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Fish Passage Studies I: Sea Lamprey Behaviour During Negotaiton of Technical and Nature-Like Fish Passes

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Sea lamprey behaviour during negotiation of technical and nature-like fish passes

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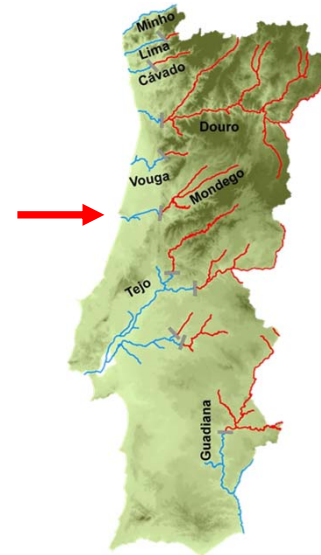
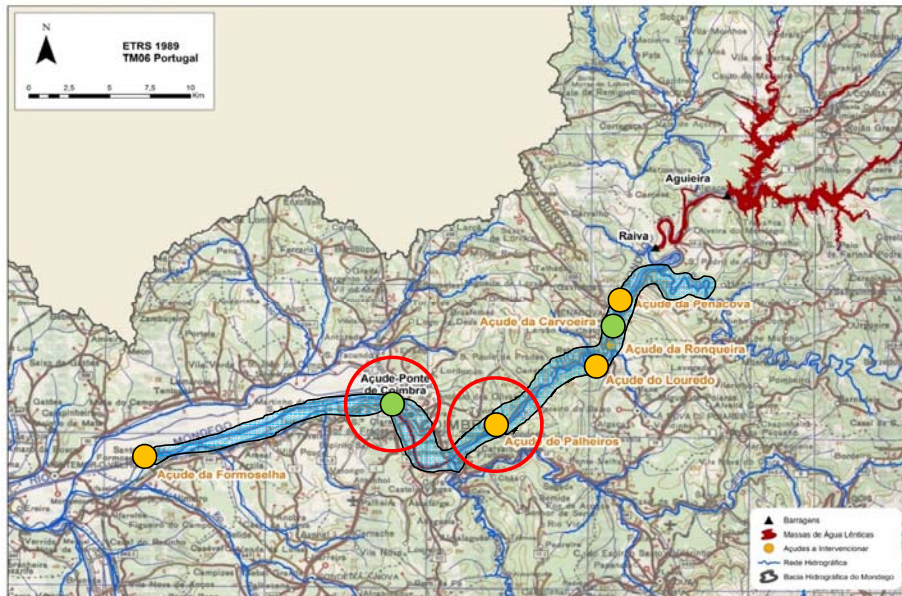
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Study site: River Mondego (Central Portugal) – 234 km, 6645 km², mean river discharge 88 m³/s

Available habitat for anadromous fish: ca. 95 km (66 km freshwater)

6 fish passes: (●)2 vertical slot + (●) 4 nature-like fish ramps





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Vertical slots fish pass
Açude-Ponte dam (Coimbra) – 6.2 m height; 45 km from the river mouth

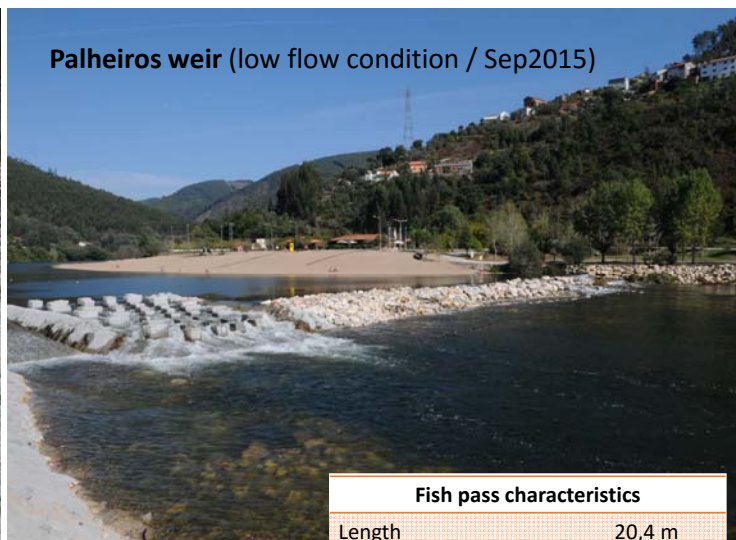
Fish pass characteristics

Length	125m
Nº pools	23
Pool dim.	4.5x3.0m
Pool depth	2.0m
Flow discharge	2.0 m ³ s ⁻¹
Attraction flow	2.0 m ³ s ⁻¹
Water velocity (slots)	ca. 1.5ms ⁻¹
Dissipated power	<150 W/m ³

