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The Floodplain Index – habitat values and indication weights for molluscs, dragonflies, caddisflies, amphibians and fish from Austrian Danube floodplain waterbodies

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With 2 tables

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Schlagwörter: Mollusca, Odonata, Trichoptera, Amphibia, Pisces, Donau, Österreich, Auen-gewässer, Wasserrahmenrichtlinie, Habitat, Bewertung, Indikator, Auen-Index, Methodik

A new method for assessing the ecological status of river/floodplain-systems is presented. The approach ("Floodplain Index") is based on the requirements of biological assessment laid down in the EU Water Framework Directive by integrating the following indicator groups: molluscs, caddisflies, dragonflies, amphibians, and fish. For these groups, the habitat values and indication weights are given and the calculation procedure is briefly discussed.

1 Introduction

The assessment of the ecological integrity of river-floodplain systems is an essential target of conservation strategies and modern water management which is reflected in various regulations, such as the EU Water Framework Directive. According to the requirements of the WFD all surface water bodies should reach at least "good ecological status" (class II within a five class system).

In line with the Directive, a scheme for assessing the ecological status of floodplain areas was developed based on a multi-species approach using a broad set of indicator groups: molluscs, caddisflies, dragonflies, amphibians and fish. Although amphibians are not listed as indicator group in the WFD, this group was considered in this approach because of its relevance for assessing the ecological integrity of river-floodplain systems.

The assessment procedure presented here was developed for a large, braided river system, the Danube in Austria, and tested in a floodplain area of this river upstream of Vienna.

2 The Floodplain Index

Key element of the assessment procedure is the Floodplain Index (FI). As the valency point system, the calculation procedure, the habitat types and the definition of the sampling sites and reference state have been described in detail elsewhere (Chovanec & Waringer 2001, Chovanec et al. 2002, 2004 in press, Schultz et al. 2003, Waringer & Graf 2002) only a brief account is given here. In order to describe the species' habitat preferences numerically, 10 valency points were distributed among five habitat types (H1–H5; H1: eupotamic, that is high connectivity between floodplain waterbody and main river, H5: temporary waterbody; Table 1).

Tab. 1: Description of the habitat types (according to Chovanec & Waringer 2001)

Habitat type	Characterisation
H1	Hydrologically dynamic water bodies, connected with the main channel at both ends at mean water discharge; in case of connectivity high water velocities; no macrophyte communities in the open water; open banks or <i>Phalaridetum</i> stands in the littoral area; sand and gravel substrate are dominating
H2	Water bodies which lack unidirectional current, connected only at the downstream end at mean water levels; only few macrophytes (e.g. <i>Phalaridetum</i>); high proportion of sand and gravel substrates
H3	No connectivity with the main channel at mean water levels; terrestrialisation processes; coverage of open water areas by macrophytes does not exceed 20% of open water area; dominating macrophyte communities: <i>Phragmitetum</i> , <i>Typhetum</i> , <i>Sagittario-Sparganietum</i> , <i>Myriophyllo-Nupharetum</i> , <i>Magnocaricetum</i> ; increased degree of sedimentation
H4	No connectivity with the main channel at mean water levels; terrestrialisation processes; coverage of open water areas by macrophytes exceeds 20% of open water area; dominating macrophyte communities: <i>Phragmitetum</i> , <i>Typhetum</i> , <i>Sagittario-Sparganietum</i> , <i>Myriophyllo-Nupharetum</i> , <i>Magnocaricetum</i> ; high degree of sedimentation
H5	Temporary pools, water level primarily dependent on ground water levels; dominating macrophyte communities: <i>Phragmitetum</i> , <i>Typhetum</i> , <i>Sagittario-Sparganietum</i> , <i>Magnocaricetum</i> ; terrestrial vegetation

Species-specific habitat values (HV) were calculated according to the equation

$$HV = (1 \cdot H1 + 2 \cdot H2 + 3 \cdot H3 + 4 \cdot H4 + 5 \cdot H5) / 10$$

Indication weights ranging from 1 for eurytopic species to 5 for stenotopic species have been allocated to each species in order to identify sensitive species (indication weight ≥ 3). The allocation of the indication weights was carried out according to the scheme of Sladeczek (1964). The valency point distributions are based on autecological knowledge as well as literature data.

