.3
<i>Astrosiga radiata</i> ZACHARIAS	o-b	0	6	4	0	0	3	1.4
<i>Aulacomonas hyalina</i> SKUJA	b	0	3	7	0	0	4	1.7
<i>Bernardinium bernardiense</i> CHODAT	o-b	0	5	5	0	0	3	1.5
<i>Bicosoeca campanulata</i> (LACKEY)	a	0	0	3	7	0	4	2.7
<i>Bicosoeca conica</i> LEMMERMANN	b	0	0	10	0	0	5	2.0

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Bicosoeca kepneri</i> REYNOLDS	b-o	0	4	6	0	0	3	1.6
<i>Bicosoeca lacustris</i> CLARK	b-a	0	0	5	5	0	3	2.5
<i>Bicosoeca mitra</i> FOTT	o-a	0	3	4	3	0	2	2.0
<i>Bicosoeca pascheri</i> CONRAD	b	0	2	8	0	0	4	1.8
<i>Bicosoeca petiolata</i> (STEIN)	b-a	0	0	5	5	0	3	2.5
<i>Bicosoeca planktonica</i> KISSELEV	b	0	2	8	0	0	4	1.8
<i>Bicosoeca oculata</i> ZACHARIAS	b	0	0	10	0	0	5	2.0
<i>Bicosoeca ovata</i> LEMMERMANN	b	0	0	10	0	0	5	2.0
<i>Bicosoeca urceolata</i> FOTT	b	0	0	10	0	0	5	2.0
<i>Bicosoeca</i> sp.	b-a	0	2	5	3	0	2	2.1
<i>Bodo angustus</i> (DUJARDIN)	a-p	0	0	0	6	4	3	3.5 E
<i>Bodo caudatus</i> (DUJARDIN)	p	0	0	0	3	7	4	3.7 E
<i>Bodo celer</i> KLEBS	m	0	0	0	0	10	5	5.6 E
<i>Bodo edax</i> KLEBS	m	0	0	0	1	9	5	5.0 E
<i>Bodo erectus</i> (RUEHLE)	a-p	0	0	0	5	5	3	3.5
<i>Bodo fusiformis</i> (STOKES)	p-i	0	0	0	0	10	5	4.7 E
<i>Bodo globosus</i> STEIN	m	0	0	0	1	9	5	5.0 E
<i>Bodo lens</i> (MUELLER)	a	0	0	0	10	0	5	3.0
<i>Bodo ludibundus</i> (KENT)	a	0	0	0	7	3	4	3.3
<i>Bodo minimus</i> (KLEBS)	m	0	0	0	1	9	5	5.0 E
<i>Bodo mutabilis</i> KLEBS	p	0	0	0	0	10	5	4.0
<i>Bodo obovatus</i> LEMMERMANN	p-i	0	0	0	0	10	5	4.5 E
<i>Bodo ovatus</i> (DUJARDIN)	a	0	0	0	9	1	5	3.1
<i>Bodo putrinus</i> (STOKES)	m	0	0	0	0	10	5	5.9
<i>Bodo repens</i> KLEBS	a	0	0	0	7	3	4	3.3
<i>Bodo saltans</i> EHRENBERG	a	0	0	1	7	2	3	3.1
<i>Bodo uncinatus</i> (KENT)	a-p	0	0	0	6	4	3	3.4
<i>Bodo</i> sp.	p-a	0	0	0	4	6	3	3.4
<i>Cephalothamnion cyclopus</i> STEIN	b	0	0	10	0	0	5	2.0
<i>Cercobodo agilis</i> (MOROFF)	m	0	0	0	1	9	5	5.0 E
<i>Cercobodo bodo</i> (MEYER)	a	0	0	0	8	2	4	3.2
<i>Cercobodo crassicauda</i> (DUJARDIN)	m	0	0	0	0	10	5	5.9 E
<i>Cercobodo digitalis</i> (MEYER)	b-a	0	0	5	5	0	3	2.5
<i>Cercobodo grandis</i> (MASKELL)	m	0	0	0	1	9	5	5.0 E
<i>Cercobodo longicauda</i> (DUJARDIN)	m	0	0	0	10	0	5	5.9 E
<i>Cercobodo ovatus</i> (KLEBS)	b-a	0	0	5	5	0	3	2.5
<i>Cercobodo radiatus</i> (KLEBS)	a-p	0	0	0	5	5	3	3.5
<i>Cercobodo simplex</i> (MOROFF)	m	0	0	0	1	9	5	5.0 E
<i>Cercobodo varians</i> SKUJA	m	0	0	0	0	10	5	5.6 E
<i>Cercobodo</i> sp.	p-a	0	0	1	3	6	2	3.5
<i>Chilomonas bacillaris</i> JAVORNICKY	a	0	0	0	10	0	5	3.0
<i>Chilomonas insignis</i> (SKUJA)	a	0	0	0	10	0	5	3.0
<i>Chilomonas oblonga</i> PASCHER	a	0	0	0	10	0	5	3.0
<i>Chilomonas oblonga f. minor</i> (CZOSNOWSKI)	a	0	0	0	10	0	5	3.0
<i>Chilomonas paramecium</i> EHRENBERG	a	0	0	2	6	2	3	3.0
<i>Chilomonas</i> sp.	a	0	0	0	8	2	4	3.2
<i>Cladomonas fruticulosa</i> STEIN	a	0	0	2	8	0	4	2.8
<i>Cladonema laxum</i> KENT	b	0	0	10	0	0	5	2.0
<i>Codonobotrys physalis</i> PASCHER	b	0	0	10	0	0	5	2.0
<i>Codonocladium umbellatum</i> (TATEM)	b	0	0	9	1	0	5	2.1
<i>Codonodendron dinobryoideum</i> (LEMMERMANN)	b	0	0	10	0	0	5	2.0
<i>Codonodendron ocellatum</i> PASCHER	b	0	0	10	0	0	5	2.0
<i>Codonomonas mitra</i> (FOTT)	o-a	0	3	4	3	0	2	2.0

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Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Codonomonas mitra</i> var. <i>succica</i> SKUJA	b	0	0	10	0	0	5	2.0
<i>Codonomonas pascheri</i> VAN GOOR	b	0	2	8	0	0	4	1.8
<i>Codonomonas urceolata</i> (FOTT)	b	0	0	10	0	0	5	2.0
<i>Codonomonas</i> sp.	b	0	1	7	2	0	3	2.1
<i>Codonosiga botrytis</i> (EHRENBERG)	a	0	1	3	5	1	1	2.6
<i>Codonosigopsis robini</i> SENN	b	0	0	10	0	0	5	2.0
<i>Colloidietyon triciliatum</i> CARTER	a	0	0	1	8	1	4	3.0
<i>Cryptoaulax akopos</i> SKUJA	a	0	0	2	8	0	4	2.8
<i>Cyathomonas truncata</i> (EHRENBERG)	b-a	0	0	4	5	1	2	2.7
<i>Cyclidiopsis acus</i> KORSCHIKOFF	b-a	0	0	5	5	0	3	2.5
<i>Dallingeria drysdali</i> KENT	p-i	0	0	0	0	10	5	4.0 E
<i>Desmarella moniliformis</i> KENT	b-a	0	0	4	6	0	3	2.6
<i>Dinema griseolum</i> PERTY	b-a	0	0	5	5	0	3	2.5
<i>Diploeca flava</i> (KORSCHIKOFF)	b	0	0	10	0	0	5	2.0
<i>Diplosiga francei</i> LEMMERMANN	b	0	0	10	0	0	5	2.0
<i>Diplosiga socialis</i> FRENZEL	o	0	8	2	0	0	4	1.2
<i>Diplosigopsis affinis</i> LEMMERMANN	b	0	0	10	0	0	5	2.0
<i>Diplosigopsis entzii</i> FRANCE	o-b	0	5	5	0	0	3	1.5
<i>Distigma curvatum</i> PRINGSHEIM	a-p	0	0	0	6	4	3	3.4
<i>Distigma proteus</i> EHRENBERG	a	0	0	3	7	0	4	2.7
<i>Entosiphon obliquus</i> KLEBS	a	0	0	0	10	0	5	3.0
<i>Entosiphon ovatum</i> STOKES	a	0	0	0	10	0	5	3.0
<i>Entosiphon sulcatum</i> (DUJARDIN)	a	0	0	0	10	0	5	3.0
<i>Euglenopsis vorax</i> KLEBS	p	0	0	0	3	7	4	3.7
<i>Furcilla lobosa</i> STOKES	p-a	0	0	0	4	6	3	3.6
<i>Furcilla trifurca</i> HUBER-PESTALOZZI	a	0	0	0	10	0	5	3.0
<i>Gyrodinium hyalinum</i> (SCHILLING)	a	0	0	0	10	0	5	3.0
<i>Gymnodinium lantzschii</i> var. <i>lantzschii</i> JAVORNICKY	o	0	10	0	0	0	5	1.0
<i>Gymnodinium lantzschii</i> var. <i>rhinophoron</i> JAVORNICKY	b-a	0	0	6	4	0	3	2.4
<i>Gymnodinium</i> sp.	o-a	0	3	4	3	0	2	2.0
<i>Gyromitus cordiformis</i> SKUJA	o-b	0	5	5	0	0	3	1.5
<i>Gyropaigue kosmos</i> SKUJA	b-a	0	0	5	5	0	3	2.5
<i>Gyropaigue spirale</i> (MATVIENKO)	o	0	8	2	0	0	4	1.2
<i>Helikotropis okteus</i> POCHMANN	b	0	0	10	0	0	5	2.0
<i>Helkesimastix faecicola</i> WOODCOCK	p	0	0	0	3	7	4	3.7
<i>Heteronema acus</i> (EHRENBERG)	b-a	0	0	5	5	0	3	2.5
<i>Heteronema acutissimum</i> LEMMERMANN	b	0	0	8	2	0	4	2.2
<i>Heteronema nebulosum</i> (DUJARDIN)	b-a	0	0	5	5	0	3	2.5
<i>Heteronema scabrum</i> CYRUS	a	0	0	0	8	2	4	3.2
<i>Heteronema</i> sp.	b-a	0	0	4	5	1	2	2.7
<i>Hexamita crassus</i> KLEBS	m	0	0	0	0	10	5	5.9 E
<i>Hexamita fissus</i> KLEBS	m	0	0	0	0	10	5	5.9 E
<i>Hexamita fusiformis</i> KLEBS	m	0	0	0	0	10	5	5.9 E
<i>Hexamita inflatus</i> DUJARDIN	m	0	0	0	0	10	5	5.9 E
<i>Hexamita pusillus</i> KLEBS	m	0	0	0	0	10	5	5.9 E
<i>Hexamita</i> sp.	m	0	0	0	0	10	5	5.9 E
<i>Hyaliellia polytomoides</i> PASCHER	a	0	0	0	10	0	5	3.0
<i>Hyalogonium klebsii</i> PASCHER	p	0	0	0	0	10	5	4.0
<i>Katablepharis hyalurus</i> SKUJA	a	0	0	0	10	0	5	3.0
<i>Katablepharis notonectoides</i> SKUJA	a	0	0	0	10	0	5	3.0
<i>Katablepharis ovalis</i> SKUJA	a	0	0	0	10	0	5	3.0
<i>Katodinium fungiforme</i> (ANISIMOVA)	b	0	0	7	3	0	4	2.3
<i>Katodinium piscinale</i> FOTT	a	0	0	0	10	0	5	3.0