Palheiros weir (77 m³/s, Mar2016)

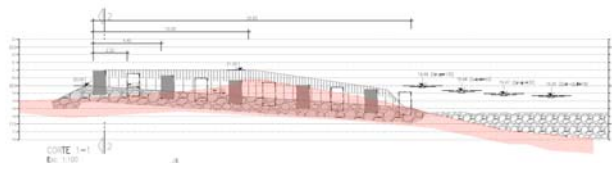


Palheiros weir (low flow condition / Sep2015)



Fish pass characteristics

Length	20,4 m
Width	10 m
Average slope	7%
Nr. stone blocks rows	10
Dist. between rows	1.4 m
Dist. between blocks	1.4 m
Water depth	0.3 – 1.0 m
Flow discharge	Variable
Attraction flow	Variable
Water velocity (slots)	< 2.0 ms ⁻¹



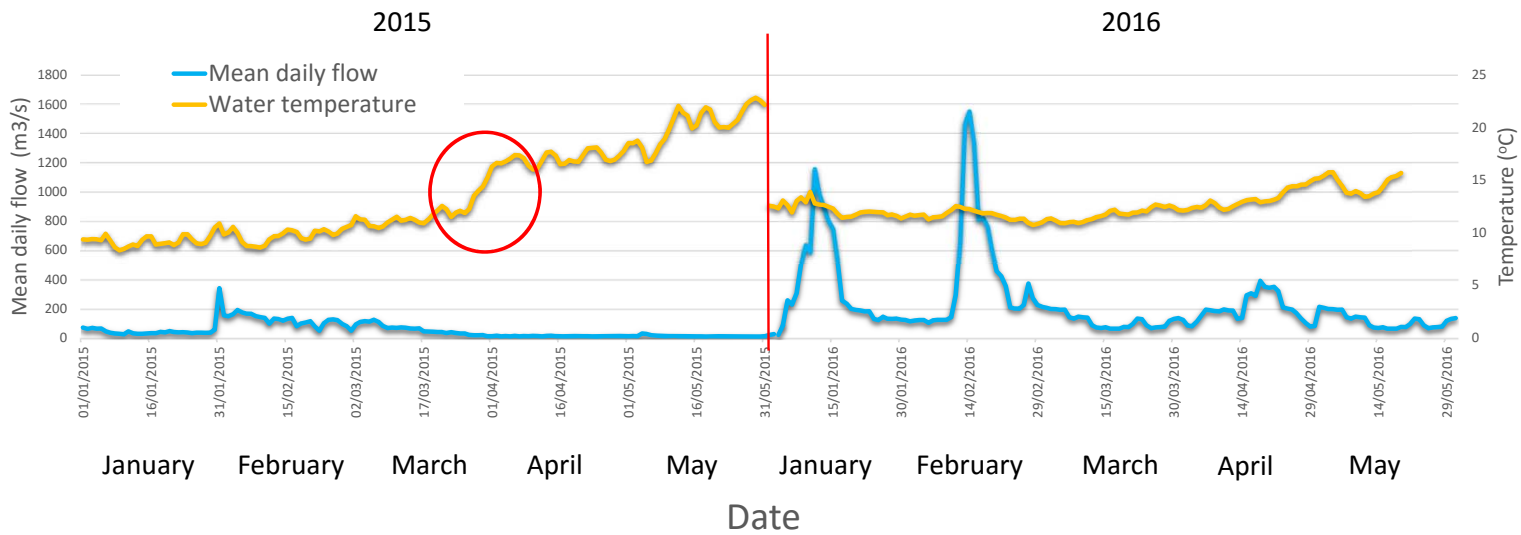
Palheiros weir fish pass (construction final phase)



15th March 2016 – 77 m³/s



Mean daily flow and temperature (Jan-May 2015 and 2016)





cEMG Telemetry

#9 sea lampreys tagged with cEMG R11-18 transmitters (Lotek).