The Floodplain Index (FI) is based on the summation of the habitat values and indication weights of all species present at the sampling site and is calculated using the following equation:

$$FI = \sum (HV * IW) / \sum IW$$

where HV is the habitat value and IW is the species-specific indication weight given in Table 2. The method is based on a presence/absence approach; thus, abundances are not considered in the formula.

The calculation of the index is made for every investigation site and results in a number between 1 and 5, indicating habitat preferences of the community at the investigation site. When the percentage distribution of calculated habitat types H1–H5 at the floodplain area investigated is compared with the percentage of the reference situation, deviations may be transformed into the five classes of ecological quality of the Water Framework Directive. For the Austrian Danube (reference situation = pristine anabranching river section) this transformation is done as follows:

- Quality class I: Distribution and range of the FI correspond to the reference situation and indicate that all habitat types are present with H1 dominating.
- Quality class II: Distribution and range of the FI indicate that all habitat types are present with H1 not dominating or one habitat type (with the exception of H1) is missing.
- Quality class III: Distribution and range of the FI indicate that at least H1 or two habitat types are missing.
- Quality class IV: Distribution and range of the FI indicate that one or two habitat types are present; few sensitive species are found.
- Quality class V: Floodplain is missing or distribution and range of the FI indicate that only one habitat type is found; no or nearly no sensitive species are found.

Table 2: Indicator species of the river/floodplain systems of the Austrian Danube considered in the Floodplain Index. H1-5: habitat types, HV: habitat values, IW: indication weights. *Greenfrogs: *Rana ridibunda* Pallas, 1771, *Rana lessonae* Camerano, 1872, *Rana kl. esculenta* Linnaeus, 1758

	H1	H2	H3	H4	H5	HV	IW
MOLLUSCA							
<i>Acroloxus lacustris</i> (Linnaeus, 1758)			4	6		3,6	3
<i>Ancylus fluviatilis</i> O. F. Müller, 1774	5	4	1			1,6	2
<i>Anisus leucostoma</i> (Millet, 1813)	2	2	2	2	2	3	1
<i>Anisus septemgyratus</i> (Rossmässler, 1835)			5	5		3,5	3
<i>Anisus spirorbis</i> (Linnaeus, 1758)			1	4	5	4,4	2
<i>Anisus vortex</i> (Linnaeus, 1758)	3	3	2	1	1	2,4	1
<i>Anisus vorticulus</i> (Troschel, 1834)			5	5		3,5	3
<i>Anodonta anatina</i> (Linnaeus, 1758)	1	6	2	1		2,3	2
<i>Anodonta cygnea</i> (Linnaeus, 1758)	1	1	7	1		2,8	2
<i>Aplexa hypnorum</i> (Linnaeus, 1758)				5	5	4,5	3
<i>Bathyomphalus contortus</i> (Linnaeus, 1758)	4	3	1	1	1	2,2	1
<i>Bithynia tentaculata</i> (Linnaeus, 1758)	1	1	3	5		3,2	1
<i>Bythinella austriaca</i> (Frauenfeld, 1857)	10					1	5
<i>Bythinella bavarica</i> Clessin, 1877	10					1	5
<i>Bythinella cylindrica</i> (Frauenfeld, 1857)	10					1	5
<i>Bythinella schmidtii</i> (Küster, 1852)	10					1	5
<i>Corbicula fluminea</i> (O. F. Müller, 1774)	7	2	1			1,4	3
<i>Dreissena polymorpha</i> (Pallas, 1771)	1	4	4	1		2,5	1
<i>Ferrissia wautieri</i> (Mirolli, 1960)	3	3	2	2		2,3	1
<i>Galba truncatula</i> (O. F. Müller, 1774)	1	4	4	1		2,5	1
<i>Gyraulus acronicus</i> (A. Ferussac, 1807)	2	2	2	2	2	3	1
<i>Gyraulus albus</i> (O. F. Müller, 1774)		2	6	2		3	3
<i>Gyraulus crista</i> (Linnaeus, 1758)		1	5	4		3,3	2
<i>Gyraulus laevis</i> (Alder, 1838)		2	6	2		3	3
<i>Gyraulus rossmaessleri</i> (Auerswald, 1852)			5	3	2	3,7	2
<i>Hippeutis complanatus</i> (Linnaeus, 1758)		2	6	2		3	3
<i>Lithoglyphus naticoides</i> (C. Pfeiffer, 1828)	3	7				1,7	4
<i>Lymnaea stagnalis</i> (Linnaeus, 1758)				4	6	4,6	3
<i>Margaritifera margaritifera</i> (Linnaeus, 1758)	10					1	5
<i>Melanoides tuberculatus</i> (O.F. Müller, 1774)	10					1	5
<i>Musculium lacustre</i> (O. F. Müller, 1774)		1	6	3		3,2	3
<i>Physa fontinalis</i> Linnaeus, 1758		5	5			2,5	3
<i>Physella acuta</i> (Draparnaud, 1805)		4	5	1		2,7	2
<i>Physella heterostropha</i> (Say, 1817)		4	5	1		2,7	2
<i>Pisidium amnicum</i> (O. F. Müller, 1774)		5	5			2,5	3
<i>Pisidium casertanum</i> (Poli, 1791)		4	5	1		2,7	2
<i>Pisidium henslowanum</i> (Sheppard, 1823)	1	4	5			2,4	2
<i>Pisidium moitessierianum</i> (Paladilhe, 1866)	1	4	5			2,4	2
<i>Pisidium nitidum</i> (Jenyns, 1832)		5	4	1		2,6	2
<i>Pisidium subtruncatum</i> (Malm, 1855)	1	4	5			2,4	2
<i>Pisidium supinum</i> (A. Schmidt, 1851)	1	5	4			2,3	2
<i>Planorbis corneus</i> (Linnaeus, 1758)			1	7	2	4,1	3
<i>Planorbis carinatus</i> O. F. Müller, 1774			1	7	2	4,1	3
<i>Planorbis planorbis</i> (Linnaeus, 1758)				7	3	4,3	4
<i>Potamopyrgus antipodarum</i> (Gray 1843)	1	5	4			2,3	2
<i>Pseudanodonta complanata complanata</i> (Rossmässler, 1835)	5	5				1,5	3

