Supplementary material

Table S1. Details of pool-type fishways studies focusing on the Iberian barbel developed in Iberian Peninsula between 2009-2019. Conf. – Configuration; L x B – Pool length x width; OF – Orifice fishway, NOF – Notch and orifice fishway, VSF – Vertical slot fishway (Fishway type). Other abbreviations stand as following: Env. – Environment; M- Males, F- females (Fish characteristics); B- Backwater profile, D- Drawdown profile (Flow characteristics); Visual obs. - Visual observations, EMG – Electromyogram, PIT- Passive Integrated Transponder (Fish Monitoring); ΔH – head drop between the pools; d- mean water depth in the pool. The main findings of each study are also shown.

Conf.	Env.	Fishway characteristics																Flow characteristics					Fish characteristics		Fish Monitor.	References	Main findings
						Orifices			Notches		Slots			Additional features													
		Fishway type	Slope (%)	Number of pools	L x B (m)	Y/N	Size (m^2)	Orient.	Y/N	Width (cm)	Y/N	N	Width (cm)	Y/N	Type	N	Size (cm)	Type	Regime in notches	Q ($L.s^{-1}$)	ΔH (cm)	d (cm)	N	Total / Fork length (FL) (mm)			
1	Lab	NOF	8.5	6	1.9 x 1.0	Y	0.04	Offset	Y	20	N	-	-	N	-	-	-	Uniform	Plunging	70.6	16	-	45	140-285	Visual obs. + video	Silva et al. 2009 [88]	•Overall, orifices were the clear choice to negotiate the fishway •Orifices and notches equally used during streaming flow •Orifices used much more than notches during plunging flow
2	Lab	NOF	8.5	6	1.9 x 1.0	Y	0.04	Offset	Y	20	N	-	-	N	-	-	-	Uniform	Streaming	90.3	16	-	45				
3	Lab	NOF	8.5	6	1.9 x 1.0	Y	0.04	Offset	Y	30	N	-	-	N	-	-	-	Uniform	Plunging	83.2	16	-	45				
4	Lab	NOF	8.5	6	1.9 x 1.0	Y	0.04	Offset	Y	30	N	-	-	N	-	-	-	Uniform	Streaming	108.3	16	-	45				
5	Lab	OF	8.7	6	1.9 x 1.0	Y	0.04	Straight	N	-	-	-	-	-	-	-	-	Uniform	-	72	-	-	8	494 (mean)	EMG telemetry	Quintella et al., 2009 [89]	•EMG telemetry useful to study barbel' behavior in pool-type fishways
6	Lab	OF	8.5	6	1.9 x 1.0	Y	0.03	Offset	N	-	N	-	-	N	-	-	-	Uniform	-	38.5	16	79	20	150-350	Visual obs. + video	Silva et al. 2011 [34]	•Larger adults with higher passage success than smaller ones •Time to negotiate the fishway lower for larger adults •Horizontal RSS as the most important hydraulic variable
7	Lab	OF	8.5	6	1.9 x 1.0	Y	0.04	Offset	N	-	N	-	-	N	-	-	-	Uniform	-	47.5	16	86	20				
8	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Offset	N	-	N	-	-	N	-	-	-	Uniform	-	62.7	16	85	20				
9	Lab	OF	8.5	6	1.9 x 1.0	Y	0.06	Offset	N	-	N	-	-	N	-	-	-	Uniform	-	77.0	16	84	20				
10	Lab	OF	8.5	6	1.9 x 1.0	Y	0.04	Offset	N	-	N	-	-	N	-	-	-	Uniform	-	47.5	16	86	20	150-350	Visual obs. + video	Silva et al. 2012 [39]	• Offset orifice configuration better than the straight one • RSS the one that most strongly influenced fish movements
11	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Offset	N	-	N	-	-	N	-	-	-	Uniform	-	62.7	16	85	20				