The cEMG transmitters were surgically implanted according to Quintella *et al.* (2009).

Release in the 2nd pool of the fish pass at the Coimbra Açude-Ponte dam.

cEMG values were standardized (each individual record was divided by the EMG rest value).



Surgery



Electrodes placement



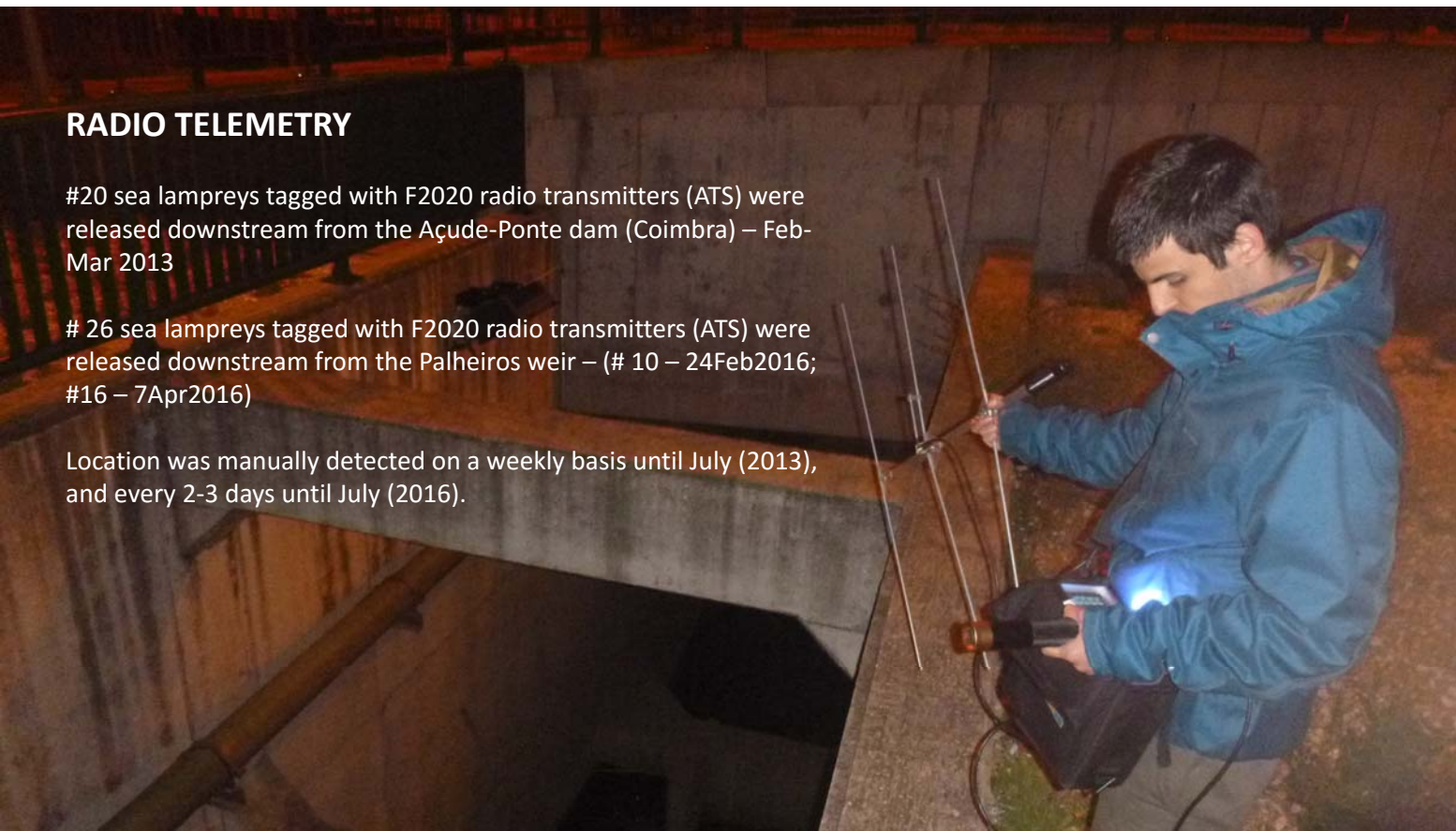
Transmitter implantation

RADIO TELEMETRY

#20 sea lampreys tagged with F2020 radio transmitters (ATS) were released downstream from the Açude-Ponte dam (Coimbra) – Feb-Mar 2013