	H1	H2	H3	H4	H5	HV	IW
Radix ampla (Hartmann, 1821)		4	5	1		2,7	2
Radix auricularia (Linnaeus, 1758)		4	5	1		2,7	2
Radix ovata (Draparnaud, 1805)		2	6	2		3	3
Radix peregra (O. F. Müller, 1774)	1	2	3	4		3	1
Segmentina nitida (O. F. Müller, 1774)			3	6	1	3,8	3
Sphaerium corneum (Linnaeus, 1758)		1	3	6		3,5	3
Sphaerium rivicola (LAamarck, 1818)		1	3	6		3,5	3
Stagnicola corvus (Gmelin, 1791)			4	5	1	3,7	2
Stagnicola fuscus (C. Pfeiffer, 1821)	1	2	3	3	1	3,1	1
Stagnicola turricula (Held, 1836)	1	2	3	3	1	3,1	1
Theodoxus danubialis danubialis (C. Pfeiffer, 1828)	6	4				1,4	3
Theodoxus danubialis strangulatus (C. Pfeiffer, 1828)	7	3				1,3	4
Theodoxus prevostianus (C. Pfeiffer, 1828)	10					1	5
Theodoxus transversalis (C. Pfeiffer, 1828)	7	3				1,3	4
Unio crassus cytherea Küster, 1833	8	2				1,2	4
Unio crassus decurvatus Rossmässler, 1835	6	2	1	1		1,7	2
Unio crassus minor Rossmässler, 1835	4	4	1	1		1,9	1
Unio pictorum (Linnaeus 1758)	1	8	1			2	4
Unio tumidus zeleebori Zelebor, 1851	1	9				1,9	5
Valvata macrostoma Mörch, 1864			4	5	1	3,7	2
Valvata piscinalis (O. F. Müller, 1774)	1	3	3	3		2,8	1
Valvata piscinalis alpestris Küster, 1852			5	5		3,5	3
Valvata piscinalis piscinalis (O. F. Müller, 1774)	4	3	2	1		2	1
Valvata pulchella Studer, 1820			5	5		3,5	3
Viviparus acerosus (Bourguignat, 1862)	4	3	1	1	1	2,2	1
Viviparus contextus (Millet, 1813)				3	7	4,7	4
TRICHOPTERA							
Adicella reducta (McLachlan, 1865)	9	1				1,1	5
Agapetus delicatulus McLachlan, 1884	10					1	5
Agapetus laniger (Pictet, 1834)	10					1	5
Agapetus ochripes Curtis, 1834	10					1	5
Agraylea multipunctata Curtis, 1834			4	6		3,6	3
Agraylea sexmaculata Curtis, 1834			4	6		3,6	3
Agrypnia pagetana Curtis, 1835			5	5		3,5	3
Agrypnia varia (Fabricius, 1793)			5	5		3,5	3
Allogamus auricollis (Pictet, 1834)	8	2				1,2	4
Allotrichia pallicornis (Eaton, 1873)	5	5				1,5	3
Anabolia brevipennis (Curtis, 1834)		1	3	3	3	3,8	1
Anabolia furcata Brauer, 1857	1	4	3	2		2,6	1
Apatania muliebris McLachlan, 1866	10					1	5
Athripsodes albifrons (Linnaeus, 1758)	8	2				1,2	4
Athripsodes aterrimus (Stephens, 1836)			4	6		3,6	3
Athripsodes bilineatus (Linnaeus, 1758)	8	2				1,2	4
Athripsodes cinereus (Curtis, 1834)	8	2				1,2	4
Athripsodes commutatus (Rostock, 1874)	10					1,0	5
Brachycentrus subnubilus Curtis, 1834	8	2				1,2	4
Ceraclea alboguttata (Hagen, 1860)	6	4				1,4	3
Ceraclea annulicornis (Stephens, 1836)	10					1	5
Ceraclea dissimilis (Stephens, 1836)	10					1	5
Ceraclea fulva (Rambur, 1842)				10		4	5
Ceraclea nigranervosa (Retzius, 1783)	5	5				1,5	3