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Katodinium tetragonops</i> (HARRIS)	b	0	0	8	2	0	4	2.2
<i>Katodinium vorticella</i> (STEIN)	a	0	0	1	9	0	5	2.9
<i>Katodinium</i> sp.	a-b	0	0	0	4	6	3	2.6
<i>Khawkinea ocellata</i> (KHAWKINE)	a	0	0	0	7	3	4	3.3
<i>Khawkinea quartana</i> (MOROFF)	a-p	0	0	0	5	5	3	3.5
<i>Lagenoeca globulosa</i> FRANCE	b	0	0	10	0	0	5	2.0
<i>Lagenoeca obovata</i> LEMMERMANN	b	0	0	10	0	0	5	2.0
<i>Mastigamoeba gigantea</i> (PROWAZEK)	p	0	0	0	0	10	5	4.0 E
<i>Mastigamoeba invertens</i> KLEBS	p-a	0	0	0	5	5	3	3.5
<i>Mastigamoeba limax</i> MOROFF	m-i	0	0	0	0	10	5	5.5 E
<i>Mastigamoeba reptans</i> STOKES	p	0	0	0	1	9	5	3.9
<i>Mastigamoeba trichophora</i> LAUTERBORN	i	0	0	0	0	10	5	5.0 E
<i>Mastigamoeba</i> sp.	a-i	0	0	0	3	7	4	4.3 E
<i>Mastigella penardi</i> LEMMERMANN	a-p	0	0	0	5	5	3	3.5
<i>Mastigella radícula</i> (MOROFF)	a-p	0	0	0	6	4	3	3.4
<i>Menoidium cultellus</i> PRINGSHEIM	a	0	0	0	10	0	5	3.0
<i>Menoidium falcatum</i> ZACHARIAS	a-b	0	0	4	6	0	3	2.6
<i>Menoidium incurvum</i> (FRESENIUS)	a	0	0	0	10	0	5	3.0
<i>Menoidium minimum</i> MATVIENKO	a	0	0	2	8	0	4	2.8
<i>Menoidium pellucidum</i> PERTY	a	0	0	2	8	0	4	2.8
<i>Menoidium tortuosum</i> SENN	a	0	0	0	10	0	5	3.0
<i>Menoidium</i> sp.	a-b	0	0	3	7	0	3	2.7
<i>Monadodendron bennettii</i> (KENT)	b-a	0	0	4	6	0	3	2.6
<i>Monadodendron distans</i> PASCHER	b	0	0	10	0	0	5	2.0
<i>Monas arhabdomonas</i> (FISCH)	m	0	0	0	1	9	5	5.0 E
<i>Monas cylindrica</i> SKUJA	b-a	0	0	5	5	0	3	2.5
<i>Monas elongata</i> (STOKES)	b-a	0	0	4	4	2	2	2.8
<i>Monas guttula</i> EHRENBERG	a	0	0	3	6	1	3	2.8
<i>Monas minima</i> MEYER	a-p	0	0	1	4	5	2	3.5 E
<i>Monas obliqua</i> SCHEWIAKOFF	b	0	1	7	2	0	3	2.1
<i>Monas ocellata</i> (SAUERFELD)	p-i	0	0	0	0	10	5	4.5 E
<i>Monas sociabilis</i> MEYER	m	0	0	0	0	10	5	5.9 E
<i>Monas uniguttata</i> SKUJA	a	0	0	3	7	0	4	2.7
<i>Monas vivipara</i> EHRENBERG	p	0	0	0	2	8	4	4.0 E
<i>Monas vulgaris</i> (CIENKOWSKI)	m	0	0	0	0	10	5	5.9 E
<i>Monosiga ovata</i> KENT	o	0	7	3	0	0	4	1.3
<i>Multicilia lacustris</i> LAUTERBORN	m	0	0	0	0	10	5	5.9 E
<i>Notosolenus apocamptus</i> STOKES	a	0	0	3	7	0	4	2.7
<i>Notosolenus orbicularis</i> STOKES	a	0	0	0	10	0	5	3.0
<i>Oikomonas mutabilis</i> KENT	p-i	0	0	0	0	10	5	4.7 E
<i>Oikomonas socialis</i> MOROFF	m	0	0	0	0	10	5	5.6 E
<i>Oikomonas termo</i> (EHRENBERG)	a	0	0	0	7	3	4	3.3
<i>Pachysoeca massartii</i> ELLIS	b-a	0	0	5	5	0	3	2.5
<i>Pachysoeca obliqua</i> FOTT	o-a	0	3	4	3	0	2	2.0
<i>Pachysoeca ruttneri</i> (BOURRELLY)	o-a	0	3	4	3	0	2	2.0
<i>Parabodo sacculiferus</i> SKUJA	m	0	0	0	0	10	5	5.5 E
<i>Paramastix coronifera</i> SKUJA	b-a	0	0	5	5	0	3	2.5
<i>Paraphysomonas vestita</i> STOKES	a	0	0	2	7	1	3	2.9
<i>Peranema cuneatum</i> PLAYFAIR	b-a	0	0	5	5	0	3	2.5
<i>Peranema granuliferum</i> PENARD	b	0	0	10	0	0	5	2.0
<i>Peranema trichophorum</i> (EHRENBERG)	a	0	0	3	7	0	4	2.7
<i>Petalomonas abscissa</i> (DUJARDIN)	a	0	0	0	10	0	5	3.0
<i>Petalomonas alata</i> STOKES	b	0	1	8	1	0	4	2.0

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Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Petalomonas angusta</i> (KLEBS)	b-a	0	0	5	5	0	3	2.5
<i>Petalomonas applanata</i> SKUJA	b	0	2	6	2	0	3	2.0
<i>Petalomonas carinata</i> FRANCE	o	0	8	2	0	0	4	1.2
<i>Petalomonas curvata</i> SKUJA	b	0	2	5	3	0	2	2.1
<i>Petalomonas inflexa</i> KLEBS	b-a	0	0	5	5	0	3	2.5
<i>Petalomonas involuta</i> SKUJA	b	0	1	6	3	0	3	2.2
<i>Petalomonas irregularis</i> SKUJA	b	0	2	6	2	0	3	2.0
<i>Petalomonas klinostoma</i> SKUJA	b	0	2	6	2	0	3	2.0
<i>Petalomonas mediocanellata</i> STEIN	a	0	0	0	10	0	5	3.0
<i>Petalomonas mira</i> AWERINZEW	b-a	0	0	5	5	0	3	2.5
<i>Petalomonas platyrhyncha</i> SKUJA	b	0	0	10	0	0	5	2.0
<i>Petalomonas polytaphrena</i> SKUJA	o-b	0	6	4	0	0	3	1.4
<i>Petalomonas praegnans</i> SKUJA	o-b	0	6	4	0	0	3	1.4
<i>Petalomonas prototheca</i> SKUJA	o	0	7	3	0	0	4	1.3
<i>Petalomonas punctato-striata</i> SKUJA	o	0	8	2	0	0	4	1.2
<i>Petalomonas pusilla</i> SKUJA	a	0	0	0	10	0	5	3.0
<i>Petalomonas quadrilineata</i> PENARD	o-a	0	3	4	3	0	2	2.0
<i>Petalomonas scutulium</i> SKUJA	a-b	0	0	4	6	0	3	2.6
<i>Petalomonas sexlobata</i> KLEBS	b-o	0	5	5	0	0	3	1.5
<i>Petalomonas sinuata</i> STEIN	a-b	0	0	4	6	0	3	2.6
<i>Petalomonas steinii</i> KLEBS	a-b	0	0	4	6	0	3	2.6
<i>Petalomonas sulcata</i> STOKES	o	0	8	2	0	0	4	1.2
<i>Petalomonas unguiformis</i> SKUJA	b	0	1	7	2	0	3	2.1
<i>Petalomonas vulgaris</i> SKUJA	a	0	0	2	8	0	4	2.8
<i>Phyllomitus amylophagus</i> KLEBS	a-p	0	0	0	5	5	3	3.5
<i>Physomonas vestita</i> STOKES	a	0	0	2	7	1	3	2.9
<i>Pleuromonas jaculans</i> PERTY	a	0	0	0	8	2	4	3.2
<i>Polytoma caudatum</i> KORSCHIKOFF	m	0	0	0	0	10	5	5.9 E
<i>Polytoma fusiforme</i> KORSCHIKOFF	m	0	0	0	0	10	5	5.9 E
<i>Polytoma obtusum</i> PASCHER	m	0	0	0	0	10	5	5.9 E
<i>Polytoma ocellatum</i> FRANCE	m	0	0	0	0	10	5	5.9 E
<i>Polytoma papillatum</i> PASCHER	m	0	0	0	0	10	5	5.9 E
<i>Polytoma tetraolare</i> PASCHER	m	0	0	0	0	10	5	5.9 E
<i>Polytoma uvella</i> EHRENBERG	m	0	0	0	0	10	5	6.0 E
<i>Polytoma</i> sp.	m	0	0	0	0	10	5	5.9 E
<i>Polytomella agilis</i> ARAGAO	p	0	0	0	0	10	5	4.0
<i>Polytomella caeca</i> PRINGSHEIM	p	0	0	0	2	8	4	3.8
<i>Poteriodendron petiolatum</i> STEIN	b-a	0	0	5	5	0	3	2.5
<i>Protaspis obovata</i> SKUJA	b-a	0	0	4	6	0	3	2.6
<i>Protophysa haeckeli</i> KENT	o	0	10	0	0	0	5	1.0
<i>Pseudobodo minimus</i> HOLLANDE	a	0	0	0	10	0	5	3.0
<i>Rhabdomonas costata</i> (KORSCHIKOFF)	o-a	0	3	4	3	0	2	2.0
<i>Rhabdomonas incurva</i> FRESENIUS	a-p	0	0	0	6	4	3	3.4
<i>Rhabdomonas minima</i> (MATVIENKO)	b	0	2	7	1	0	3	1.9
<i>Rhabdomonas spiralis</i> PRINGSHEIM	o-b	0	4	6	0	0	3	1.6
<i>Rhipidodendron splendidum</i> STEIN	b	0	3	5	2	0	2	1.9
<i>Rhynchomonas nasuta</i> (STOKES)	b	0	0	8	2	0	4	2.2
<i>Salpingoeca amphoridium</i> CLARK	b	0	1	6	3	0	3	2.2
<i>Salpingoeca buetschlii</i> LEMMERMANN	b	0	0	10	0	0	5	2.0
<i>Salpingoeca flava</i> KORSCHIKOFF	b	0	0	10	0	0	5	2.0
<i>Salpingoeca frequentissima</i> ZACHARIAS	o-b	0	4	6	0	0	3	1.6
<i>Salpingoeca fusiformis</i> KENT	b	0	0	10	0	0	5	2.0
<i>Salpingoeca gracilis</i> CLARK	b	0	0	10	0	0	5	2.0