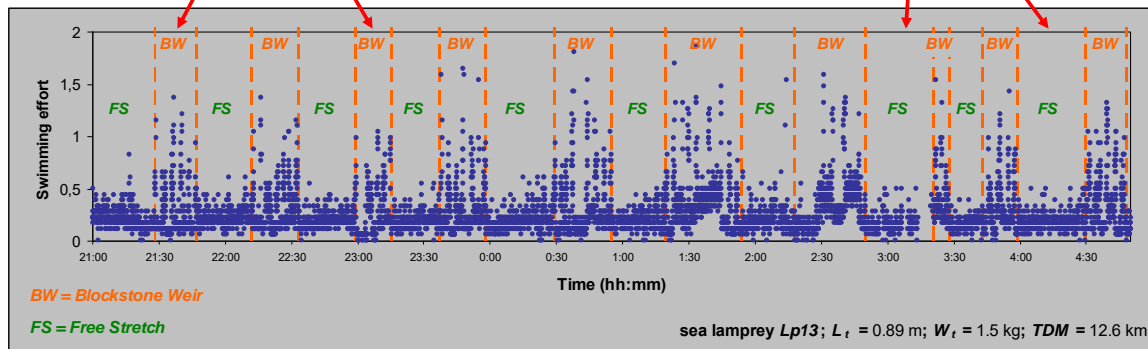
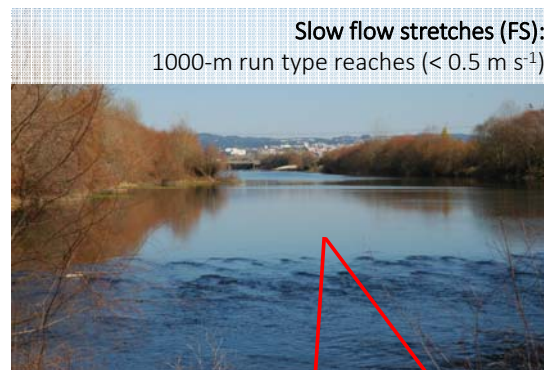
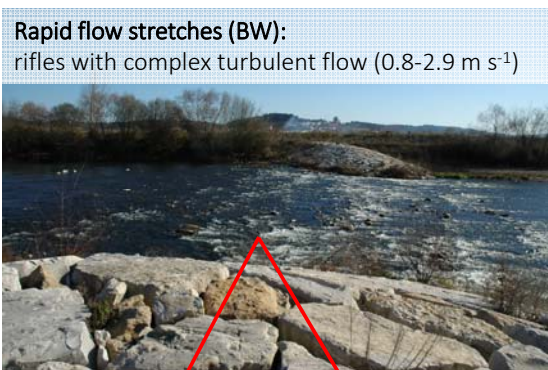
26 sea lampreys tagged with F2020 radio transmitters (ATS) were released downstream from the Palheiros weir – (# 10 – 24Feb2016; #16 – 7Apr2016)

Location was manually detected on a weekly basis until July (2013), and every 2-3 days until July (2016).