	H1	H2	H3	H4	H5	HV	IW
<i>Ceraclea senilis</i> (Burmeister, 1839)		1	3	4	2	3,7	1
<i>Cheumatopsyche lepida</i> (Pictet, 1834)	10					1	5
<i>Chimarra marginata</i> (Linnaeus, 1767)	10					1	5
<i>Cyrnus crenaticornis</i> (Kolenati, 1859)			2	8		3,8	4
<i>Cyrnus flavidus</i> McLachlan, 1864			2	8		3,8	4
<i>Cyrnus trimaculatus</i> (Curtis, 1834)	1	4	3	2		2,6	1
<i>Ecnomus tenellus</i> (Rambur, 1842)	1	2	4	3		2,9	1
<i>Erotesis baltica</i> McLachlan, 1877				10		4	5
<i>Glossosoma boltoni</i> Curtis, 1834	10					1	5
<i>Glyptotaelius pellucidus</i> (Retzius, 1783)	1	1	3	2	3	3,5	1
<i>Goera pilosa</i> (Fabricius, 1775)	9	1				1,1	5
<i>Grammotaulius nigropunctatus</i> (Retzius, 1783)			2	5	3	4,1	2
<i>Halesus digitatus</i> (Schränk, 1781)	7	3				1,3	3
<i>Halesus radiatus</i> Curtis, 1834	7	3				1,3	3
<i>Halesus tessellatus</i> (Rambur, 1842)	7	3				1,3	3
<i>Holocentropus dubius</i> (Rambur, 1842)			4	6		3,6	3
<i>Holocentropus picicornis</i> (Stephens, 1836)			4	6		3,6	3
<i>Holocentropus stagnalis</i> (Albarda, 1874)			6	4		3,4	3
<i>Hydropsyche angustipennis</i> (Curtis, 1834)	8	2				1,2	4
<i>Hydropsyche bulbifera</i> McLachlan, 1878	8	2				1,2	4
<i>Hydropsyche bulgaromanorum</i> Malicky, 1977	8	2				1,2	4
<i>Hydropsyche contubernalis</i> McLachlan, 1865	8	2				1,2	4
<i>Hydropsyche guttata</i> Pictet, 1834	10					1	5
<i>Hydropsyche incognita</i> Pitsch, 1993	10					1	5
<i>Hydropsyche modesta</i> Navas, 1925	8	2				1,2	4
<i>Hydropsyche ornatula</i> McLachlan, 1878	10					1	5
<i>Hydropsyche pellucidula</i> (Curtis, 1834)	10					1	5
<i>Hydropsyche saxonica</i> McLachlan, 1884	10					1	5
<i>Hydropsyche siltalai</i> Döhler, 1963	10					1	5
<i>Hydroptila angulata</i> Mosely, 1922	2	8				1,8	4
<i>Hydroptila dampfi</i> Ulmer, 1929		1	3	6		3,5	2
<i>Hydroptila forcipata</i> Eaton, 1873	8	2				1,2	4
<i>Hydroptila ivisa</i> Malicky, 1972	10					1	5
<i>Hydroptila lotensis</i> Mosely, 1930	6	4				1,4	3
<i>Hydroptila martini</i> Marshall, 1977	8	2				1,2	4
<i>Hydroptila pulchricornis</i> Pictet, 1834			6	4		3,4	3
<i>Hydroptila simulans</i> Mosely, 1920	5	5				1,5	3
<i>Hydroptila sparsa</i> Curtis, 1834	4	6				1,6	3
<i>Hydroptila tineoides</i> Dalman, 1819	2	2	3	3		2,7	1
<i>Hydroptila vectis</i> Curtis, 1834	8	2				1,2	4
<i>Ithytrichia lamellaris</i> Eaton, 1873	6	2	2			1,6	2
<i>Lasiocephala basalis</i> (Kolenati, 1848)	8	2				1,2	4
<i>Lepidostoma hirtum</i> (Fabricius, 1775)	5	5				1,5	3
<i>Leptocerus tineiformis</i> Curtis, 1834				10		4	5
<i>Limnephilus affinis</i> Curtis, 1834		1	3	3	3	3,8	1
<i>Limnephilus auricula</i> Curtis, 1834		1	3	3	3	3,8	1
<i>Limnephilus binotatus</i> Curtis, 1834			4	4	2	3,8	2
<i>Limnephilus decipiens</i> (Kolenati, 1848)			4	4	2	3,8	2
<i>Limnephilus extricatus</i> McLachlan, 1865	1	8	1			2	4
<i>Limnephilus flavicornis</i> (Fabricius, 1787)			3	4	3	4	2
<i>Limnephilus griseus</i> (Linnaeus, 1758)				2	8	4,8	4