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Salpingoeca macrostoma</i> KORSCHIKOFF	b	0	0	10	0	0	5	2.0
<i>Salpingoeca oblonga</i> STEIN	b-a	0	0	6	4	0	3	2.4
<i>Salpingoeca riethi</i> FOTT	b	0	0	10	0	0	5	2.0
<i>Salpingoeca vaginicola</i> STEIN	b	0	0	10	0	0	5	2.0
<i>Salpingoeca</i> sp.	b	0	1	8	1	0	4	2.0
<i>Scytomonas pusilla</i> STEIN	a	0	0	0	10	0	5	3.0
<i>Sphaeroeca volvox</i> LAUTERBORN	a	0	0	0	8	2	4	3.2
<i>Sphenomonas quadrangularis</i> STEIN	a	0	0	0	10	0	5	3.0
<i>Sphenomonas teres</i> (STEIN)	a-p	0	0	0	5	5	3	3.5
<i>Spironema multiciliatum</i> KLEBS	a	0	0	0	10	0	5	3.0
<i>Spongomonas uvella</i> STEIN	o-b	0	5	5	0	0	3	1.5
<i>Stelaxmonas dichotoma</i> LACKEY	o-b	0	5	5	0	0	3	1.5
<i>Sterromonas formicina</i> KENT	b-a	0	0	6	4	0	3	2.4
<i>Stephanocodon irregularis</i> PASCHER	b-a	0	0	5	5	0	3	2.5
<i>Stephanocodon socialis</i> (LAUTERBORN)	b	0	0	10	0	0	5	2.0
<i>Streptomonas cordata</i> (PERTY)	b-a	0	0	5	5	0	3	2.5
<i>Tetralepharis multifilis</i> (KLEBS)	p	0	0	0	0	10	5	4.0 E
<i>Tetramitus descissus</i> PERTY	m	0	0	0	0	10	5	5.9 E
<i>Tetramitus pyriformis</i> KLEBS	m	0	0	0	0	10	5	5.9 E
<i>Tetramitus rostratus</i> PERTY	m	0	0	0	0	10	5	5.5 E
<i>Tetramitus sulcatus</i> KLEBS	m	0	0	0	0	10	5	5.5 E
<i>Tetramitus</i> sp.	m	0	0	0	0	10	5	5.5 E
<i>Thylacomonas compressa</i> SCHEWIAKOFF	b	0	0	7	3	0	4	2.3
<i>Toussetia polytomoides</i> PASCHER	p	0	0	0	0	10	5	4.1 E
<i>Trepomonas agilis</i> DUJARDIN	m	0	0	0	0	10	5	5.9 E
<i>Trepomonas rotans</i> KLEBS	m	0	0	0	0	10	5	5.9 E
<i>Trepomonas steinii</i> KLEBS	m	0	0	0	0	10	5	5.5 E
<i>Trepomonas</i> sp.	m	0	0	0	0	10	5	5.5 E
<i>Trigonomonas compressa</i> KLEBS	m	0	0	0	0	10	5	6.0 E
<i>Trigonomonas cyrusii</i> CYRUS & SLADECEK	m	0	0	0	0	10	5	5.9 E
<i>Trigonomonas inflata</i> SKUJA	m	0	0	0	0	10	5	5.9 E
<i>Trigonomonas tortuosa</i> SKUJA	m	0	0	0	0	10	5	5.9 E
<i>Trigonomonas</i> sp.	m	0	0	0	0	10	5	5.9 E
<i>Tropidoscyphus octocostatus</i> STEIN	a	0	0	0	10	0	5	3.0
<i>Urceolus costatus</i> LEMMERMANN	b	0	0	7	3	0	4	2.3
<i>Urceolus cyclostomus</i> (STEIN)	b-a	0	0	4	6	0	3	2.6
<i>Urceolus cyrusorum</i> CYRUS & SLADECEK	a	0	0	0	10	0	5	3.0
<i>Urophagus caudatus</i> SKUJA	m	0	0	0	0	10	5	5.9 E
<i>Urophagus rostratus</i> (KLEBS)	m-p	0	0	0	0	10	5	5.1 E
Naked amoebae								
<i>Amoeba chlorochlamys</i> LAUTERBORN	m	0	0	0	0	10	5	5.9 E
<i>Amoeba proteus</i> (PALLAS)	b	0	0	8	2	0	4	2.2
<i>Astramoeba radiosa</i> EHRENBERG	a-b	0	0	5	4	1	2	2.6
<i>Hartmanella</i> sp.	p	0	0	1	3	6	2	3.5
<i>Hyalodiscus rubicundus</i> HERTWIG & LESSER	b	0	2	8	0	0	4	1.8
<i>Mayorella vespertilio</i> (PENARD)	o-b	0	5	5	0	0	3	1.5
<i>Nuclearia radians</i> (GREEFF)	o	0	8	2	0	0	4	1.2
<i>Pelomyxa palustris</i> GREEFF	p	0	0	0	0	10	5	4.0
<i>Thecamoeba verrucosa</i> EHRENBERG	b	0	2	8	0	0	4	1.8
<i>Vahlkampfia guttula</i> (DUJARDIN)	p-a	0	0	0	4	6	3	3.6
<i>Vahlkampfia limax</i> (DUJARDIN)	p	0	0	0	0	10	5	4.2 E
<i>Vampyrella pendula</i> CIENKOWSKI	o-b	0	5	5	0	0	3	1.5

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Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
Testate amoebae								
<i>Arcella dentata</i> EHRENBERG	o	0	7	3	0	0	4	1.3
<i>Arcella discoides</i> EHRENBERG	b	0	2	5	3	0	2	2.1
<i>Arcella hemisphaerica</i> PERTY	b-a	0	0	4	5	1	2	2.7
<i>Arcella rotundata</i> PLAYFAIR	b	0	0	9	1	0	5	2.1
<i>Arcella vulgaris</i> EHRENBERG	b	0	1	7	2	0	3	2.1
<i>Arcella</i> sp.	b-a	0	2	4	4	0	2	2.2
<i>Centropyxis aculeata</i> (EHRENBERG)	b-o	1	3	4	2	0	1	1.7
<i>Centropyxis aerophila</i> DEFLANDRE	o-b	0	5	4	1	0	2	1.6
<i>Centropyxis discoides</i> PENARD	o-b	0	6	4	0	0	3	1.4
<i>Centropyxis ecornis</i> (EHRENBERG)	b	0	1	8	1	0	4	2.0
<i>Centropyxis orbicularis</i> DEFLANDRE	b-o	0	4	5	1	0	2	1.7
<i>Centropyxis platystoma</i> (PENARD)	o-b	0	4	5	1	0	2	1.7
<i>Centropyxis sylvatica</i> DEFLANDRE	o	0	7	3	0	0	4	1.3
<i>Centropyxis</i> sp.	o-b	0	3	5	2	0	2	1.9
<i>Chlamydomorphys minor</i> BELAR	b-a	0	0	4	6	0	3	2.6
<i>Chlamydomorphys stercorea</i> CIENKOWSKI	o-a	0	3	4	3	0	2	2.0
<i>Cochliopodium bilimbosum</i> (AUERBACH)	b	0	2	5	3	0	2	2.1
<i>Cryptodifflugia compressa</i> PENARD	o	0	7	3	0	0	4	1.3
<i>Cryptodifflugia oviformis</i> PENARD	b	0	2	5	3	0	2	2.1
<i>Cyphoderia ampulla</i> (EHRENBERG)	o-b	0	6	4	0	0	3	1.4
<i>Cyphoderia trochus</i> PENARD	b	0	1	8	1	0	4	2.0
<i>Difflugia acuminata</i> EHRENBERG	o	0	8	2	0	0	4	1.2
<i>Difflugia bacillifera</i> PENARD	o	0	9	1	0	0	5	1.1
<i>Difflugia capreolata</i> PENARD	b	0	1	8	1	0	4	2.0
<i>Difflugia corona</i> TARANEK	b	0	2	7	1	0	3	1.9
<i>Difflugia curvicaulis</i> PENARD	b	0	2	6	2	0	3	2.0
<i>Difflugia difficilis</i> THOMAS	o-a	0	3	4	3	0	2	2.0
<i>Difflugia elegans</i> PENARD	o	0	8	2	0	0	4	1.2
<i>Difflugia fallax</i> PENARD	o-b	0	5	4	1	0	2	1.6
<i>Difflugia globulosa</i> DUJARDIN	o-b	0	6	4	0	0	3	1.4
<i>Difflugia gramen</i> PENARD	b-a	0	1	5	4	0	2	2.3
<i>Difflugia hydrostatica</i> ZACHARIAS	o	0	10	0	0	0	5	1.0
<i>Difflugia limnetica</i> LEVANDER	o	0	7	3	0	0	4	1.3
<i>Difflugia lobostoma</i> LEIDY	b	0	1	7	2	0	3	2.1
<i>Difflugia minuta</i> RAMPI	o-b	0	4	4	2	0	2	1.8
<i>Difflugia oblonga</i> EHRENBERG	o-b	0	5	5	0	0	3	1.5
<i>Difflugia oblonga var. nodosa</i> LEIDY	o-b	0	6	4	0	0	3	1.4
<i>Difflugia pristis</i> PENARD	o-b	0	6	4	0	0	3	1.4
<i>Difflugia pyriformis</i> PERTY	o-b	0	5	5	0	0	3	1.5
<i>Difflugia</i> sp.	o-a	0	4	3	3	0	2	1.9
<i>Diplophrys archeri</i> BARKER	b-a	0	0	6	4	0	3	2.4
<i>Euglypha acanthophora</i> (EHRENBERG)	b	0	2	6	2	0	3	2.0
<i>Euglypha alveolata</i> DUJARDIN	b	0	2	6	2	0	3	2.0
<i>Euglypha aspera</i> PENARD	b	0	3	7	0	0	4	1.7
<i>Euglypha ciliata</i> (EHRENBERG)	b	0	3	7	0	0	4	1.7
<i>Euglypha laevis</i> PERTY	b	0	1	7	2	0	3	2.1
<i>Euglypha</i> sp.	b-o	0	3	6	1	0	3	1.8
<i>Gromia brunneri</i> BLANC	b	0	3	7	0	0	4	1.7
<i>Gromia fluviatilis</i> DUJARDIN	o	0	8	2	0	0	4	1.2
<i>Lesquereusia spiralis</i> (EHRENBERG)	o	2	8	0	0	0	4	0.8
<i>Microchlamys patella</i> (CLAPAREDE & LACHMANN)	o-b	0	4	6	0	0	3	1.6
<i>Nebela collaris</i> (EHRENBERG)	o	0	8	2	0	0	4	1.2

