http://efi-plus.boku.ac.at/

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Project acronym: EFI+

Improvement and spatial extension of the European Fish Index

Instrument: STREP

Thematic Priority: Scientific Support to Policies (SSP) - POLICIES-1.5

D 5.3 Joint Danube Survey report

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Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

First experiences with the application of the EFI+ to fish data of Joint Danube Survey 2

Objectives

The EFI+ assessment software (New European Fish Index) was tested with data from the second Joint Danube Survey (JDS2, Liška et al. 2008) in 2007 in order to evaluate the applicability of the EFI+ for the Danube.

Methods

In this exercise we used data from the JDS sampled during 2007 (Jepsen et al. 2008). Only sites with fished areas of at least 1 ha are considered (sufficient sampling effort, reliability of data), data of sites RO46, BG47, RO48, RO49 are also excluded from analysis due to improper sampling conditions. Finally, 26 sites along the Danube have been selected for further analyses. Backwaters and tributaries are not included in the samples.

The results for the Danube downstream from Serbia are less reliable due to differences in sampling design and high water level downstream of the Iron Gate (downstream Golubak Koronin RO27, JDS60) and are thus not commented in detail here.

For calculating the EFI+ we used the web-based EFI+ software (http://efi-plus.boku.ac.at, 2009-06-10). The data were transferred to the Excel spreadsheet provided by the EFI+ website, uploaded and the calculated output was received in a separate Excel spreadsheet.

Preliminary results showed that invasive *Neogobius* species, classified as lithophilic species, i.e. *Neogobius melanostomus* and *Neogobius kessleri*, and thus considered in the EFI+ do have a strong influence on the index. Both species together represent about 9 % of the total catch in the selected dataset (Fig. 1) which is more than any other species except *Alburnus alburnus* (about 50 %). Therefore, a separate dataset was prepared where the two species were "excluded" by changing their names to other "dummy species" not considered as relevant functional guild in the EFI+. We kept the fish in the calculation to maintain the original total number of species and fish caught as those are also used in the calculation of the index in order to balance effects of different sample efforts and sample sizes (EFI+ consortium 2009, Pont et al. 2009).

For evaluating the EFI+ classification we compared the fish index with the hydromorphological classification according to the JDS2.

Results

The fished area of the 26 selected sites was quite consistent among sites (median 1.79, min 1.02, max 1.79). Between 15 and 38 species and were caught at individual sites (median 25.5). The total catch ranged from 249 to 6319 fish per site (median 1218).

When applying the EFI+ 19 sites were classified as good and only 7 sites as class 3, 4 or 5. Comparing EFI+ with the hydromorphological classification at the level class 1-2 versus 3-5 shows that only 23 % were correctly classified (Table 1).

The main reason for the high misclassification is that the two invasive species *Neogobius melanostomus* and *Neogobius kessleri* strongly influence the index. When excluding this influence the correctly classified sites increase to 46 %. In the upper part of the Danube (upstream of Croatia) the correct classification increases up to 60 % (Table 1).

Analysing the data in more detail reveals that only the metric density of lithophilic species show a response to hydromorphological pressures (Fig. 2). The metric richness of rheopar species nearly always indicates high or good status.

The few free flowing stretches of the upper Danube (DE1, DE2, AT6, AT7) are classified the similar way or even worse (class 3-4) than the impounded stretches (class 2-3). Although only 249 fish were caught at site AT5 (representing about 20 % of median catch) this impounded

site is still classified as class 3 (index 0.44). Nevertheless, the index reveals better conditions in the free flowing part of the Hungarian Danube in accordance with better hydromorphological classification.

Conclusions

The current version of the EFI+ is not able to reflect hydromorphological conditions along the main channel of the Danube. The main reason for that is that invasive species do have a strong impact on the EFI+. However, an adapted version of the EFI+, where the effect of invasive species is eliminated, reveals - according to the expectation - better ecological conditions for the free flowing Hungarian Danube than for the mostly impounded upper Danube (DE, AT). Only one of the two metrics seems to be responsive. Within the upper Danube the index is not able to distinguish between impounded and free flowing river sections. Additional metrics are probably required to better reflect the complex structure of large floodplain river fish communities at smaller scales (e.g. DE2, AT7). Further research is necessary for improving the assessment of large rivers and to better cope with the effects of invasive species.