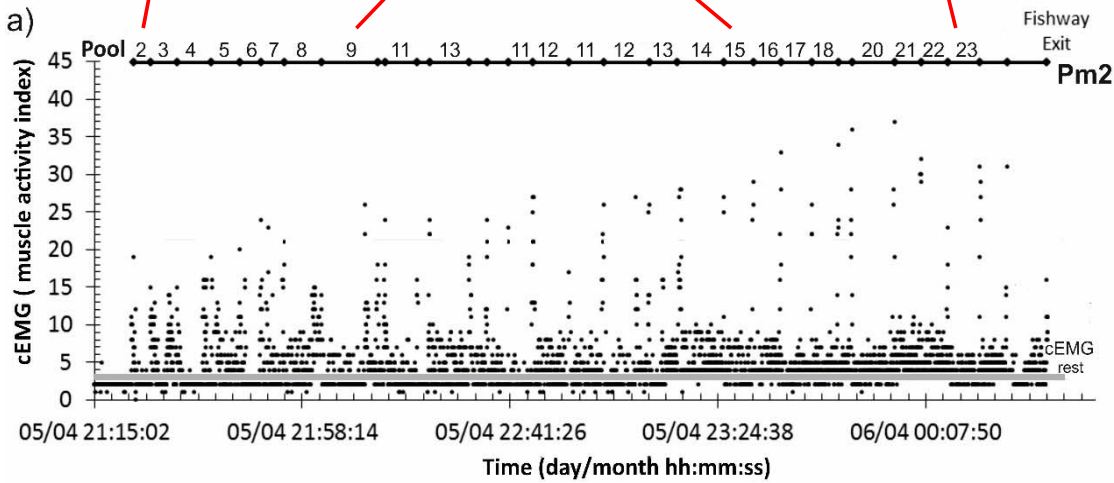
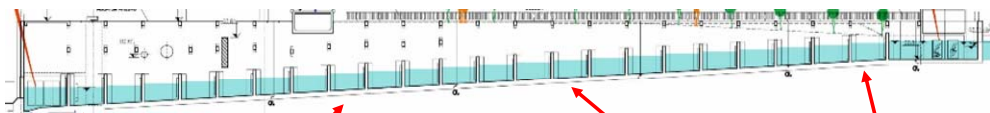


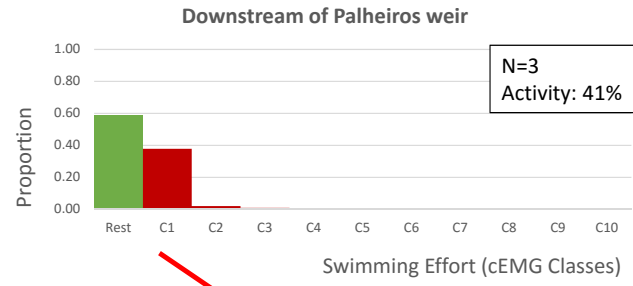
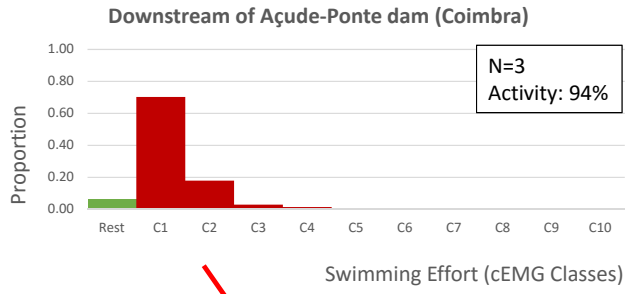
Electromyogram telemetry (EMG) proved to be a good method to assess swimming behaviour of upriver migrating sea lamprey

