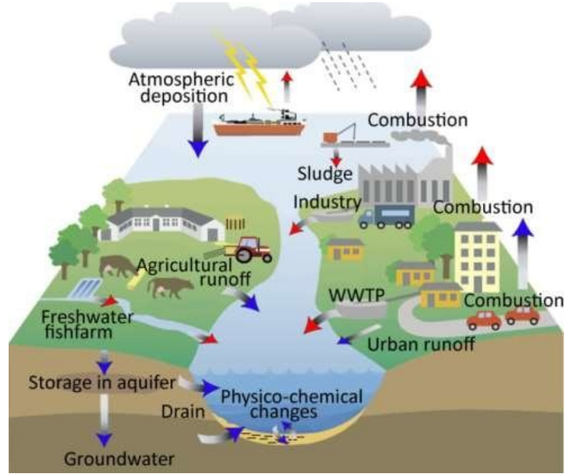
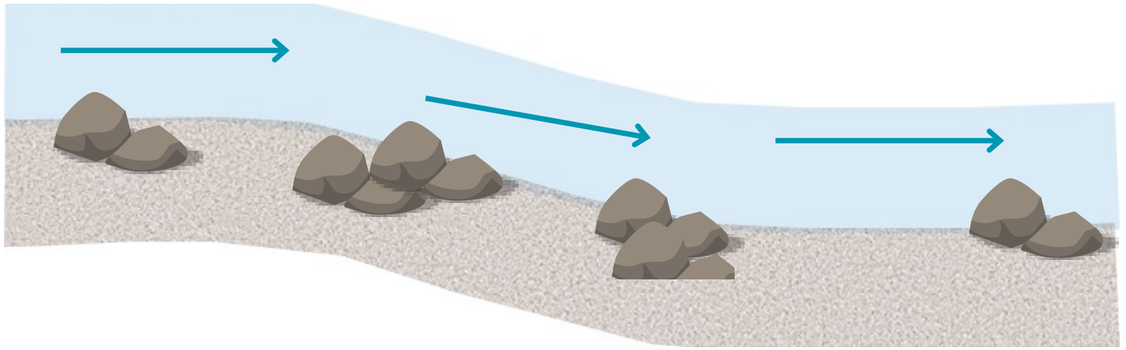
University of the Basque Country

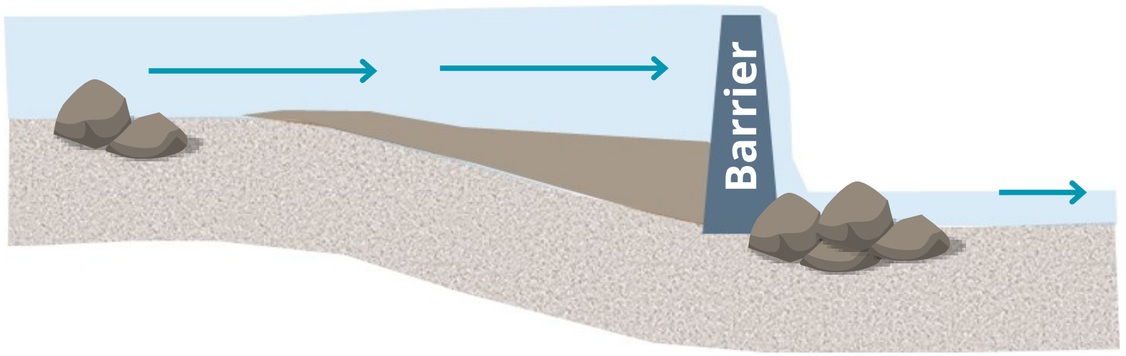
Green house gas emissions from dammed river basin — a case study at basin scale

Miriam Colls, Clara Schmidt, Maite Arroita, Alba Camacho, Fernanda Mejia, Biel Obrador, Daniel von Schiller, Arturo Elosegi