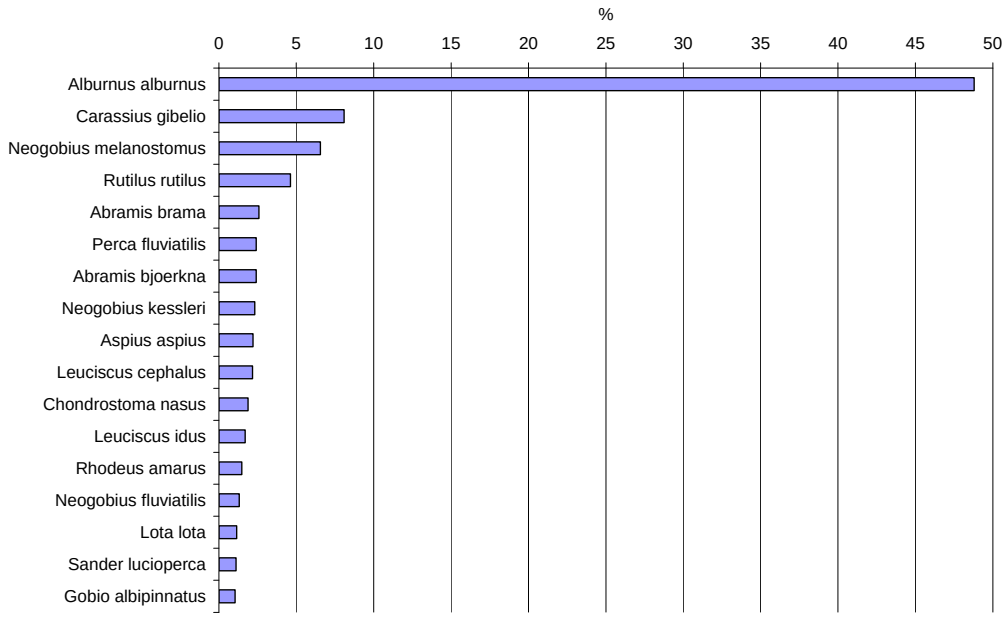

Fig. 1: Overall species composition of the JDS (selected dataset as described in the methods). Only species > 1 % are sown.