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Nebela militaris</i> PENARD	o	1	8	1	0	0	4	1.0
<i>Nebela tubulosa</i> PENARD	o	0	8	2	0	0	4	1.2
<i>Nebela</i> sp.	o-b	0	6	4	0	0	3	1.4
<i>Pamphagus hyalinus</i> LEIDY	o	0	7	3	0	0	4	1.3
<i>Pamphagus mutabilis</i> BAILEY	b	0	3	7	0	0	4	1.7
<i>Paulinella chromatophora</i> LAUTERBORN	b	0	3	7	0	0	4	1.7
<i>Pontigulasia bigibbosa</i> PENARD	b	0	2	6	2	0	3	2.0
<i>Pseudodiffugia fulva</i> (ARCHER)	o-a	0	3	4	3	0	2	2.0
<i>Pseudodiffugia globulosa</i> STEPANEK	o-a	0	3	4	3	0	2	2.0
<i>Pseudodiffugia gracilis</i> SCHLUMBERGER	b	0	2	6	2	0	3	2.0
<i>Pseudodiffugia orchas</i> STEPANEK	b-a	0	0	5	5	0	3	2.5
<i>Pseudodiffugia senartensis</i> COUTEAUX	b	0	3	6	1	0	3	1.8
<i>Pseudodiffugia</i> sp.	b	0	2	6	2	0	3	2.0
<i>Quadrullella symmetrica</i> (WALLICH)	b	0	3	5	2	0	2	1.9
<i>Trinema enchelys</i> (EHRENBERG)	b	0	2	6	2	0	3	2.0
<i>Trinema lineare</i> PENARD	b	0	3	6	1	0	3	1.8
Heliozoa								
<i>Acanthocystis pectinata</i> PENARD	b	0	2	8	0	0	4	1.8
<i>Acanthocystis penardi</i> WAILES	o-b	0	6	4	0	0	3	1.4
<i>Acanthocystis turfacea</i> CARTER	o	0	8	2	0	0	4	1.2
<i>Actinophrys sol</i> EHRENBERG	b-a	0	0	4	6	0	3	2.6
<i>Actinosphaerium eichhorni</i> (EHRENBERG)	o-b	0	4	6	0	0	3	1.6
<i>Belenocystis tubistella</i> RAINER	o	0	10	0	0	0	5	1.0
<i>Chlamydaster sterna</i> RAINER	o	0	8	2	0	0	4	1.2
<i>Choanocystis aculeata</i> (HERTWIG & LESSER)	b	0	2	8	0	0	4	1.8
<i>Clathrella foreli</i> PENARD	o	0	9	1	0	0	5	1.1
<i>Clathrulina elegans</i> CIENKOWSKI	b	0	2	6	2	0	3	2.0
<i>Elaeorhanis cincta</i> GREEFF	o	0	8	2	0	0	4	1.2
<i>Heterophrys fockii</i> ARCHER	o	0	9	1	0	0	5	1.1
<i>Heterophrys myriopoda</i> ARCHER	o	0	8	2	0	0	4	1.2
<i>Lithocolla globosa</i> SCHULZE	o	0	9	1	0	0	5	1.1
<i>Pterocystis echinata</i> (RAINER)	o	0	10	0	0	0	5	1.0
<i>Raphidiophrys elegans</i> HERTWIG & LESSER	b	0	1	9	0	0	5	1.9
<i>Raphidiophrys intermedia</i> PENARD	o	0	10	0	0	0	5	1.0
<i>Raphidiophrys pallida</i> SCHULZE	b	0	3	7	0	0	4	1.7
<i>Raphidiophrys symmetrica</i> PENARD	o-b	0	5	5	0	0	3	1.5
<i>Raphidocystis glutinosa</i> PENARD	o	0	7	3	0	0	4	1.3
<i>Raphidocystis tubifera</i> PENARD	o	0	8	2	0	0	4	1.2
Ciliophora								
<i>Acinera incurvata</i> DUJARDIN, 1841	p-i	0	0	0	0	10	5	4.5 E
<i>Acinera uncinata</i> TUCOLESKO, 1962	a-p	0	0	2	4	4	2	3.2
<i>Acineta flava</i> KELLICOTT, 1885	b	0	1	7	2	0	3	2.1
<i>Acineta grandis</i> KENT, 1882	b-a	0	0	4	6	0	3	2.6
<i>Acineta tuberosa</i> (PALLAS, 1766)	a	0	0	1	6	3	3	3.2
<i>Acineta</i> sp.	a-b	0	0	4	5	1	2	2.7
<i>Acinetides lacustris</i> (STOKES, 1886)	p-a	0	0	0	4	6	3	3.6
<i>Actinobolina radians</i> (STEIN, 1867)	b	0	1	7	2	0	3	2.1
<i>Actinobolina vorax</i> (WENRICH, 1929)	o	0	7	3	0	0	4	1.3
<i>Amphileptus carchesii</i> STEIN, 1867	a	0	0	1	8	1	4	3.0
<i>Amphileptus claparedii</i> STEIN, 1867	a	0	0	2	8	0	4	2.8
<i>Amphileptus meleagris</i> (EHRENBERG, 1835)	a	0	0	0	10	0	5	3.0
<i>Amphileptus pleurosigma</i> (STOKES, 1884)	b-a	0	0	5	5	0	3	2.5
<i>Amphileptus punctatus</i> (KAHL, 1926)	a	0	0	1	9	0	5	2.9

B-11.12

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Amphileptus rotundus</i> (KAHL, 1926)	a	0	0	1	8	1	4	3.0
<i>Amphileptus trachelioides</i> (ZACHARIAS, 1894)	o	0	7	3	0	0	4	1.3
<i>Amphileptus</i> sp.	a	0	1	2	6	1	1	2.7
<i>Askenasia volvox</i> (EICHWALD, 1852)	b	0	1	6	3	0	3	2.2
<i>Aspidisca cicada</i> (MUELLER, 1786)	a-b	0	0	4	5	1	2	2.7
<i>Aspidisca lynceus</i> (MUELLER, 1773)	b-a	0	1	4	4	1	1	2.5
<i>Aspidisca turrita</i> (EHRENBERG, 1831)	a-b	0	0	4	6	0	3	2.6
<i>Aspidisca</i> sp.	b-a	0	0	5	5	0	3	2.5
<i>Astylozoon fallax</i> ENGELMANN, 1862	b-a	0	0	5	5	0	3	2.5
<i>Astylozoon faurei</i> KAHL, 1935	b-a	0	0	5	5	0	3	2.5
<i>Blepharisma coeruleum</i> GAJEVSKAJA, 1927	b	0	2	8	0	0	4	1.8
<i>Blepharisma lateritium</i> (EHRENBERG, 1831)	b	0	2	8	0	0	4	1.8
<i>Bothrostoma</i> sp.	p-i	0	0	0	0	10	5	4.0 E
<i>Brachonella</i> sp.	p-i	0	0	0	0	10	5	4.0 E
<i>Bursaria truncatella</i> MUELLER, 1773	b-a	0	2	4	3	1	1	2.3
<i>Bursaridium pseudobursaria</i> (FAURÉ-FREMIET, 1924)	o-b	0	6	4	0	0	3	1.4
<i>Bursellopsis spumosa</i> (SCHMIDT, 1921)	o	0	7	3	0	0	4	1.3
<i>Caenomorpha lauterborni</i> KAHL, 1927	p-i	0	0	0	0	10	5	4.0 E
<i>Caenomorpha medusula</i> PERTY, 1852	p-i	0	0	0	0	10	5	4.0 E
<i>Caenomorpha sapropelica</i> KAHL, 1927	p-i	0	0	0	0	10	5	4.0 E
<i>Caenomorpha uniserialis</i> LEVANDER, 1894	p-i	0	0	0	0	10	5	4.0 E
<i>Caenomorpha</i> sp.	p-i	0	0	0	0	10	5	4.0 E
<i>Calyptotricha lanuginosa</i> (PENARD, 1922)	a	0	0	3	7	0	4	2.7
<i>Campanella umbellaria</i> (LINNAEUS, 1758)	a-b	0	0	3	6	1	3	2.8
<i>Carchesium pectinatum</i> (ZACHARIAS, 1897)	o-b	0	6	4	0	0	3	1.4
<i>Carchesium polypinum</i> (LINNAEUS, 1758)	a	0	0	2	7	1	3	2.9
<i>Chaenea limicola</i> LAUTERBORN, 1901	p	0	0	0	0	10	5	4.0
<i>Chaenea teres</i> (DUJARDIN, 1841)	b	0	0	7	3	0	4	2.3
<i>Chaenea vorax</i> QUENNERSTEDT, 1867	b	0	0	10	0	0	5	2.0
<i>Chaetospora muelleri</i> LACHMANN, 1856	b	0	1	8	1	0	4	2.0
<i>Chaetospora remex</i> (HUDSON, 1875)	b-a	0	1	5	4	0	2	2.3
<i>Chilodonella uncinata</i> (EHRENBERG, 1838)	a	0	0	2	6	2	3	3.0
<i>Chilodontopsis depressa</i> (PERTY, 1852)	b	0	1	7	2	0	3	2.1
<i>Chilodontopsis muscorum</i> KAHL, 1931	a	0	0	0	10	0	5	3.0
<i>Chilodontopsis vorax</i> (STOKES, 1887)	b-a	0	0	5	5	0	3	2.5
<i>Chlamydonella alpestris</i> FOISSNER, 1979	b-a	0	2	4	4	0	2	2.2
<i>Chlamydonellopsis plurivacuolata</i> BLATTERER & FOISSNER, 1990	b-a	0	0	5	5	0	3	2.5
<i>Cinetochilum margaritaceum</i> (EHRENBERG, 1831)	b-p	0	1	3	3	3	1	2.8
<i>Climacostomum virens</i> (EHRENBERG, 1838)	b	0	0	8	2	0	4	2.2
<i>Codonella cratera</i> (LEIDY, 1877)	b-o	0	4	6	0	0	3	1.6
<i>Cohnilembus verminus</i> (MUELLER, 1786)	a-b	0	0	4	6	0	3	2.6
<i>Cohnilembus vexillarius</i> (KAHL, 1926)	b	0	0	10	0	0	5	2.0
<i>Cohnilembus</i> sp.	b-a	0	0	5	5	0	3	2.5
<i>Coleps bicuspis</i> NOLAND, 1925	b-a	0	0	7	3	0	4	2.3
<i>Coleps hirtus</i> (MUELLER, 1786)	b-a	0	0	5	5	0	3	2.5
<i>Coleps</i> sp.	a-b	0	0	4	6	0	3	2.6
<i>Colpidium colpoda</i> (LOSANA, 1829)	p-i	0	0	0	2	8	4	4.0 E
<i>Colpidium kleini</i> FOISSNER, 1969	p	0	0	0	3	7	4	3.7
<i>Colpidium</i> sp. (sensu lato)	p-i	0	0	0	3	7	4	3.7 E
<i>Colpoda cucullus</i> (MUELLER, 1773)	p-a	0	0	0	4	6	3	3.6
<i>Colpoda ecaudata</i> (LIEBMANN, 1936)	p-i	0	0	0	1	9	5	3.9
<i>Colpoda inflata</i> (STOKES, 1884)	a-p	0	0	0	5	5	3	3.5