12	Lab	OF	8.5	6	1.9 x 1.0	Y	0.03	Straight	N	-	N	-	-	N	-	-	-	Uniform	-	50.1	16	88	20				
13	Lab	OF	8.5	6	1.9 x 1.0	Y	0.04	Straight	N	-	N	-	-	N	-	-	-	Uniform	-	71.7	16	89	20				
14	Lab	OF	8.5	6	1.9 x 1.0	Y	0.03	Offset	N	-	N	-	-	N	-	-	-	Uniform	-	38.5	16	89	20	150-350	Visual obs. + video	Silva et al. 2012 [38]	•Higher passage rates / lower time with offset orifices •Size-related behavioural responses to turbulence •RSS most important turbulence descriptor •Behavior of larger fish strongly affected by eddies
15	Lab	OF	8.5	6	1.9 x 1.0	Y	0.04	Offset	N	-	N	-	-	N	-	-	-	Uniform	-	47.5	16	86	20				
16	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Offset	N	-	N	-	-	N	-	-	-	Uniform	-	62.7	16	85	20				
17	Lab	OF	8.5	6	1.9 x 1.0	Y	0.03	Straight	N	-	N	-	-	N	-	-	-	Uniform	-	50.0	16	88	20				
18	Lab	OF	8.5	6	1.9 x 1.0	Y	0.04	Straight	N	-	N	-	-	N	-	-	-	Uniform	-	71.8	16	89	20				
19	Lab	OF	8.5	6	1.9 x 1.0	Y	0.03	Straight	N	-	N	-	-	Y	Deflector bar	1/pool	-	Uniform	-	38.5	16	88	20				
20	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Straight	N	-	N	-	-	Y	Deflector bar	1/pool	-	Uniform	-	62.7	16	84	20				
21	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Offset	N	-	N	-	-	-	-	-	-	Uniform	-	65	16	-	24	450 (mean)	EMG telemetry	Alexandre et al. 2013 [41]	•Burst swimming was required to move through the orifices •Horizontal RSS as the most important hydraulic variable
22	Lab	NOF	8.5	6	1.9 x 1.0	Y	0.04	Offset	Y	20	N	-	-	N	-	-	-	Uniform	Plunging	59.3	16	90	15	26	Visual obs.	Branco et al. 2013 [85]	•Species used the notches more readily during streaming flow •Species more successful during streaming flow •Streaming flow most suitable in PaW with different species
23	Lab	NOF	8.5	6	1.9 x 1.0	Y	0.04	Offset	Y	20	N	-	-	N	-	-	-	Uniform	Streaming	78.5	16	100	15	25.5			
24	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Offset	N	-	N	-	-	Y	Bottom boulders	12/pool	15x15x10	Uniform	-	62.7	16	84	20	150-350	Visual obs. + video	Santos et al. 2013 [86]	•Lower relative depth of flow more beneficial to fish passage
25	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Offset	N	-	N	-	-	Y	Bottom boulders	12/pool	15x15x15	Uniform	-	62.7	16	53	20				
26	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Offset	N	-	N	-	-	Y	Bottom boulders	12/pool	15x15x10	Uniform	-	62.7	16	84	20	150-250	Visual obs. + video	Santos et al. 2014 [40]	•Fish passage success discharge-related •Fish passage success independent of boulder density •Higher boulder density and discharge lowered time of passage
27	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Offset	N	-	N	-	-	Y	Bottom boulders	8/pool	15x15x10	Uniform	-	62.7	16	84	20				
28	Lab	OF	8.5	6	1.9 x 1.0	Y	0.03	Offset	N	-	N	-	-	Y	Bottom boulders	12/pool	15x15x10	Uniform	-	38.5	16	88	20				