	H1	H2	H3	H4	H5	HV	IW
<i>Limnephilus hirsutus</i> (Pictet, 1834)	1	8	1			2	4
<i>Limnephilus ignavus</i> McLachlan, 1865	2	3	3	2		2,5	1
<i>Limnephilus lunatus</i> Curtis, 1834		3	4	3		3	2
<i>Limnephilus marmoratus</i> Curtis, 1834			6	4		3,4	3
<i>Limnephilus rhombicus</i> (Linnaeus, 1758)			6	4		3,4	3
<i>Limnephilus sparsus</i> Curtis, 1834			3	4	3	4	2
<i>Limnephilus stigma</i> Curtis, 1834			5	5		3,5	3
<i>Limnephilus vittatus</i> (Fabricius, 1798)				2	8	4,8	4
<i>Lype phaeopa</i> (Stephens, 1936)	3	3	2	2		2,3	1
<i>Micrasema setiferum</i> (Pictet, 1834)	8	2				1,2	4
<i>Molanna angustata</i> Curtis, 1840	5	5				1,5	3
<i>Mystacides azurea</i> (Linnaeus, 1761)		3	4	3		3	2
<i>Mystacides longicornis</i> (Linnaeus, 1758)	1	3	3	3		2,8	1
<i>Mystacides nigra</i> (Linnaeus, 1758)		3	4	3		3	2
<i>Nemotaulius punctatolineatus</i> (Retzius, 1783)			5	5		3,5	3
<i>Neureclipsis bimaculata</i> (Linnaeus, 1758)	3	7				1,7	4
<i>Oecetis furva</i> (Rambur, 1842)				10		4	5
<i>Oecetis lacustris</i> (Pictet, 1834)			5	5		3,5	3
<i>Oecetis notata</i> (Rambur, 1842)	5	5				1,5	3
<i>Oecetis ochracea</i> (Curtis, 1825)			2	8		3,8	4
<i>Oecetis testacea</i> (Curtis, 1834)	3	7				1,7	3
<i>Oligotricha striata</i> (Linnaeus, 1758)			5	5		3,5	3
<i>Orthotrichia costalis</i> (Curtis, 1834)			6	4		3,4	3
<i>Orthotrichia tragetti</i> Mosely, 1930			5	5		3,5	3
<i>Oxyethira flavicornis</i> Pictet, 1834	1	2	4	3		2,9	1
<i>Phryganea bipunctata</i> Retzius, 1783			5	5		3,5	3
<i>Phryganea grandis</i> Linnaeus, 1758			5	5		3,5	3
<i>Plectrocnemia conspersa</i> (Curtis, 1834)	6	4				1,4	3
<i>Polycentropus flavomaculatus</i> (Pictet, 1834)	5	5				1,5	3
<i>Polycentropus irroratus</i> Curtis, 1835	5	5				1,5	3
<i>Potamophylax cingulatus</i> Stephens, 1837	10					1	5
<i>Potamophylax latipennis</i> (Curtis, 1834)	8	2				1,2	4
<i>Potamophylax luctuosus</i> (Piller & Mitterpacher, 1783)	8	2				1,2	4
<i>Potamophylax rotundipennis</i> (Brauer, 1857)	5	5				1,5	3
<i>Psychomyia fragilis</i> (Pictet, 1834)	6	3	1			1,5	2
<i>Psychomyia pusilla</i> (Fabricius, 1781)	5	4	1			1,6	2
<i>Rhadicoleptus alpestris</i> (Kolenati, 1848)				5	5	4,5	3
<i>Rhyacophila dorsalis</i> (Curtis, 1834)	10					1	5
<i>Rhyacophila fasciata</i> Hagen, 1859	10					1	5
<i>Rhyacophila pascoei</i> McLachlan, 1879	10					1	5
<i>Sericostoma schneideri</i> Kolenati, 1848	10					1	5
<i>Setodes punctatus</i> (Fabricius, 1793)	6	4				1,4	3
<i>Silo nigricornis</i> (Pictet, 1834)	10					1	5
<i>Silo piceus</i> (Brauer, 1857)	10					1	5
<i>Tinodes waeneri</i> (Linnaeus, 1758)	1	2	4	3		2,9	1
<i>Triaenodes bicolor</i> (Curtis, 1834)				10		4	5
<i>Trichostegia minor</i> (Curtis, 1834)				2	8	4,8	4
ODONATA							
<i>Calopteryx splendens</i> (Harris, 1782)	7	3				1,3	4
<i>Calopteryx virgo</i> (Linnaeus, 1758)	10					1	5
<i>Lestes barbarus</i> (Fabricius, 1798)				2	8	4,8	4