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Colpoda magna</i> GRUBER, 1880	a-p	0	0	2	5	3	2	3.1
<i>Colpoda steinii</i> MAUPAS, 1883 ³	a-p	0	0	0	5	5	3	3.5
<i>Colpoda steinii</i> MAUPAS, 1883 ⁴	b-a	0	2	4	3	1	1	2.3
<i>Condylostoma vorticella</i> (EHRENBERG, 1833)	b-a	0	1	6	3	0	3	2.2
<i>Cothurnia annulata</i> STOKES, 1885	o-b	0	6	4	0	0	3	1.4
<i>Cristigera media</i> KAHL, 1928	p-i	0	0	0	0	10	5	4.4 E
<i>Ctedoctema acanthocrypta</i> STOKES, 1884	b	0	1	8	1	0	4	2.0
<i>Cyclidium citrullus</i> (COHN, 1866)	a	0	0	1	8	1	4	3.0
<i>Cyclidium elongatum</i> (SCHEWIAKOFF, 1889)	b-a	0	0	5	5	0	3	2.5
<i>Cyclidium glaucoma</i> MUELLER, 1773	a	0	0	0	9	1	5	3.1
<i>Cyclidium heptatrichum</i> SCHEWIAKOFF, 1893	b	0	0	8	2	0	4	2.2
<i>Cyclidium oblongum</i> KAHL, 1931	a-b	0	0	4	6	0	3	2.6
<i>Cyclidium singulare</i> (KAHL, 1926)	a	0	0	0	10	0	5	3.0
<i>Cyclidium versatile</i> PENARD, 1922	a-b	0	2	3	5	0	2	2.3
<i>Cyclidium</i> sp.	a-b	0	0	4	6	0	3	2.6
<i>Cyrtolophosis mucicola</i> STOKES, 1885	b-p	0	1	2	4	3	1	2.9
<i>Dendrosoma radians</i> EHRENBERG, 1838	b-a	0	0	5	5	0	3	2.5
<i>Dexiostoma campyla</i> (STOKES, 1886)	p-i	0	0	0	1	9	5	4.2 E
<i>Dexiotracha plagia</i> STOKES, 1885	a	0	0	2	6	2	3	3.0
<i>Dexiotracha</i> sp.	p	0	0	0	1	9	5	4.5 E
<i>Dexiotrachides centralis</i> (STOKES, 1885)	p-i	0	0	0	0	10	5	4.5 E
<i>Didinium cinctum</i> VOIGT, 1902	o	0	8	2	0	0	4	1.2
<i>Didinium nasutum</i> (MUELLER, 1773)	b-a	0	2	4	4	0	2	2.2
<i>Dileptus anser</i> (MUELLER, 1773)	b-o	0	4	6	0	0	3	1.6
<i>Dileptus conspicuus</i> KAHL, 1931	a	0	0	0	10	0	5	3.0
<i>Dileptus gigas</i> (CLAPAREDE & LACHMANN, 1859)	b	0	0	7	3	0	4	2.3
<i>Dileptus margaritifer</i> (EHRENBERG, 1833)	b-o	0	4	6	0	0	3	1.6
<i>Dileptus monilatus</i> (STOKES, 1886)	b	0	0	7	3	0	4	2.3
<i>Dileptus</i> sp.	a	0	1	3	6	0	2	2.5
<i>Discomorphella lauterborni</i> (WETZEL, 1928)	p-i	0	0	0	0	10	5	4.4 E
<i>Discomorphella pectinata</i> (LEVANDER, 1894)	p-i	0	0	0	0	10	5	4.5 E
<i>Disematostoma buetschlii</i> LAUTERBORN, 1894	b	0	1	7	2	0	3	2.1
<i>Disematostoma tetraedricum</i> (FAURÉ-FREMIET, 1924)	b	0	0	10	0	0	5	2.0
<i>Drepanomonas dentata</i> FRESENIUS, 1858	o	0	8	2	0	0	4	1.2
<i>Drepanomonas revoluta</i> PENARD, 1922	a-p	0	0	0	5	5	3	3.5
<i>Dysteria fluviatilis</i> (STEIN, 1859)	b	0	0	8	2	0	4	2.2
<i>Enchelyodon elegans</i> (KAHL, 1926)	a	0	0	0	10	0	5	3.0
<i>Enchelyodon fusidens</i> KAHL, 1930	a	0	0	0	10	0	5	3.0
<i>Enchelyomorpha vermicularis</i> (SMITH, 1899)	p-m	0	0	0	0	10	5	5.5 E
<i>Enchelys gasterosteus</i> KAHL, 1926	b-a	0	0	5	5	0	3	2.5
<i>Enchelys pupa</i> (MUELLER, 1786)	b-a	0	0	5	5	0	3	2.5
<i>Epalxella</i> sp.	p-i	0	0	0	0	10	5	4.5 E
<i>Epenardia myriophylli</i> (PENARD, 1922)	a-b	0	0	4	6	0	3	2.6
<i>Epistylis chrysemydis</i> BISHOP & JAHN, 1941	a	0	0	2	6	2	3	3.0
<i>Epistylis coronata</i> NUSCH, 1970	a	0	0	0	10	0	5	3.0
<i>Epistylis digitalis</i> (LINNAEUS, 1758)	o-b	0	5	5	0	0	3	1.5
<i>Epistylis entzii</i> STILLER, 1935	a	0	0	2	7	1	3	2.9
<i>Epistylis galea</i> EHRENBERG, 1831	a-b	0	0	3	7	0	4	2.7
<i>Epistylis hentscheli</i> KAHL, 1935	a-b	0	0	3	6	1	3	2.8
<i>Epistylis nympharum</i> ENGELMANN, 1862	o-a	0	3	4	3	0	2	2.0
<i>Epistylis plicatilis</i> EHRENBERG, 1831	a-b	0	0	3	6	1	3	2.8
<i>Epistylis procumbens</i> ZACHARIAS, 1897	o-b	0	5	5	0	0	3	1.5
<i>Epistylis</i> sp.	b-a	0	0	5	5	0	3	2.5