29	Lab	OF	8.5	6	1.9 x 1.0	y	0.03	Offset	N	-	N	-	-	Y	Bottom boulders	8/pool	15x15x10	Uniform	-	38.5	16	88	20				
30	Lab	VSF	7.5	11	1.85 x 1.5	N	-	-	-	-	Y	1	27	N	-	-	-	Uniform	-	100	14	30	81	100-350	Video	Aramburu et al. 2014 [90]	•Iberian barbel had higher passage success than Mediterranean barbel and Iberian nase •Larger fish were more successful in negotiating the fishway
31	Lab	OF	8.5	6	1.9 x 1.0	Y	0.05	Offset	N	-	N	-	-	Y	Bottom grass	-	-	Uniform	-	62.7	16	84	20	150-350	Visual obs. + video	Branco et al. 2015 [91]	•Boulders: greater fish passage success at higher discharge •Grass: greater fish passage success at lower discharge
32	Lab	OF	8.5	6	1.9 x 1.0	Y	0.03	Offset	N	-	N	-	-	Y	Bottom grass	-	-	Uniform	-	38.5	16	88	20				

Conf.	Env.	Fishway characteristics: Fishway type	Slope (%)	Number of pools	L x B (m)	Orifices: Y/N	Orifices: Size (m²)	Orifices: Orient.	Notches: Y/N	Notches: Width (cm)	Slots: Y/N	Slots: N	Slots: Width (cm)	Additional features: Y/N	Additional features: Type	Additional features: N	Additional features: Size (cm)	Flow characteristics: Type	Regime in notches	Q (L.s⁻¹)	ΔH (cm)	d (cm)	Fish characteristics: N	Total / Fork length (FL) (mm)	Fish Monitor.	References	Main findings
33	Lab	VSF	7.5	11	1.85 x 1.5	N	-	-	-	-	Y	1	27	N	-	-	-	Uniform	-	250	14	75	63	100-350	Video	Aramburu et al. 2014 [90] Rodríguez et al. 2015 [80]	•Fish avoided high velocity and turbulent areas •Fish rested frequently in the upstream low-velocity areas of the pools •Lower fish passage at higher discharge
34	Field	VSF	7.7	9	2.4 x 1.6	N	-	-	-	-	N	1	20	Y	Bottom substrate	-	-	-	-	245	20	110	17	M: 241.8±58.2 (FL) F: 250.3±46.9 (FL)	PIT telemetry	Sanz-Ronda et al. 2016 [49]	•Barbel and nase ascended easily the VSF •Barbel and nase performed better than trout •Fishway discharge affected fish motivation •Fishway discharge did not influence passage success
35	Field	VSF	7.7	9	2.4 x 1.6	N	-	-	-	-	N	1	20	Y	Bottom substrate	-	-	-	-	334	20	110	17				
36	Field	VSF	7.7	9	2.4 x 1.6	N	-	-	-	-	N	1	20	Y	Bottom substrate	-	-	Uniform	-	402	20	110	17				
37	Lab	VSF	8.5	6	1.9 x 1.0	N	-	-	-	-	Y	1	10	Y	Lateral + central baffle (C1)	-	6.25 + 25	Uniform	-	110	16	80	25	157-236	Visual obs. + video	Romão et al. 2017 [69]	•Barbel: no difference in N UP movements between C1 and C2 •Chub: higher N UP movements in C2 •C2 more cost-effective because requires less water
38	Lab	VSF	8.5	6	1.9 x 1.0	N	-	-	-	-	Y	1	10	Y	Lateral baffle (C2)	-	6.25	Uniform	-	81	16	80	25	160-308			
39	Field	NOF	8.8-9.8	23	2.6 x 1.6	Y	0.02-0.06	Offset	Y	20-40	N	-	-	Y	Bottom substrate	-	10	-	-	159-395	25	-	89	171-388 (FL)	PIT telemetry	Bravo-Córdoba et al. 2018 [92]	•Flow, temperature and atmospheric pressure were important for fish entrance. •No preference between path routes (bypass and turbine channel) •Dual entrance fishway could be important for conservation