Introduction



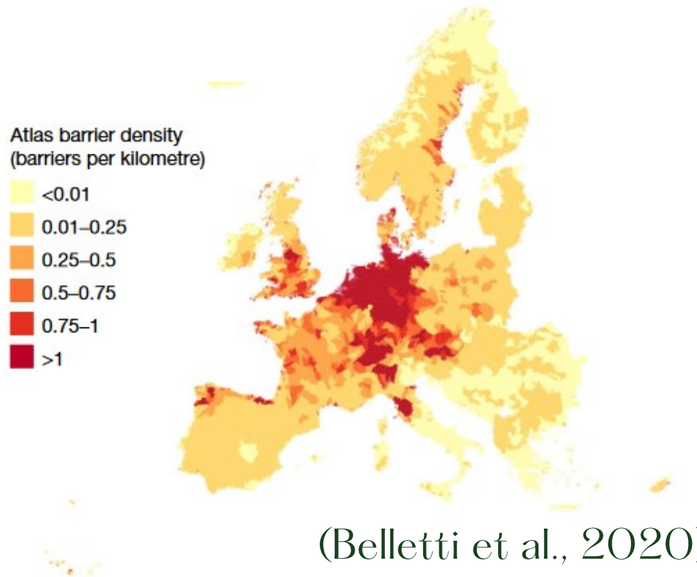




Introduction

Article

More than one million barriers fragment Europe's rivers



(Belletti et al., 2020)

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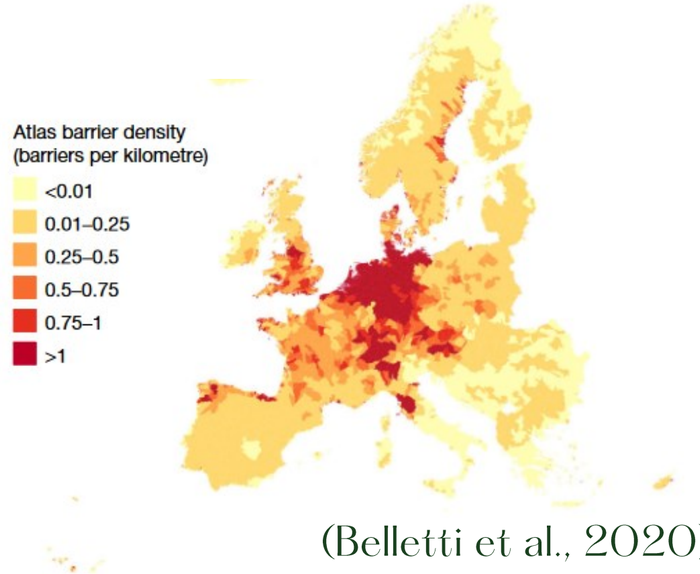
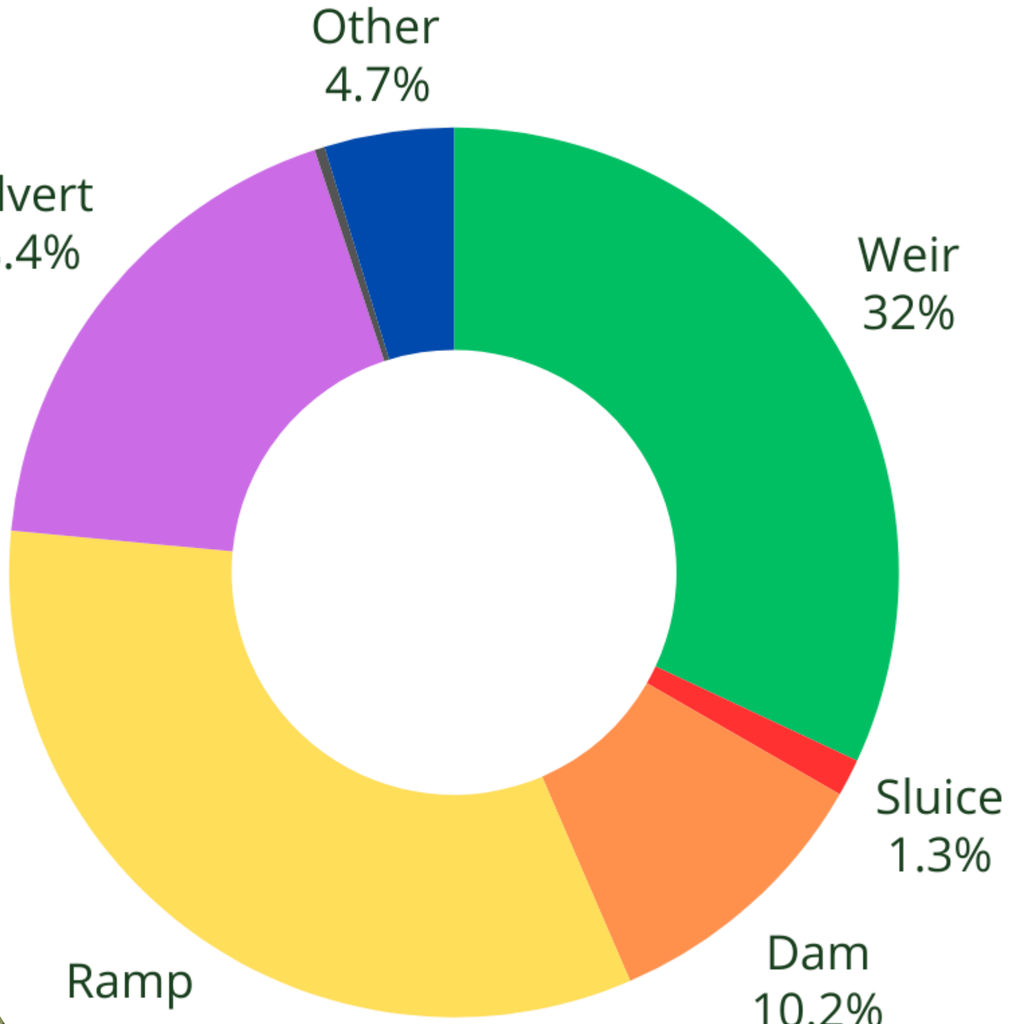