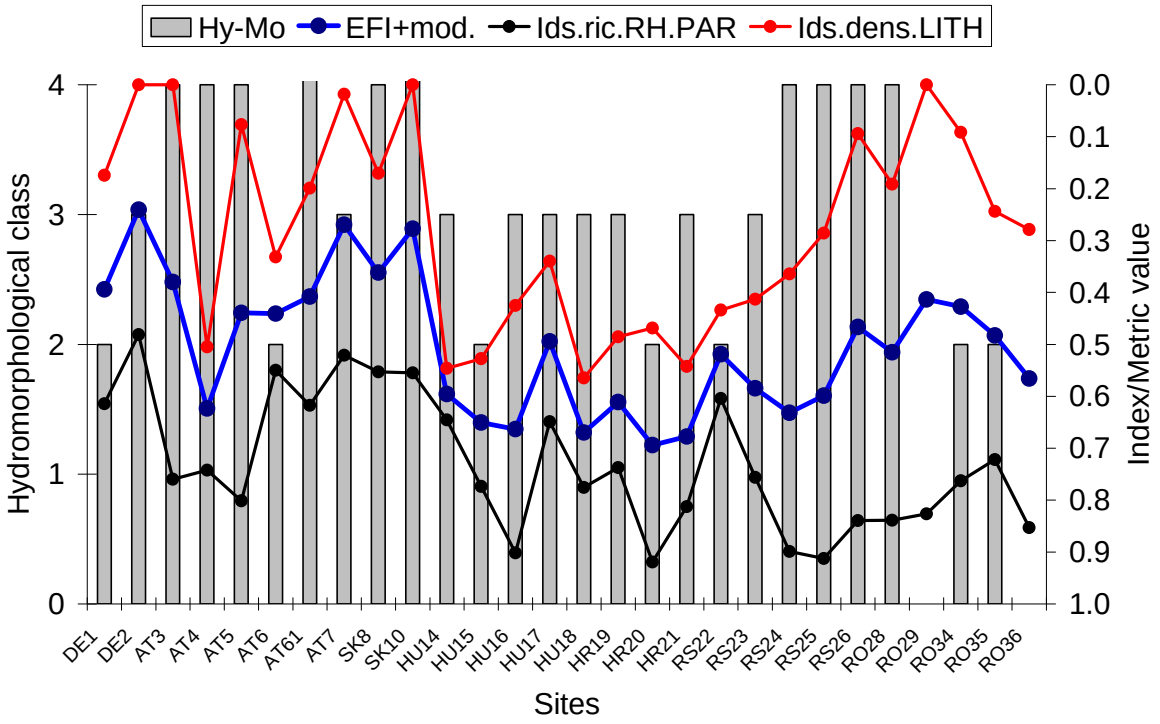

Fig.2: Comparison between hydromorphological classification (Hy-Mo) and modified EFI+ (EFI+mod.) and metrics (Ids.ric.RH.PAR = proportion of rheopar species, Ids.dens.LITH = proportion of lithophilic individuals) along selected JDS2 sites (codes according to country abbreviations)

Table1: Comparison between EFI+ and hydromorphological classification

EFI+

		Hydromorphological pressure				
		1-2		3-5		correct
		sites	%	sites	%	classif.
EFI+	1-2	3	**11.5**	16	61.5	
	3-5	4	15.4	3	**11.5**	
	total	7	26.9	19	73.1	**23.1%**

EFI+ Neogobius replaced

		Hydromorphological pressure				
		1-2		3-5		correct
		sites	%	sites	%	classif.
EFI+	1-2	2	**7.7**	9	34.6	
	3-5	5	19.2	10	**38.5**	
	total	7	26.9	19	73.1	**46.2%**

EFI+ Neogobius replaced, upstream Croatia

		Hydromorphological pressure				
		1-2		3-5		correct
		sites	%	sites	%	classif.
EFI+	1-2	1	**6.7**	4	26.7	
	3-5	2	13.3	8	**53.3**	
	total	3	20.0	12	80.0	**60.0%**