	H1	H2	H3	H4	H5	HV	IW
<i>Lestes dryas</i> Kirby, 1893				2	8	4,8	4
<i>Lestes sponsa</i> (Hansemann, 1823)		1	4	4	1	3,5	1
<i>Lestes virens</i> Charpentier, 1825				4	6	4,6	3
<i>Lestes</i> (<i>Chalcolestes</i>) <i>viridis</i> (Vander Linden, 1825)		1	3	3	3	3,8	1
<i>Sympecma fusca</i> (Vander Linden, 1820)	1	1	1	6	1	3,5	1
<i>Platycnemis pennipes</i> (Pallas, 1771)	4	3	2	1		2	1
<i>Coenagrion hastulatum</i> (Charpentier, 1825)			1	7	2	4,1	3
<i>Coenagrion puella</i> (Linnaeus, 1758)	1	2	2	4	1	3,2	1
<i>Coenagrion pulchellum</i> (Vander Linden, 1825)	1		1	8		3,6	4
<i>Coenagrion scitulum</i> (Rambur, 1842)			3	7		3,7	4
<i>Cercion lindenii</i> (Selys, 1840)	1		2	7		3,5	3
<i>Enallagma cyathigerum</i> (Charpentier, 1840)	2	2	4	2		2,6	1
<i>Erythromma najas</i> (Hansemann, 1823)	1		3	6		3,4	3
<i>Erythromma viridulum</i> (Charpentier, 1840)	1		3	6		3,4	3
<i>Ischnura elegans</i> (Vander Linden, 1820)	1	2	3	3	1	3,1	1
<i>Ischnura pumilio</i> (Charpentier, 1825)		1		2	7	4,5	3
<i>Ceriagrion tenellum</i> (Villers 1789)		1	1	7	1	3,8	2
<i>Pyrrhosoma nymphula</i> (Sulzer, 1776)	1	2	2	5		3,1	1
<i>Aeshna affinis</i> Vander Linden, 1823				9	1	4,1	5
<i>Aeshna cyanea</i> (Mueller, 1764)		2	4	4		3,2	2
<i>Aeshna grandis</i> (Linnaeus, 1758)		1	4	5		3,4	2
<i>Aeshna isosceles</i> (Mueller, 1767)			2	8		3,8	4
<i>Aeshna juncea</i> (Linnaeus, 1758)			3	7		3,7	4
<i>Aeshna mixta</i> Latreille, 1805		1	2	7		3,6	3
<i>Aeshna viridis</i> Eversmann 1835			3	7		3,7	4
<i>Anax imperator</i> Leach, 1815	1	1	4	4		3,1	1
<i>Anax parthenope</i> (Selys, 1839)			4	6		3,6	3
<i>Brachytron pratense</i> Mueller, 1764	1		1	8		3,6	4
<i>Hemianax ephippiger</i> (Burmeister, 1839)			4	6		3,6	3
<i>Gomphus flavipes</i> (Charpentier, 1825)	10					1	5
<i>Gomphus vulgatissimus</i> (Linnaeus, 1758)	7	2	1			1,4	3
<i>Onychogomphus forcipatus</i> (Linnaeus, 1758)	9	1				1,1	5
<i>Ophiogomphus cecilia</i> (Fourcroy, 1785)	10					1	5
<i>Cordulegaster boltoni</i> (Donovan, 1807)	10					1	5
<i>Cordulia aenea</i> (Linnaeus, 1758)		5	3	2		2,7	2
<i>Epitheca bimaculata</i> (Charpentier, 1825)		2	4	4		3,2	2
<i>Somatochlora flavomaculata</i> (Vander Linden, 1825)		1	3	6		3,5	3
<i>Somatochlora meridionalis</i> Nielsen, 1935	9	1				1,1	5
<i>Somatochlora metallica</i> (Vander Linden, 1825)		3	4	3		3	2
<i>Crocothemis erythraea</i> (Brulle, 1832)		3	4	3		3	2
<i>Leucorrhinia pectoralis</i> (Charpentier, 1825)			1	7	2	4,1	3
<i>Libellula depressa</i> Linnaeus, 1758		3	2	2	3	3,5	1
<i>Libellula fulva</i> Mueller, 1764	6	2	1	1		1,7	2
<i>Libellula quadrimaculata</i> Linnaeus, 1758		1	3	6		3,5	3
<i>Orthetrum albistylum</i> (Selys, 1848)	1	6	2	1		2,3	2
<i>Orthetrum brunneum</i> (Fonscolombe, 1837)	7	3				1,3	4
<i>Orthetrum coerulescens</i> (Fabricius, 1798)	6		1	2	1	2,2	2
<i>Orthetrum cancellatum</i> (Linnaeus, 1758)	1	6	2	1		2,3	2
<i>Sympetrum danae</i> (Sulzer, 1776)				4	6	4,6	3
<i>Sympetrum depressiusculum</i> (Selys, 1841)				7	3	4,3	4
<i>Sympetrum flaveolum</i> (Linnaeus, 1758)				3	7	4,7	4