40	Field	NOF	8.8-9.8	23	2.6 x 1.6	Y	0.02-0.06	Offset	Y	20-40	N	-	-	Y	Bottom substrate	-	10	-	-	159-395	25	-	30	343 (mean) (FL)			
41	Field	NOF	8.8-9.8	23	2.6 x 1.6	Y	0.02-0.06	Offset	Y	20-40	N	-	-	Y	Bottom substrate	-	10	-	-	159-395	25	-	50	172 (mean) (FL)			
42	Field	NOF	8.8-9.8	23	2.6 x 1.6	Y	0.02-0.06	Offset	Y	20-40	N	-	-	Y	Bottom substrate	-	10	-	-	159-395	25	-	28	186 (mean) (FL)			
43	Field	VSF	6.52	18	2.1 x 1.6	-	-	-	-	-	Y	1	20	Y	Bottom substrate	-	-	-	-	250	15	-	41	110-240 (FL)	PIT telemetry	Bravo-Córdoba et al. 2018 [42]	•Ascent ability in VSF and NOF were similar •Larger fish displayed lower transit time in ascension •Motivation greater in VSF, though not relevant for success
44	Field	VSF	6.52	18	2.1 x 1.6	-	-	-	-	-	Y	1	20	Y	Bottom substrate	-	-	-	-	250	15	-	33	112-277 (FL)			
45	Field	NOF	8.77	11	2.6 x 1.6	Y	0.04	Offset	Y	30	N	-	-	Y	Bottom substrate	-	-	-	-	270	25	-	41	112-340 (FL)			
46	Field	NOF	8.77	11	2.6 x 1.6	Y	0.04	Offset	Y	30	N	-	-	Y	Bottom substrate	-	-	-	-	270	25	-	38	110-240 (FL)			
47	Lab	VSF	8.5	6	1.9 x 1.0	-	-	-	-	-	Y	1	10.5	N	-	-	-	Uniform	-	81	17.8	72	5	210-300	Visual obs. + video	Fuentes-Pérez et al. 2018 [76]	•Broader fish use of the fishway with lower head drop •Protection by the walls was key in the use of space •VSF designed with uniform flow can be unsuitable when non-uniform flows are present
48	Lab	VSF	8.5	6	1.9 x 1.0	-	-	-	-	-	Y	1	10.5	N	-	-	-	Non-uniform (B)	-	50	7.4	71	5	210-300			
49	Lab	VSF	8.5	6	1.9 x 1.0	-	-	-	-	-	Y	1	10.5	N	-	-	-	Non-uniform (D)	-	81	21.2	61	5	210-300			
50	Lab	VSF	8.5	6	1.9 x 1.0	N	-	-	-	-	Y	1	10	Y	Lateral baffle (C2)	-	6.25	Uniform	-	81	16	80	25	208±36	Visual obs. + video	Romão et al. 2018 [93]	•No difference in passage performance between VSF and MSF •MSF is preferable as it requires less water (31%) to operate
51	Lab	VSF	8.5	6	1.9 x 1.0	N	-	-	-	-	Y	2	10	Y	Lateral baffle (C2)	-	6.25	Uniform	-	56	16	80	25	208±36			
52	Lab	VSF	8.5	6	1.9 x 1.0	N	-	-	N	-	Y	1	10	Y	Lateral baffle	-	6.25	Uniform	-	110	16	80	70	185 (mean)	Visual obs. + video	Romão et al. 2018 [94]	•No significant differences on passage performance between spring and autumn •Evaluation of passage performance in fishways can be extended to early-autumn
53	Lab	VSF	8.5	6	1.9 x 1.0	N	-	-	N	-	Y	2	10	-	-	-	-	Uniform	-	56	16	80	50	196 (mean)	Visual obs. + video	Romão et al. 2019 [95]	•No seasonal differences in passage performance between spring and autumn •MSF can be considered a cost-effective design for the I. barbel
54	Field	NOF	16.3	46	1.6 x 1.75	Y	0.03	Offset	Y	17/40	N	-	-	N	-	-	-	-	-	140	25-30	100	61	336 (mean) (FL)	PIT telemetry	Pedescoll et al. 2019 [96]	•Upstream passage efficiency was the greatest for barbel (60%) •Entry efficiency was low for the barbel (3.8%) •Fishway has limited efficiency for small fish

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