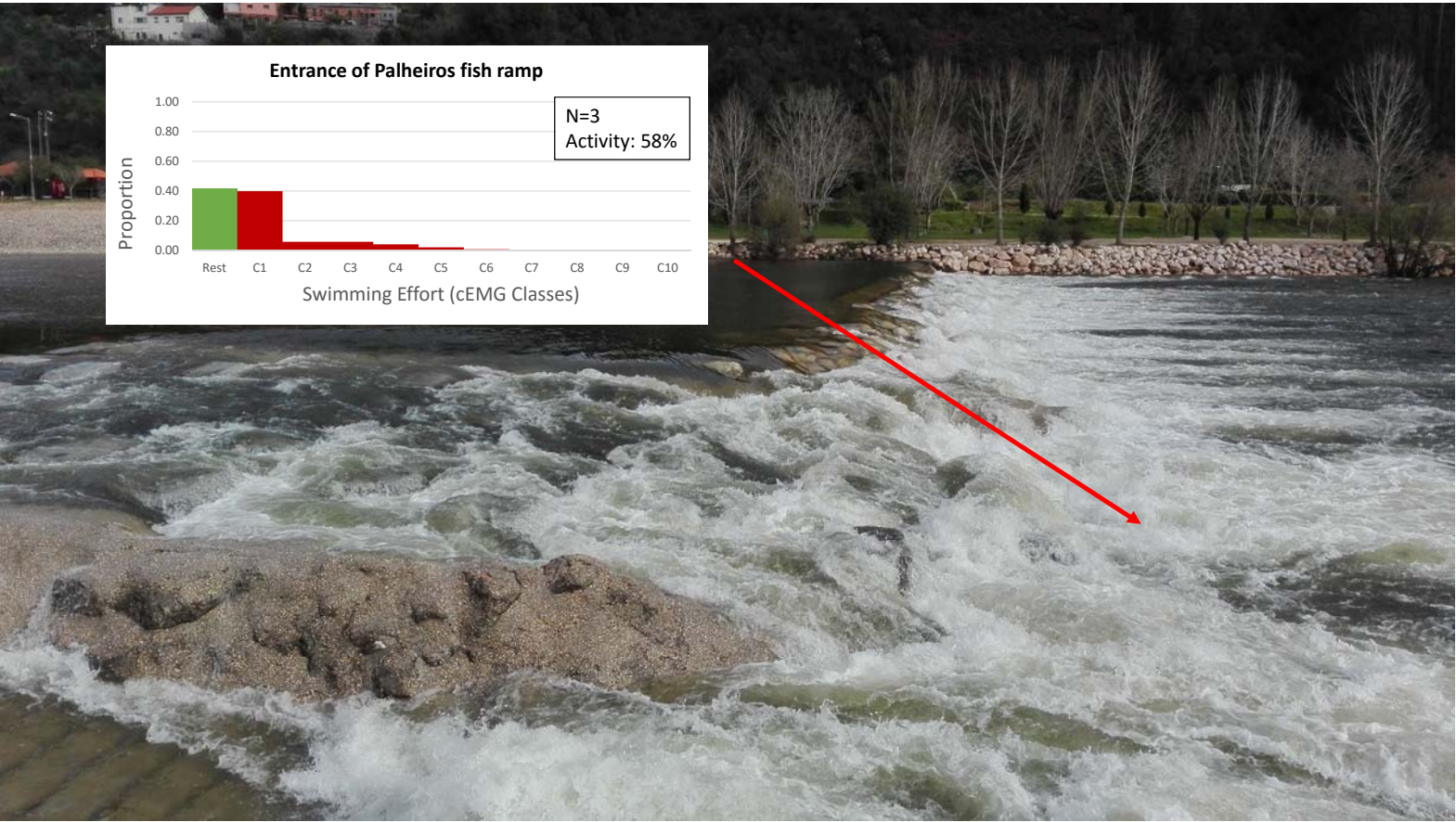
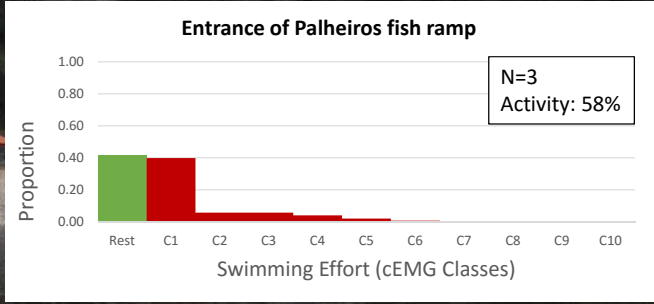
Quintella *et al.* (2009) *Journal of Applied Ichthyology* 25: 46-54



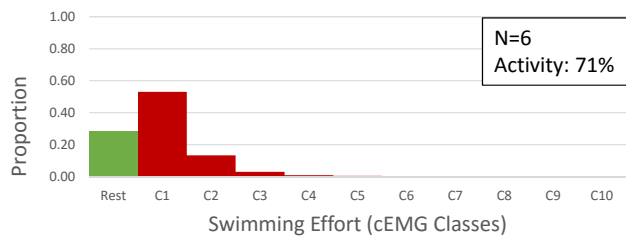
Behaviour of sea lampreys during negotiation of the vertical slots fish pass at the Coimbra Açude-Ponte dam