Table 2: Site-specific assessment of the ecological status of the Danube

River	JDS	Site	Site	Area	Rich-		Observed values		Observed modified		Index-metrics		Index-metrics modified		EFI+		EFI+ modified		Hy-Mo
km	ID	code	name	(ha)	ness	Catch	ric.RH.PAR	dens.LITH	ric.RH.PAR	dens.LITH	ric.RH.PAR	dens.LITH	ric.RH.PAR	dens.LITH	index	class	index	class	class
2,420	2	DE1	Kelheim	1.62	24	2076	9	1.44	9	1.44	0.61	0.17	0.61	0.17	0.394	3	0.394	3	2
2,278	5	DE2	Niederalteich	1.80	25	2567	8	1.13	8	0.81	0.48	0.03	0.48	0.00	0.254	4	0.241	4	3
2,215	7	AT3	Jochenstein	5.48	26	3514	9	1.77	9	0.26	0.76	0.59	0.76	0.00	0.672	2	0.380	3	4
2,118	8	AT4	Enghagen	4.16	28	1556	13	1.79	13	1.02	0.74	0.71	0.74	0.50	0.724	2	0.624	2	4
2,072	9	AT5	Ybbs	3.62	15	249	5	0.46	5	0.04	0.80	0.94	0.80	0.08	0.871	2	0.439	3	4
2,010	10	AT6	Oberloiben	5.65	32	1838	12	0.93	12	0.61	0.55	0.48	0.55	0.33	0.514	3	0.441	3	2
1,934	-	AT61	Nussdorf	3.88	22	999	8	1.47	8	0.27	0.62	0.80	0.62	0.20	0.710	2	0.408	3	5
1,894	13	AT7	Hainburg	5.47	38	6319	12	1.72	12	0.74	0.52	0.32	0.52	0.02	0.421	3	0.270	4	3
1,875	16	SK8	Bratislava	2.42	23	930	7	1.52	7	0.36	0.55	0.69	0.55	0.17	0.619	2	0.362	4	4
1,860	17	SK10	Cunovo	1.10	19	784	3	4.50	3	0.16	0.55	0.99	0.55	0.00	0.774	2	0.277	4	5
1,807	18	HU14	Medvedov	4.14	23	599	8	0.61	8	0.37	0.65	0.72	0.65	0.55	0.685	2	0.596	2	3
1,705	26	HU15	Szob	2.88	28	1293	11	2.25	11	0.98	0.77	0.82	0.77	0.53	0.799	2	0.651	2	2
1,662	30	HU16	Szentendre side arm	2.72	19	837	9	0.71	9	0.47	0.90	0.57	0.90	0.42	0.734	2	0.663	2	3
1,632	32	HU17	Budapest downstream	3.88	32	2280	9	1.63	9	0.72	0.65	0.63	0.65	0.34	0.640	2	0.494	3	3
1,446	39a	HU18	Mohacs	3.90	37	2746	9	1.32	9	0.93	0.78	0.69	0.78	0.56	0.732	2	0.670	2	3
1,430	40	HR19	Batina	1.21	27	1724	6	5.12	6	1.51	0.74	0.92	0.74	0.49	0.829	2	0.611	2	3
1,380	41	HR20	Aljmas	1.22	26	1733	7	3.09	7	1.24	0.92	0.79	0.92	0.47	0.856	2	0.694	2	2
1,303	45	HR21	Ilok / Backa Palanka	1.34	24	2735	7	8.23	7	2.76	0.81	0.93	0.81	0.54	0.872	2	0.678	2	3
1,252	47	RS22	Novi Sad downstream	1.02	22	688	4	1.64	4	0.66	0.60	0.76	0.60	0.43	0.680	2	0.519	3	2
1,202	50	RS23	Belegish	1.42	29	1265	7	1.27	7	0.77	0.76	0.59	0.76	0.41	0.672	2	0.585	2	3
1,163	52	RS24	Pancevo upstream	1.97	27	1089	7	0.43	7	0.35	0.90	0.44	0.90	0.36	0.668	2	0.632	2	4
1,132	54	RS25	Grocka	1.26	30	1093	8	0.97	8	0.44	0.91	0.56	0.91	0.29	0.736	2	0.599	2	4
1,107	57	RS26	Velika Morava downstream	1.09	35	1163	8	0.33	8	0.32	0.84	0.10	0.84	0.09	0.472	3	0.467	3	4
931	63	RO28	Vrbica / Simijan	1.40	31	1205	8	1.71	8	0.50	0.84	0.63	0.84	0.19	0.733	2	0.515	3	4
883	64	RO29	Old Danube Arm	1.50	20	1230	5	0.16	5	0.13	0.83	0.00	0.83	0.00	0.413	3	0.413	3	-
603	75	RO34	Olt downstream	1.79	24	1098	6	0.31	6	0.21	0.76	0.22	0.76	0.09	0.492	3	0.427	3	2
557	77	RO35	Zimnicea / Svishtov downstream	1.47	22	933	5	0.35	5	0.34	0.72	0.26	0.72	0.24	0.490	3	0.483	3	2
491	82	RO36	Ruse / Giurgiu downstream	1.02	23	760	7	0.44	7	0.44	0.85	0.28	0.85	0.28	0.566	2	0.566	2	-

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