	H1	H2	H3	H4	H5	HV	IW
Sympetrum fonscolombeii (Selys, 1840)		5	2	1	2	3	1
Sympetrum meridionale (Selys, 1841)				5	5	4,5	3
Sympetrum pedemontanum (Allioni, 1766)	1	1	2	5	1	3,4	1
Sympetrum sanguineum (Mueller, 1764)	1	2	2	4	1	3,2	1
Sympetrum striolatum (Charpentier, 1840)		4	2	2	2	3,2	1
Sympetrum vulgatum (Linnaeus, 1758)		1	2	5	1	3,3	1
AMPHIBIA							
Triturus vulgaris (Linnaeus, 1758)			1	3	6	4,5	3
Triturus dobrogicus (Kiritzescu, 1903)			1	2	7	4,6	3
Triturus carnifex (Laurenti, 1768)				4	6	4,6	3
Bombina bombina (Linnaeus, 1758)				3	7	4,7	4
Bombina variegata (Linnaeus, 1758)					10	5	5
Pelobates fuscus (Laurenti, 1768)				3	7	4,7	4
Bufo bufo (Linnaeus, 1758)		1	2	3	4	4	1
Bufo viridis Laurenti, 1768		1	4	1	4	3,8	1
Hyla arborea (Linnaeus, 1758)			1	3	6	4,5	3
Rana dalmatina Bonaparte, 1840		1	1	2	6	4,3	2
Rana arvalis wolterstorffii Fejervary, 1919		1	2	3	4	4	1
Rana temporaria Linnaeus, 1758		1	1	2	6	4,3	2
Greenfrogs*			2	3	5	4,3	2
PISCES							
Abramis ballerus (Linnaeus, 1758)	6	4				1,4	3
Abramis brama (Linnaeus, 1758)	2	4	4			2,2	2
Abramis sapa (Pallas, 1814)	7	3				1,3	4
Alburnus alburnus (Linnaeus, 1758)	4	3	3			1,9	2
Aspius aspius (Linnaeus, 1758)	3	4	3			2	2
Barbatula barbatula (Linnaeus, 1758)	8	2				1,2	4
Barbus barbus Linnaeus, 1758)	10					1	5
Blicca bjoerkna (Linnaeus, 1758)	3	5	2			1,9	2
Carassius auratus gibelio (Linnaeus, 1758)	1	3	3	3		2,8	1
Carassius carassius Linnaeus, 1758)		2	3	5		3,3	2
Chondrostoma nasus Linnaeus, 1758)	10					1	5
Cobitis taenia (Linnaeus, 1758)	6	3	1			1,5	3
Cottus gobio (Linnaeus, 1758)	9	1				1,1	5
Cyprinus carpio (Linnaeus, 1758)	1	2	5	2		2,8	1
Esox lucius (Linnaeus, 1758)		2	4	4		3,2	2
Gasterosteus aculeatus (Linnaeus, 1758)		3	4	3		3	2
Gobio alpinus (Lukasch, 1933)	10					1	5
Gobio gobio (Linnaeus, 1758)	10					1	5
Gymnocephalus baloni (Holcik & Hensel, 1974)	3	6	1			1,8	3
Gymnocephalus cernuus (Linnaeus, 1758)	1	3	5	1		2,6	1
Gymnocephalus schraetser (Linnaeus, 1758)	6	4				1,4	3
Hucho hucho (Linnaeus, 1758)	10					1	5
Leuciscus deloneatus (Heckel, 1843)			2	8		3,8	4
Leuciscus cephalus (Linnaeus, 1758)	6	3	1			1,5	3
Leuciscus idus (Linnaeus, 1758)	8	2				1,2	4
Leuciscus leuciscus (Linnaeus, 1758)	9	1				1,1	5
Lota lota (Linnaeus, 1758)	5	3	2			1,7	2
Minogurnus fossilis (Linnaeus, 1758)			1	6	3	4,2	3
Neogobius kessleri (Günther 1861)	9	1				1,1	5
Pelecus cultratus (Linnaeus, 1758)	7	3				1,3	4