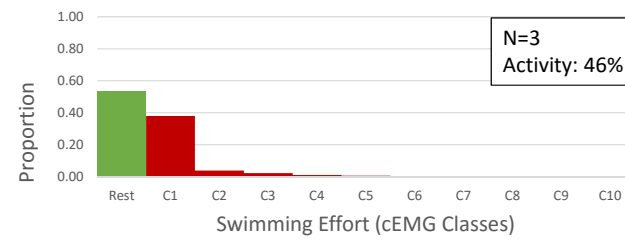




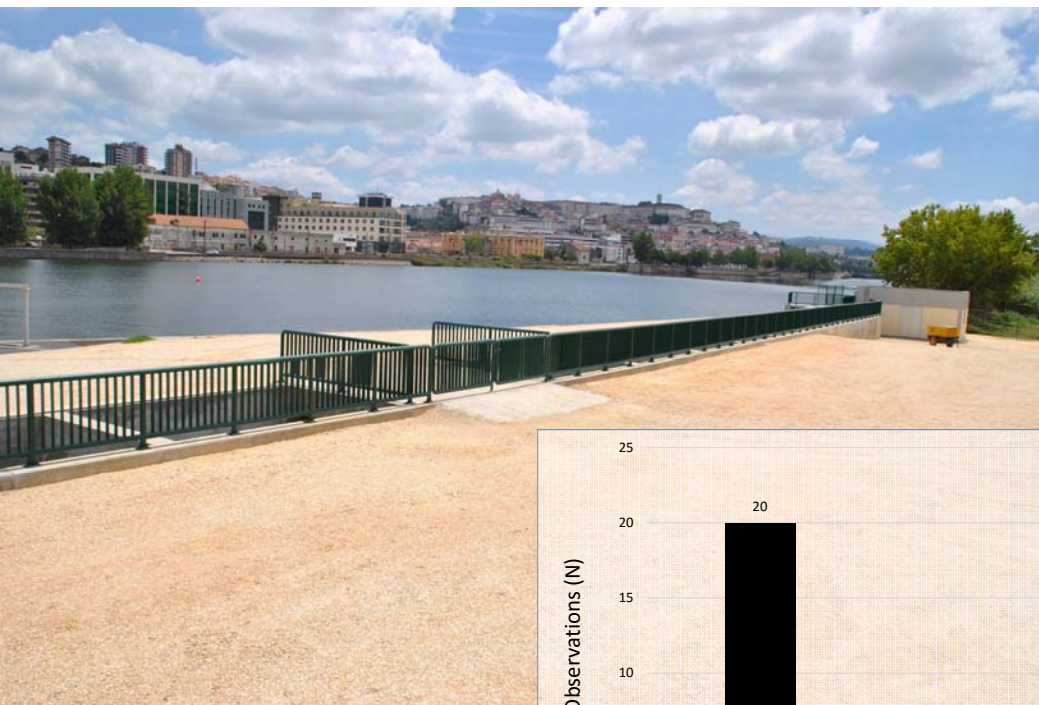
Negotiation of Coimbra Açude-Ponte dam fish pass