B-11.14

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Euplotes aediculatus</i> PIERSON, 1943	a	0	0	1	9	0	5	2.9
<i>Euplotes affinis</i> (DUJARDIN, 1841)	b-a	0	0	5	4	1	2	2.6
<i>Euplotes eurytomus</i> WRZESNIOWSKI, 1870	a	0	0	2	6	2	3	3.0
<i>Euplotes moebiusi</i> KAHL, 1932	a	0	0	2	7	1	3	2.9
<i>Euplotes patella</i> (MUELLER, 1773)	b	0	0	7	3	0	4	2.3
<i>Euplotes</i> sp.	a	0	0	3	6	1	3	2.8
<i>Frontonia acuminata</i> (EHRENBERG, 1833)	o	0	6	4	0	0	3	1.4
<i>Frontonia atra</i> (EHRENBERG, 1833)	b	0	0	10	0	0	5	2.0
<i>Frontonia leucas</i> (EHRENBERG, 1833)	o-p	0	2	3	3	2	1	2.5
<i>Frontonia vesiculosa</i> DaCUNHA, 1913	b	0	1	6	3	0	3	2.2
<i>Frontonia</i> sp.	b	0	1	6	3	0	3	2.2
<i>Gastronauta clatratus</i> DEROUX, 1976	b-a	0	2	4	4	0	2	2.2
<i>Gastronauta membranaceus</i> BUETSCHLI, 1889	b	0	2	6	2	0	3	2.0
<i>Gastrostyla mystacea</i> (STEIN, 1859)	p	0	0	0	3	7	4	3.7
<i>Gastrostyla steinii</i> ENGELMANN, 1862	a	0	0	2	7	1	3	2.9
<i>Glaucoma reniforme</i> SCHEWIAKOFF, 1892	p	0	0	0	2	8	4	3.8
<i>Glaucoma scintillans</i> EHRENBERG, 1830	p-i	0	0	0	1	9	5	4.2 E
<i>Glaucoma</i> sp.	p-a	0	0	1	4	5	2	3.4
<i>Halteria chlorelligera</i> KAHL, 1932	o	0	8	2	0	0	4	1.2
<i>Halteria grandinella</i> (MUELLER, 1773)	b-a	0	1	6	3	0	3	2.2
<i>Halteria</i> sp.	b-o	0	4	5	1	0	2	1.7
<i>Hastatella radians</i> ERLANGER, 1890	b-a	0	1	6	3	0	3	2.2
<i>Heliophrya minima</i> (RIEDER, 1936)	b-a	0	0	5	5	0	3	2.5
<i>Heliophrya rotunda</i> (HENTSCHEL, 1916)	b-a	0	0	5	5	0	3	2.5
<i>Hexotricha caudata</i> LACKEY, 1925	p-m	0	0	0	0	10	5	5.0 E
<i>Histiculus vorax</i> (STOKES, 1891)	a	0	0	0	10	0	5	3.0
<i>Holophrya nigricans</i> LAUTERBORN, 1894	b	0	0	10	0	0	5	2.0
<i>Holosticha kessleri</i> (WRZESNIOWSKI, 1877)	a-b	0	0	4	5	1	2	2.7
<i>Holosticha monilata</i> KAHL, 1928	a-b	0	0	3	6	1	3	2.8
<i>Holosticha multistilata</i> KAHL, 1928	a-b	0	0	4	5	1	2	2.7
<i>Holosticha pullaster</i> (MUELLER, 1773)	b-a	0	1	4	4	1	1	2.5
<i>Homalozoon vermiculare</i> (STOKES, 1887)	b-a	0	2	4	4	0	2	2.2
<i>Hypotrichidium conicum</i> ILOWAISKY, 1921	b-p	0	0	3	4	3	2	3.0
<i>Kellicotta cuspidata</i> (KELLICOTT, 1885)	b-a	0	0	5	5	0	3	2.5
<i>Kerona pediculus</i> (MUELLER, 1773)	b-o	0	4	5	1	0	2	1.7
<i>Lacrymaria olor</i> (MUELLER, 1786)	b	0	2	6	2	0	3	2.0
<i>Lagenophrys vaginicola</i> STEIN, 1852	o	0	9	1	0	0	5	1.1
<i>Lagynophrya acuminata</i> KAHL, 1935	o	0	8	2	0	0	4	1.2
<i>Lagynus cucumis</i> (PENARD, 1922)	p	0	0	0	0	10	5	4.0
<i>Lagynus elegans</i> (ENGELMANN, 1862)	p-i	0	0	0	0	10	5	4.0 E
<i>Lembadion bullinum</i> (MUELLER, 1786)	b	0	0	9	1	0	5	2.1
<i>Lembadion lucens</i> (MASKELL, 1887)	b	0	0	9	1	0	5	2.1
<i>Lembadion magnum</i> (STOKES, 1887)	b	0	2	8	0	0	4	1.8
<i>Leptopharynx costatus</i> MERMOD, 1914	o-b	0	5	5	0	0	3	1.5
<i>Litonotus anguilla</i> (KAHL, 1931)	b-a	0	0	5	5	0	3	2.5
<i>Litonotus carinatus</i> STOKES, 1885	b-a	0	0	5	5	0	3	2.5
<i>Litonotus crystallinus</i> (VUXANOVICI, 1960)	b-a	0	0	5	5	0	3	2.5
<i>Litonotus cygnus</i> (MUELLER, 1773)	b	0	0	10	0	0	5	2.0
<i>Litonotus fasciola</i> (MUELLER, 1773)	a	0	0	1	8	1	4	3.0
<i>Litonotus fusidens</i> (KAHL, 1926)	b-p	0	0	3	4	3	2	3.0
<i>Litonotus hirundo</i> (PENARD, 1922)	a	0	0	1	8	1	4	3.0
<i>Litonotus lamella</i> (MUELLER, 1773)	a	0	0	2	8	0	4	2.8
<i>Litonotus procerus</i> (PENARD, 1922)	o-b	0	5	5	0	0	3	1.5

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Litonotus varsaviensis</i> WRZESNIEWSKI, 1870	b-a	0	0	5	5	0	3	2.5
<i>Litonotus varsaviensis f. polysaprobica</i> SRAMEK-HUSEK, 1954	p-i	0	0	0	1	9	5	3.9 E
<i>Litonotus</i> sp.	a	0	0	1	7	2	3	3.1
<i>Loxocephalus granulatus</i> KENT, 1881	a	0	0	2	8	0	4	2.8
<i>Loxocephalus luridus</i> EBERHARD, 1862	a	0	0	0	10	0	5	3.0
<i>Loxodes magnus</i> STOKES, 1887	p	0	0	0	3	7	4	3.7
<i>Loxodes rostrum</i> (MUELLER, 1773)	a-b	0	0	4	6	0	3	2.6
<i>Loxodes striatus</i> (ENGELMANN, 1862)	a	0	0	1	6	3	3	3.2
<i>Loxodes</i> sp.	b-p	0	0	2	5	3	2	3.1
<i>Loxophyllum helus</i> (STOKES, 1884)	b	0	0	10	0	0	5	2.0
<i>Loxophyllum meleagris</i> (MUELLER, 1773)	b	0	0	8	2	0	4	2.2
<i>Loxophyllum utriculariae</i> (PENARD, 1922)	b	0	1	8	1	0	4	2.0
<i>Loxophyllum</i> sp.	b	0	1	6	3	0	3	2.2
<i>Marituja pelagica</i> GAJEVSKAJA, 1928	o	0	10	0	0	0	5	1.0
<i>Mesodinium acarus</i> STEIN, 1863	b	0	0	7	3	0	4	2.3
<i>Mesodinium cinctum</i> CALKINS, 1902	b	0	0	6	3	1	3	2.5
<i>Mesodinium pulex</i> (CLAPAREDE & LACHMANN, 1859)	b	0	2	6	2	0	3	2.0
<i>Mesodinium</i> sp.	b	0	1	6	3	0	3	2.2
<i>Metacineta mystacina</i> (EHRENBERG, 1831)	b-a	0	0	5	5	0	3	2.5
<i>Metopus</i> sp.	p-i	0	0	0	1	9	5	4.4 E
<i>Microthorax pusillus</i> ENGELMANN, 1862	a	0	0	2	8	0	4	2.8
<i>Microthorax sulcatus</i> ENGELMANN, 1862	b	0	0	10	0	0	5	2.0
<i>Monodinium balbianii</i> FABRE-DOMERGUE, 1888	b-o	0	4	5	1	0	2	1.7
<i>Mucophrya pelagica</i> GAJEVSKAJA, 1928	o	0	10	0	0	0	5	1.0
<i>Multifasciculatum elongatum</i> (CLAPAREDE & LACHMANN, 1859)	a	0	0	1	9	0	5	2.9
<i>Myrionecta rubra</i> (LOHMANN, 1908)	o	0	10	0	0	0	5	1.0
<i>Nassula flava</i> CLAPAREDE & LACHMANN, 1859	a-b	0	0	4	6	0	3	2.6
<i>Nassula gracilis</i> KAHL, 1931	a	0	0	2	8	0	4	2.8
<i>Nassula ornata</i> EHRENBERG, 1833	b-a	0	0	5	5	0	3	2.5
<i>Nassula</i> sp.	a	0	0	3	6	1	3	2.8
<i>Nassulopsis elegans</i> (EHRENBERG, 1833)	b	0	1	8	1	0	4	2.0
<i>Obertruria aurea</i> (EHRENBERG, 1833)	b-a	0	0	6	4	0	3	2.4
<i>Odontochlamys alpestris</i> FOISSNER, 1981	b-a	0	0	5	5	0	3	2.5
<i>Opercularia articulata</i> GOLDFUSS, 1820	a-b	0	1	3	5	1	1	2.6
<i>Opercularia coarctata</i> (CLAPAREDE & LACHMANN, 1858)	a	0	0	2	7	1	3	2.9
<i>Opercularia nutans</i> (EHRENBERG, 1831)	b-a	0	0	5	5	0	3	2.5
<i>Opercularia</i> sp.	b-a	0	0	5	5	0	3	2.5
<i>Ophrydium crassicaule</i> PENARD, 1922	b-a	0	0	5	5	0	3	2.5
<i>Ophrydium eutrophicum</i> FOISSNER, 1979	b-a	0	1	6	3	0	0	2.2
<i>Ophrydium sessile</i> KENT, 1882	a-b	0	2	3	5	0	2	2.3
<i>Ophrydium versatile</i> (MUELLER, 1786)	o	0	8	2	0	0	4	1.2
<i>Ophrydium</i> sp.	b-a	0	2	4	4	0	2	2.2
<i>Ophryoglena atra</i> LIEBERKÜHN, 1856	b	0	0	10	0	0	5	2.0
<i>Ophryoglena flava</i> (EHRENBERG, 1833)	b	0	0	10	0	0	5	2.0
<i>Ophryoglena oblonga</i> GAJEVSKAJA, 1927	b	0	2	8	0	0	4	1.8
<i>Opisthonecta henneguyi</i> FAURÉ-FREMIET, 1906	b-p	0	0	3	4	3	2	3.0
<i>Oxytricha chlorelligera</i> KAHL, 1932	a	0	0	0	10	0	5	3.0
<i>Oxytricha fallax</i> STEIN, 1859	a	0	0	1	8	1	4	3.0
<i>Oxytricha ferruginea</i> STEIN, 1859	o	0	7	3	0	0	4	1.3
<i>Oxytricha haematoplasma</i> BLATTERER & FOISSNER, 1990	b-a	0	0	6	4	0	3	2.4

B-11.16

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Oxytricha hymenostoma</i> STOKES, 1887	p	0	0	0	2	8	4	3.8
<i>Oxytricha saprobia</i> KAHL, 1932	a-p	0	0	0	6	4	3	3.4
<i>Oxytricha setigera</i> STOKES, 1891	a-b	0	0	4	6	0	3	2.6
<i>Oxytricha similis</i> ENGELMANN, 1862	b-a	0	0	5	5	0	3	2.5
<i>Papillorhabdos carchesii</i> FOISSNER, 1984	a	0	0	2	7	1	3	2.9
<i>Paracolpidium truncatum</i> (STOKES, 1885)	a	0	0	2	6	2	3	3.0
<i>Paradileptus elephantinus</i> (SVEC, 1897)	b	0	3	6	1	0	3	1.8
<i>Paramecium aurelia</i> -Complex	b-a	0	0	5	5	0	3	2.5
<i>Paramecium bursaria</i> (EHRENBERG, 1831)	b	0	0	7	3	0	4	2.3
<i>Paramecium calkinsi</i> WOODRUFF, 1921	a	0	0	0	10	0	5	3.0
<i>Paramecium caudatum</i> EHRENBERG, 1833	a	0	0	0	7	3	4	3.3 E
<i>Paramecium putrinum</i> CLAPAREDE & LACHMANN, 1859	p-i	0	0	0	1	9	5	3.9 E
<i>Paramecium woodruffi</i> WENRICH, 1928	p-i	0	0	0	0	10	5	4.2 E
<i>Paraurostyla viridis</i> (STEIN, 1859)	b-a	0	0	5	5	0	3	2.5
<i>Paraurostyla weissei</i> (STEIN, 1859)	a	0	0	2	7	1	3	2.9
<i>Pelagohalteria cirrifera</i> (KAHL, 1932)	o-b	0	6	4	0	0	3	1.4
<i>Pelodinium reniforme</i> LAUTERBORN, 1908	p-i	0	0	0	0	10	5	4.5 E
<i>Phascolodon vorticella</i> STEIN, 1859	b-a	0	0	6	4	0	3	2.4
<i>Phialina coronata</i> (CLAPAREDE & LACHMANN, 1859)	b	0	1	8	1	0	4	2.0
<i>Phialina pupula</i> (MUELLER, 1773)	b	0	0	10	0	0	5	2.0
<i>Philasterides armata</i> (KAHL, 1926)	b-a	0	0	5	5	0	3	2.5
<i>Placus luciae</i> (KAHL, 1926)	o-b	0	5	5	0	0	3	1.5
<i>Placus ovum</i> (KAHL, 1926)	b	0	0	10	0	0	5	2.0
<i>Plagiocampa longis</i> KAHL, 1927	a	0	0	0	10	0	5	3.0
<i>Plagiopyla nasuta</i> STEIN, 1860	p-i	0	0	0	0	10	5	4.5 E
<i>Plagiopyla simplex</i> WETZEL, 1928	p-i	0	0	0	0	10	5	4.5 E
<i>Platycola decumbens</i> (EHRENBERG, 1830)	b-a	0	2	4	4	0	2	2.2
<i>Platynematum sociale</i> (PENARD, 1922)	a	0	0	2	7	1	3	2.9
<i>Platyophrya vorax</i> KAHL, 1926	p-i	0	0	0	0	10	5	4.5 E
<i>Pleuronema coronatum</i> KENT, 1881	b	0	0	7	3	0	4	2.3
<i>Pleuronema crassum</i> DUJARDIN, 1841	o	0	10	0	0	0	5	1.0
<i>Pleuronema setigerum</i> CALKINS, 1902	b	0	0	10	0	0	5	2.0
<i>Pleurotricha grandis</i> STEIN, 1859	b	0	0	10	0	0	5	2.0
<i>Podophrya fixa</i> (MUELLER, 1786)	a	0	0	1	7	2	3	3.1
<i>Podophrya maupasii</i> BUETSCHLI, 1889	a	0	0	1	9	0	5	2.9
<i>Prodiscophrya collini</i> (ROOT, 1914)	a-i	0	0	1	5	4	2	3.4
<i>Prorodon ovum</i> (EHRENBERG, 1831)	o-b	0	5	5	0	0	3	1.5
<i>Prorodon platyodon</i> BLOCHMANN, 1895	b	0	0	10	0	0	5	2.0
<i>Prorodon teres</i> EHRENBERG, 1833	a	0	0	1	9	0	5	2.9
<i>Prorodon viridis</i> KAHL, 1927	a	0	0	1	6	3	3	3.2
<i>Prorodon</i> sp.	b-a	0	1	4	4	1	1	2.5
<i>Pseudoblepharisma tenue</i> (KAHL, 1926)	p	0	0	0	3	7	4	3.7
<i>Pseudochilodonopsis algivora</i> (KAHL, 1931) ³	a	0	0	0	10	0	5	3.0
<i>Pseudochilodonopsis algivora</i> (KAHL, 1931) ⁴	a-b	0	0	5	5	0	3	2.5
<i>Pseudochilodonopsis fluviatilis</i> FOISSNER, 1988	b-a	0	0	5	3	2	2	2.7
<i>Pseudochilodonopsis piscatoris</i> (BLOCHMANN, 1895)	b	0	0	7	3	0	4	2.3
<i>Pseudocohnilembus pusillus</i> (QUENNERSTEDT, 1869)	a-p	0	0	0	5	5	3	3.5
<i>Pseudomicrothorax agilis</i> MERMED, 1914	b	0	0	10	0	0	5	2.0
<i>Pseudoprorodon ellipticus</i> KAHL, 1930	b-a	0	0	5	5	0	3	2.5
<i>Pseudoprorodon niveus</i> (EHRENBERG, 1833)	o	0	10	0	0	0	5	1.0
<i>Pseudovorticella chlamydothora</i> (PENARD, 1922)	b-a	0	0	5	5	0	3	2.5
<i>Pseudovorticella monilata</i> (TATEM, 1870)	b-a	0	1	5	4	0	2	2.3
<i>Pyxicola carteri</i> KENT, 1882	o-b	0	5	5	0	0	3	1.5

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Rhabdostyla inclinans</i> (MUELLER, 1773)	a	0	0	0	10	0	5	3.0
<i>Saprodinium dentatum</i> (LAUTERBORN, 1901)	p-i	0	0	0	0	10	5	4.5 E
<i>Saprodinium putrinum</i> LACKEY, 1925	p-i	0	0	0	0	10	5	4.5 E
<i>Saprodinium</i> sp.	p-i	0	0	0	0	10	5	4.5 E
<i>Sathrophilus mobilis</i> (KAHL, 1926)	b-a	0	0	6	4	0	3	2.4
<i>Sathrophilus muscorum</i> (KAHL, 1931)	b-a	0	0	5	5	0	3	2.5
<i>Scyphidia rugosa</i> DUJARDIN, 1841	a	0	0	0	8	2	4	3.2
<i>Spathidium depressum</i> KAHL, 1930	o	0	7	3	0	0	4	1.3
<i>Spathidium faurei</i> KAHL, 1930	o	0	7	3	0	0	4	1.3
<i>Spathidium gibbum</i> KAHL, 1930	a	0	0	0	10	0	5	3.0
<i>Spathidium spathula</i> (MUELLER, 1773)	o-b	0	5	3	2	0	2	1.7
<i>Spathidium</i> sp.	b-a	0	2	4	3	1	1	2.3
<i>Sphaerophrya magna</i> MAUPAS, 1881	p	0	0	0	2	8	4	3.8
<i>Sphaerophrya pusilla</i> CLAPAREDE & LACHMANN, 1859	a	0	0	0	10	0	5	3.0
<i>Sphaerophrya soliformis</i> LAUTERBORN, 1908	p	0	0	0	1	9	5	3.9
<i>Sphaerophrya stentoris</i> MAUPAS, 1881	a-b	0	1	4	5	0	2	2.4
<i>Sphaerophrya</i> sp.	p-a	0	0	1	4	5	2	3.4
<i>Spirostomum ambiguum</i> (MUELLER, 1786)	a	0	0	2	6	2	3	3.0
<i>Spirostomum caudatum</i> (MUELLER, 1786)	o-b	0	6	4	0	0	3	1.4
<i>Spirostomum minus</i> (ROUX, 1901)	a-b	0	0	3	6	1	3	2.8
<i>Spirostomum teres</i> CLAPAREDE & LACHMANN, 1858	p	0	0	1	2	7	3	3.6
<i>Staurophrya elegans</i> ZACHARIAS, 1893	o-a	0	3	4	3	0	2	2.0
<i>Steinia platystoma</i> (EHRENBERG, 1831)	b-a	0	0	6	4	0	3	2.4
<i>Stentor amethystinus</i> LEIDY, 1880	b	0	2	6	2	0	3	2.0
<i>Stentor coeruleus</i> (PALLAS, 1766)	a-b	0	0	4	6	0	3	2.6
<i>Stentor igneus</i> EHRENBERG, 1838	b	0	0	7	3	0	4	2.3
<i>Stentor muelleri</i> EHRENBERG, 1831	b-a	0	0	5	5	0	3	2.5
<i>Stentor multiformis</i> (MUELLER, 1786)	b-a	0	0	5	5	0	3	2.5
<i>Stentor niger</i> (MUELLER, 1773)	o-b	0	6	4	0	0	3	1.4
<i>Stentor polymorphus</i> (MUELLER, 1773)	b-a	0	0	5	5	0	3	2.5
<i>Stentor roeselii</i> EHRENBERG, 1835	b-a	0	1	4	5	0	2	2.4
<i>Stentor</i> sp.	b-a	0	1	5	4	0	2	2.3
<i>Sterkiella histriomuscorum</i> (FOISSNER, BLATTERER, BERGER & KOHMANN, 1991)	a	0	0	2	6	2	3	3.0
<i>Stichotricha aculeata</i> WRZESNIEWSKI, 1866	b-a	0	1	5	4	0	2	2.3
<i>Stichotricha secunda</i> PERTY, 1849	o	0	7	3	0	0	4	1.3
<i>Stokesia vernalis</i> WENRICH, 1929	o-b	0	5	5	0	0	3	1.5
<i>Strobilidium caudatum</i> (FROMENTEL, 1876)	o-b	0	5	5	0	0	3	1.5
<i>Strobilidium humile</i> PENARD, 1922	b	0	2	8	0	0	4	1.8
<i>Strombidium viride</i> STEIN, 1867	b	0	1	8	1	0	4	2.0
<i>Stylonychia mytilus-complex</i>	a	0	0	1	9	0	5	2.9
<i>Stylonychia pustulata</i> (MUELLER, 1786)	b	0	1	7	2	0	3	2.1
<i>Stylonychia putrina</i> STOKES, 1885	a	0	0	2	7	1	3	2.9
<i>Stylonychia stylomuscorum</i> (FOISSNER, BLATTERER, BERGER & KOHMANN, 1991)	b	0	0	10	0	0	5	2.0
<i>Stylonychia vorax</i> STOKES, 1885	b	0	0	10	0	0	5	2.0
<i>Stylonychia</i> sp.	b-a	0	0	5	5	0	3	2.5
<i>Supraspathidium vermiforme</i> (PENARD, 1922)	a	0	0	0	8	2	4	3.2
<i>Tachysoma bicirratum</i> FOISSNER, BLATTERER, BERGER & KOHMANN, 1991	a-p	0	0	2	4	4	2	3.2
<i>Tachysoma pelliellum</i> (MUELLER, 1773)	b-a	0	1	4	4	1	1	2.5
<i>Tetrahymena pyriformis-complex</i>	a-i	0	0	0	3	7	4	4.1 E

B-11.18

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Thigmogaster oppositovacuolatus</i> AUGUSTIN & FOISSNER, 1989	a-b	0	0	3	5	2	2	2.9
<i>Thigmogaster potamophilus</i> FOISSNER, 1988	b-a	0	0	5	5	0	3	2.5
<i>Thuricola folliculata</i> KENT, 1881	b	0	2	6	2	0	3	2.0
<i>Thuricola kelicottiana</i> (STOKES, 1887)	b	0	2	7	1	0	3	1.9
<i>Thuricola vasiformis</i> HAMMANN, 1952	a	0	0	0	10	0	5	3.0
<i>Thuricola</i> sp.	b-a	0	0	5	5	0	3	2.5
<i>Tintinnidium fluviatile</i> (STEIN, 1863)	o-b	0	5	5	0	0	3	1.5
<i>Tintinnidium pusillum</i> ENTZ, 1909	b	0	0	8	2	0	4	2.2
<i>Tintinnidium semiciliatum</i> (STERKI, 1879)	b	0	2	6	2	0	3	2.0
<i>Tintinnopsis cylindrata</i> KOFOID & CAMPBELL, 1929	b	0	0	7	3	0	4	2.3
<i>Tokophrya carchesii</i> (CLAPAREDE & LACHMANN, 1859)	a	0	0	2	7	1	3	2.9
<i>Tokophrya infusionum</i> (STEIN, 1859)	b-a	0	2	5	3	0	2	2.1
<i>Tokophrya lemnarum</i> (STEIN, 1859)	a	0	0	1	7	2	3	3.1
<i>Tokophrya quadripartita</i> (CLAPAREDE & LACHMANN, 1859)	a-b	0	0	3	5	2	2	2.9
<i>Tokophrya</i> sp.	a-b	0	0	3	5	2	2	2.9
<i>Trachelius ovum</i> (EHRENBERG, 1831)	b	0	1	7	2	0	3	2.1
<i>Trachelophyllum apiculatum</i> (PERTY, 1852)	b-a	0	0	5	5	0	3	2.5
<i>Trachelophyllum brachypharynx</i> LEVANDER, 1894	a	0	0	0	10	0	5	3.0
<i>Trachelophyllum pusillum</i> (PERTY, 1852)	b-a	0	0	5	3	2	2	2.7
<i>Trachelophyllum</i> sp.	a-b	0	0	4	5	1	2	2.7
<i>Trichodina pediculus</i> EHRENBERG, 1831	b	0	2	6	2	0	3	2.0
<i>Trichospira inversa</i> (CLAPAREDE & LACHMANN, 1859)	a-p	0	0	0	5	5	3	3.5
<i>Trimyema compressum</i> LACKEY, 1925	p-m	0	0	0	0	10	5	5.0 E
<i>Trithigmostoma cucullulus</i> (MUELLER, 1786)	a-p	0	0	2	5	3	2	3.1
<i>Trithigmostoma srameki</i> FOISSNER, 1988	b-a	0	1	6	3	0	3	2.2
<i>Trithigmostoma steini</i> (BLOCHMANN, 1895)	b-a	0	1	6	3	0	3	2.2
<i>Trochilia minuta</i> (ROUX, 1899)	b-a	0	0	5	5	0	3	2.5
<i>Trochiloides recta</i> (KAHL, 1928)	a	0	0	0	10	0	5	3.0
<i>Tropidoactractus acuminatus</i> LEVANDER, 1894	p-i	0	0	0	0	10	5	4.5 E
<i>Urocentrum turbo</i> (MUELLER, 1786)	b	0	0	7	3	0	4	2.3
<i>Uroleptus gallina</i> (MUELLER, 1786)	b	0	0	10	0	0	5	2.0
<i>Uroleptus musculus</i> (KAHL, 1932)	a	0	1	8	1	0	4	3.0
<i>Uroleptus piscis</i> (MUELLER, 1773)	a	0	0	3	7	0	4	2.7
<i>Uroleptus rattulus</i> STEIN, 1859	b	0	0	10	0	0	5	2.0
<i>Uronema marinum</i> DUJARDIN, 1841	a	0	0	1	8	1	4	3.0
<i>Uronema parduczi</i> FOISSNER, 1971	a	0	0	1	8	1	4	3.0
<i>Urostyla grandis</i> EHRENBERG, 1830	a	0	0	3	7	0	4	2.7
<i>Urotricha agilis</i> (STOKES, 1886)	a	0	0	0	10	0	5	3.0
<i>Urotricha armata</i> KAHL, 1927	a	0	0	2	8	0	4	2.8
<i>Urotricha farcta</i> CLAPAREDE & LACHMANN, 1859	a-b	0	0	4	6	0	3	2.6
<i>Urotricha globosa</i> SCHEWIAKOFF, 1892	b	0	0	7	3	0	4	2.3
<i>Urotricha ovata</i> KAHL, 1926	a-p	0	0	0	6	4	3	3.4
<i>Urotricha</i> sp.	a	0	0	2	6	2	3	3.0
<i>Urozona buetschlii</i> SCHEWIAKOFF, 1889	p-i	0	0	0	0	10	5	4.5 E
<i>Vaginicola ingenita</i> (MUELLER, 1786)	b	0	2	6	2	0	3	2.0
<i>Vaginicola tincta</i> EHRENBERG, 1830	o-b	0	5	5	0	0	3	1.5
<i>Vaginicola</i> sp.	b	0	2	6	2	0	3	2.0
<i>Vorticella aquadulcis</i> -complex ⁵	b-a	0	2	5	3	0	2	2.1
<i>Vorticella campanula</i> EHRENBERG, 1831	b-a	0	1	4	5	0	2	2.4
<i>Vorticella convallaria</i> -complex ⁶	a	0	1	2	6	1	2	2.7
<i>Vorticella fromenteli</i> KAHL, 1935	a	0	0	2	8	0	4	2.8

Taxa	S	Saprobic valency ²					I	SI
		x	o	b	a	p		
<i>Vorticella infusionum</i> -complex ⁷	p-a	0	0	1	4	5	2	3.4
<i>Vorticella marginata</i> STILLER, 1931	b	0	2	8	0	0	4	1.8
<i>Vorticella mayeri</i> FAURÉ-FREMIET, 1920	b	0	0	10	0	0	5	2.0
<i>Vorticella microstoma</i> -complex ⁸	p-a	0	0	0	5	5	3	3.5
<i>Vorticella natans</i> (FAURÉ-FREMIET, 1924)	b	0	0	10	0	0	5	2.0
<i>Vorticella octava</i> -complex ⁹	b-a	0	2	4	4	0	2	2.2
<i>Vorticella picta</i> (EHRENBERG, 1831)	b	0	2	6	2	0	3	2.0
<i>Zoothamnium arbuscula</i> (EHRENBERG, 1831)	b-a	0	1	6	3	0	3	2.2
<i>Zoothamnium kentii</i> GRENFELL, 1884	b-a	0	0	5	5	0	3	2.5
<i>Zoothamnium procerius</i> KAHL, 1935	b-a	0	0	5	5	0	3	2.5
<i>Zoothamnium</i> sp.	b-a	0	0	5	5	0	3	2.5

¹⁾ Flagellates and amoebae were copied from Sladeczek et al. (12) and Wegl (15). Their nomenclature, taxonomy and saprobic assessment need major revision (cp. [3]); some nomenclatural improvements were accomplished with several revisions (1, 4, 9). The list for the ciliates is also based on Sladeczek et al. (12) and Wegl (15), but nomenclature and taxonomy are according to the improved list of Foissner (3). The revision of the saprobic classification of the ciliates is in progress and complete for cyrtophorids, oligotrichs, hypotrichs, colpodids, peritrichs, heterotrichs and odontostomatids (5, 6).

²⁾ Abbreviations: a, alpha-mesosaprobity; b, beta-mesosaprobity; E, eusaprobity (worse than polysaprobity, comprises raw, concentrated or very little diluted industrial wastes or waters with a very high load of organic matter undergoing anaerobic decomposition by microorganisms); I, indicative weight of species ranging from 5 to 1; o, oligosaprobity; p, polysaprobity; S, indication of saprobic assessment by simple letter; SI, saprobic index ranging from 0-8 (0 = xenosaprobity, 1 = oligosaprobity, 2 = beta-mesosaprobity, 3 = alpha-mesosaprobity, 4 = polysaprobity, 5 = isosaprobity, 6 = metasaprobity, 7 = hypersaprobity, 8 = ultrasaprobity); x, xenosaprobity.

Notes: The saprobic valencies and the indicative weights are for the limnosaprobic area; however, the saprobic assessment (S) and the saprobic index (SI) includes both limnosaprobity (xenosaprobity, oligosaprobity, beta-mesosaprobity, alpha-mesosaprobity, polysaprobity) and eusaprobity (isosaprobity, metasaprobity, hypersaprobity, ultrasaprobity). The letter "E" marks cases where both values do not correspond, i. e. the saprobic index (SI) is > 4.0 (11). Pollution increases from xenosaprobity → ultrasaprobity.

³⁾ If abundant or very abundant.

⁴⁾ If sparse.

⁵⁾ Includes *V. octava* of Sladeczek's list.

⁶⁾ Includes *V. convallaria*, *V. citrina*, *V. nebulifera* and *V. similis* of Sladeczek's list.

⁷⁾ Includes *V. cupifera*, *V. hians*, *V. microstoma* (pro parte), *V. microstoma* f. *elongata*, *V. microstoma* f. *monilata* and *V. microstoma* f. *turgescens* of Sladeczek's list.

⁸⁾ Includes *V. aequilata* and *V. microstoma* (pro parte) of Sladeczek's list.

⁹⁾ Includes *V. hamata*, but not *V. octava* sensu Noland & Finley and Sladeczek.

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