	H1	H2	H3	H4	H5	HV	IW
<i>Perca fluviatilis</i> (Linnaeus, 1758)	2	5	2	1		2,2	1
<i>Proterorhinus marmoratus</i> (Pallas, 1811)	4	4	2			1,8	2
<i>Rhodeus sericeus amarus</i> (Bloch, 1782)		2	4	4		3,2	2
<i>Rutilus pigus virgo</i> (Heckel, 1852)	10					1	5
<i>Rutilus rutilus</i> (Linnaeus, 1758)	2	3	3	2		2,5	1
<i>Salmo trutta forma fario</i> (Linnaeus, 1758)	10					1	5
<i>Scardinius erythrophthalmus</i> (Linnaeus, 1758)		3	4	3		3	2
<i>Silurus glanis</i> (Linnaeus, 1758)	3	3	4			2,1	2
<i>Stizostedion lucioperca</i> (Linnaeus, 1758)	2	4	4			2,2	2
<i>Stizostedion volgensis</i> (Gmelin, 1758)	1	3	6			2,5	3
<i>Tinca tinca</i> (Linnaeus, 1758)		2	3	5		3,3	2
<i>Vimba vimba</i> (Linnaeus, 1758)	7	3				1,3	4
<i>Zingel streber</i> (Siebold, 1863)	10					1	5
<i>Zingel zingel</i> (Linnaeus, 1766)	10					1	5

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