Negotiation of Palheiros fish ramp

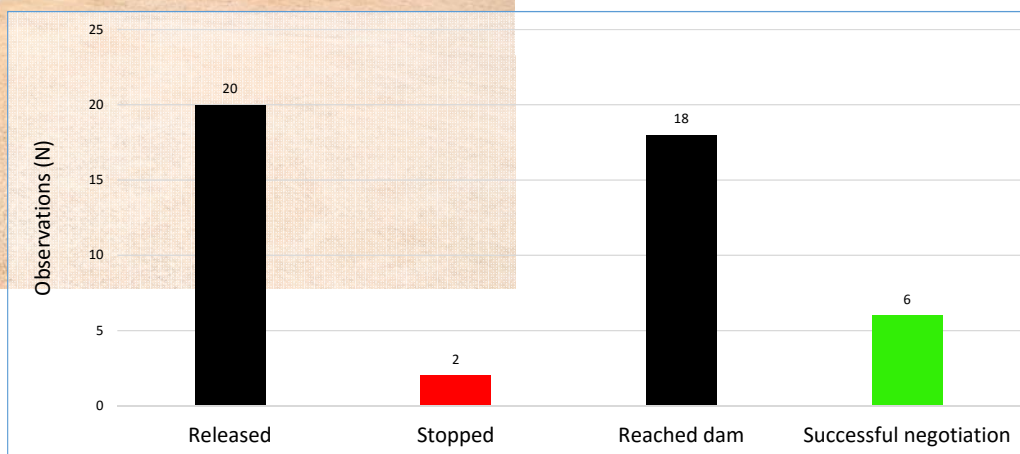


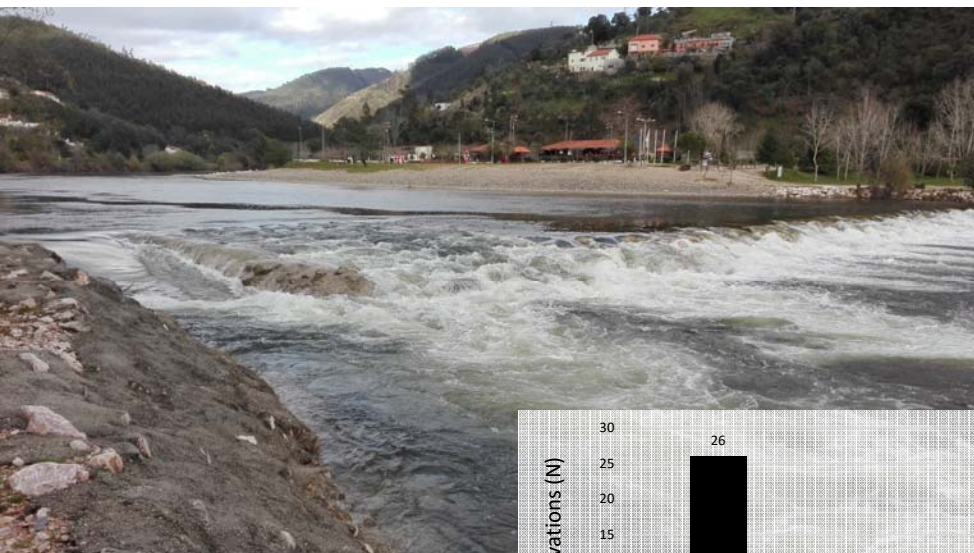




Radio telemetry results

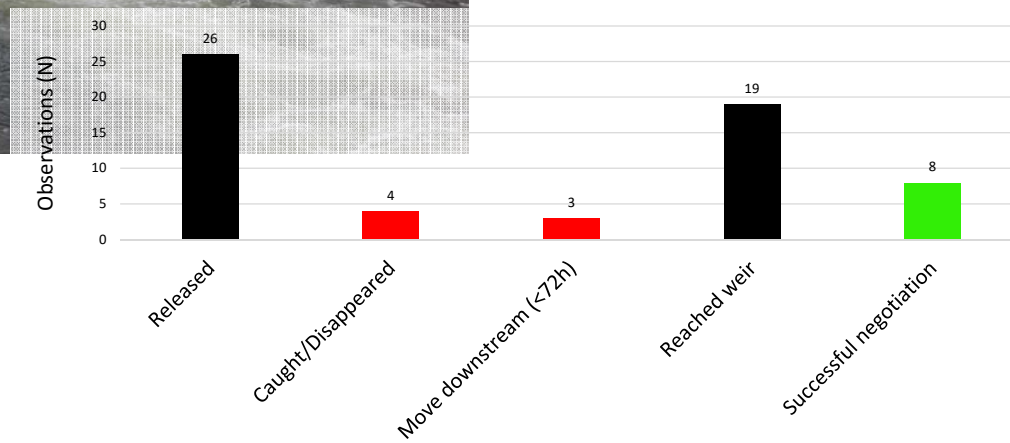
33% of the sea lampreys successfully negotiated the Coimbra Açude-Ponte dam (10 – 22 days)





Radio telemetry results

42% of the sea lampreys successfully negotiated Palheiros weir (24h – 26 days)



Some sea lampreys turned back after reaching the upstream end of the Palheiros weir fish pass.

It is the less demanding stretch of the fish pass;

This behaviour was also observed in the technical fish pass at Coimbra Açude-Ponte dam.





Final remarks

Sea lampreys present a much higher level of activity trying to negotiate the Coimbra Açude-Ponte dam (94%), comparatively to what happens in the Palheiros weir (47%);

The swimming effort during the negotiation of the nature-like fish pass (46%) is lower when compared to the negotiation of the technical fish pass (71%);

Sea lampreys successfully negotiated the technical fish pass (33%) and of the nature-like fish pass (42%);

Sea lamprey seemed to get suspicious when water velocity is reduced inside fish passes.

THANK YOU!

Acknowledgements:

