Habitat establishment, captive breeding and conservation translocation to save threatened populations of the vulnerable European mudminnow *Umbra krameri*

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TABLE S1 Pre-stocking values of water quality parameters and coverage of macrophytes in Illés Ponds (Fig. 1) and their reference ranges based on literature data (Geyer, 1940; Sterbetz, 1963; Keresztessy, 1995; Povž, 1995a; Wanzenböck & Spindler, 1995; Májsky & Hajdú, 2004; Sallai, 2005; Sekulić et al., 2013; Keckeis & Sehr, 2014; Pekárik et al., 2014; Sallai & Müller, 2014) and our measurements at various native habitats (sites 1–10, Table 1). Values in bold are outside the range of natural habitats.

	Date of sampling	pH	Conductivity ($\mu S\ cm^{-1}$)	O_2 ($mg\ l^{-1}$)	PO_4–P ($mg\ l^{-1}$)	NH_4^+ ($mg\ l^{-1}$)	NO_2^- ($mg\ l^{-1}$)	NO_3^- ($mg\ l^{-1}$)	% coverage of macrophytes (Dominant taxa)
Illés Pond I (Created July 2008)	May 2010	7.8	1,120	1.1	0.8	0.20	**0.35**	20.0	1 (*Ceratophyllum demersum*, planted)
Illés Pond II (Created July 2008)	June 2010	7.5	**1,600**	1.2	0.9	0.25	0.02	6.0	0.9 (*Lemna trisulca*, occurring naturally)[1]
Illés Pond III (Created July 2009)	Sep. 2010	7.4	870		1.0	0.10	0.05	0.5	65 (*Ceratophyllum demersum*, planted)
Illés Pond IV (Created July 2009)	May 2010	7.6	1,050	1.7	0.3	0.10	0.12	26.0	95 (*Chara* sp., occurring naturally)
Illés Pond V (Created Sep. 2010)	Aug. 2012	7.6	690	3.2	0.4	0.30	**0.60**	5.0	0[2]
Illés Pond VI (Created Sep. 2010)	Aug. 2011	n.a.	820	9.9	0.3	0.05	0.01	1.0	52 (*Ceratophyllum demersum*, planted)
Range of natural habitats		6.4–9.2	182–1,180	0.3–12.7	0.0–1.3	0.01–0.50	0.00–0.23	0.0–35.0	0–100

[1] We observed a rapid increase in the abundance of cyanobacteria and sulphur bacteria during August.

[2] We observed planktonic algal bloom.

TABLE S2 Abundance and number of taxa of macroinvertebrates in samples collected in natural habitats of the European mudminnow *Umbra krameri* in Hungary (Fig. 1) in summer.

Sites	Date of sampling	Abundance of macroinvertebrates per sample (No. of taxa)
Pócos Pond A	June 2008	119 (12)
Pócos Pond B	June 2009	71 (17)
	June 2012	38 (12)
Ócsa Landscape Protection Area	June 2008	48 (9)
Gőgő-Szenke Stream, site 1	June 2010	(27)*
Gőgő-Szenke Stream, site 2	May 2009	134 (24)
Felső-Tápió Stream	June 2009	196 (19)
Hejő main channel, site 1	June 2007	78* (16)*
Hejő main channel, site 2	June 2007	43* (15)*
Pocsaji-láp Nature Reserve	June 2010	(26)
Zala-Somogy-Canal	June 2007	232* (19)*
Range		38–232 (9–27)
Mean		107 (18)

*Data from the Hungarian Ministry of Agriculture

TABLE S3 Pre-stocking abundance and number of taxa of macroinvertebrates in the artificially created Illés Ponds (Fig. 1). Values in bold are outside the range of natural habitats.

	Date of sampling	Abundance of macroinvertebrates per sample (No. of taxa)
Illés Pond I	June 2009	149 (18)
Illés Pond II	June 2012	38 (12)
Illés Pond III		Not available[1]
Illés Pond IV	May 2010	65 (18)
Illés Pond V	June 2012	**323** (19)
Illés Pond VI	June 2011	98 (14)
Range of natural habitats[2]		38–232 (9–27)
Mean value of natural habitats*		107 (17)

[1] The stored sample was damaged.
[2]Reference values from Table S2

TABLE S4 Post-stocking values of water quality parameters and maximum % coverage of macrophytes in Illés Ponds during 2011–2013, and their reference ranges for natural habitats (Table S1). Values in bold are outside the range of natural habitats.

	Date of sampling	pH	Conductivity ($\mu S\ cm^{-1}$)	O_2 ($mg\ l^{-1}$)	PO_4–P ($mg\ l^{-1}$)	NH_4^+ ($mg\ l^{-1}$)	NO_2^- ($mg\ l^{-1}$)	NO_3^- ($mg\ l^{-1}$)	Max. % coverage of macrophytes (Dominant taxa)
Illés Pond I	Feb.–Aug. 2011	7.9–8.9	620–1,040	7.8–8.4	0.5–**1.8**	0.05–0.15	0.07–0.17	13.0–25.0	0
Illés Pond II*	Feb.–Aug. 2011	7.3–8.5	600–**1,730**	2.0–9.6	0.1–**3.0**	0.05–**6.00**	0.01–0.15	0.5–5.0	0
Illés Pond III	July, Aug. 2012; Mar. 2013	7.0–8.2	540–720	2.1–2.4	0.1–0.6	0.05–0.10	0.01–0.02	0.5–0.5	100 (*Ceratophyllum demersum*, planted)
Illés Pond IV	July, Aug. 2012; Mar. 2013	7.3–8.0	780–810	1.8–2.0	0.1–0.2	0.05–0.05	0.01–0.01	0.3–24.0	95 (*Chara* sp., occurring naturally)
Illés Pond V*	Mar., Aug. 2013	7.3–7.3	870–1,130		0.1–0.3	0.05–0.25		0.5–4.0	0
Illés Pond VI	July, Aug. 2012; Mar. 2013	7.3–7.4	830–980	2.1–2.8	0–1.0	0.10–0.10	0.01–0.02	0.5–1.0	75 (*Ceratophyllum demersum*, planted)
Range of natural habitats		6.4–9.2	182–1,180	0.3–12.7	0.0–1.3	0.01–0.50	0.00–0.23	0.0–35.0	0–100

Pre-stocking monitoring of Illés Ponds II and V revealed poor water quality and therefore these ponds were not stocked with European mudminnow, although we continued to monitor them.

TABLE S5 Post-stocking abundance and number of taxa of macroinvertebrates in the artificially created Illés Ponds. Values in bold are outside the range of natural habitats.

	Date of sampling	Abundance of macroinvertebrates per sample (No. of taxa)
Illés Pond I	June 2012	150 (14)
Illés Pond II[1]	May 2015	52 (**8**)
Illés Pond III	June 2012	73 (18)
Illés Pond IV	June 2012	62 (15)
Illés Pond V[1]	May 2015	104 (**7**)
Illés Pond VI	June 2012	98 (14)
Range of natural habitats[2]		38–232 (9–27)
Mean value of natural habitats[2]		107 (17)

[1]Illés Ponds II and V were not stocked with European mudminnow but their monitoring continued.
[2]Reference values from Table S2

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