(Belletti et al., 2020)



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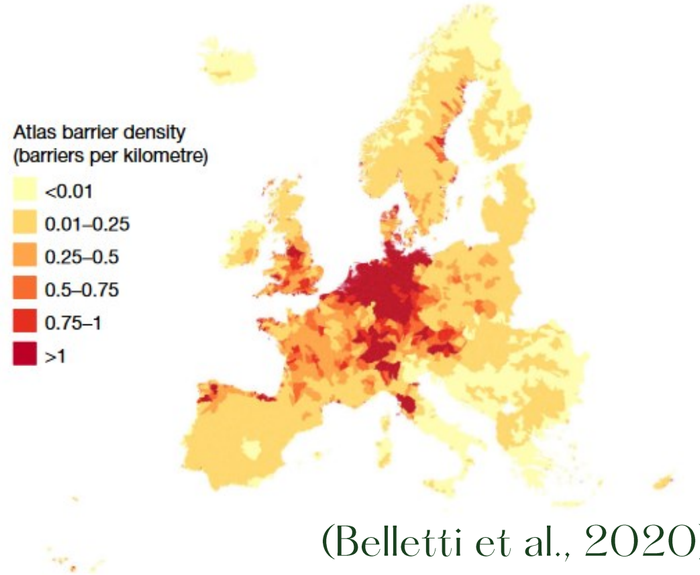

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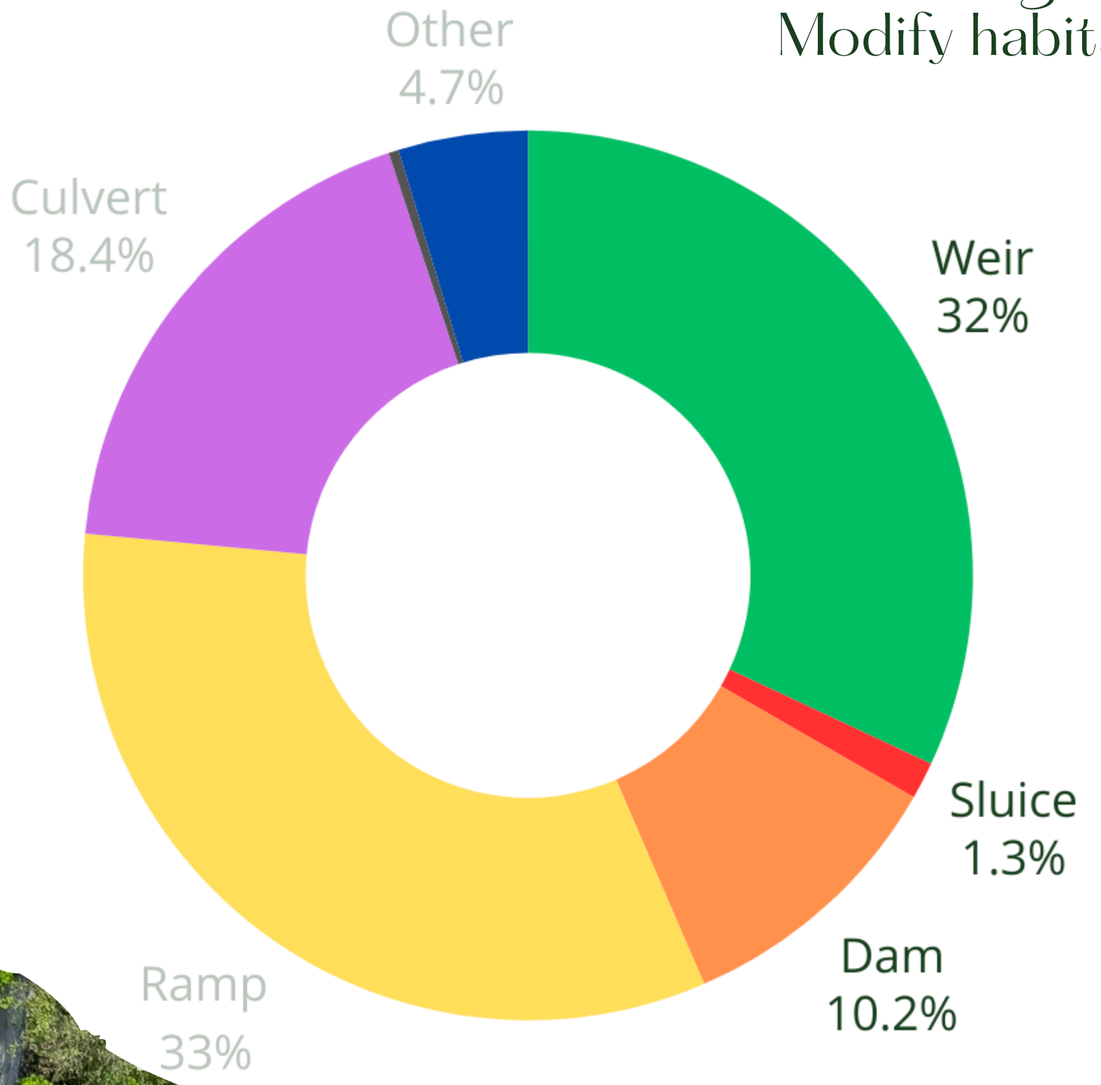
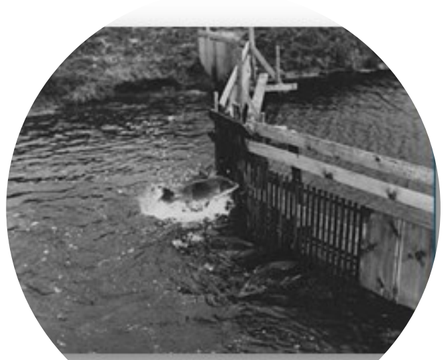
Ponding – Modify habitats



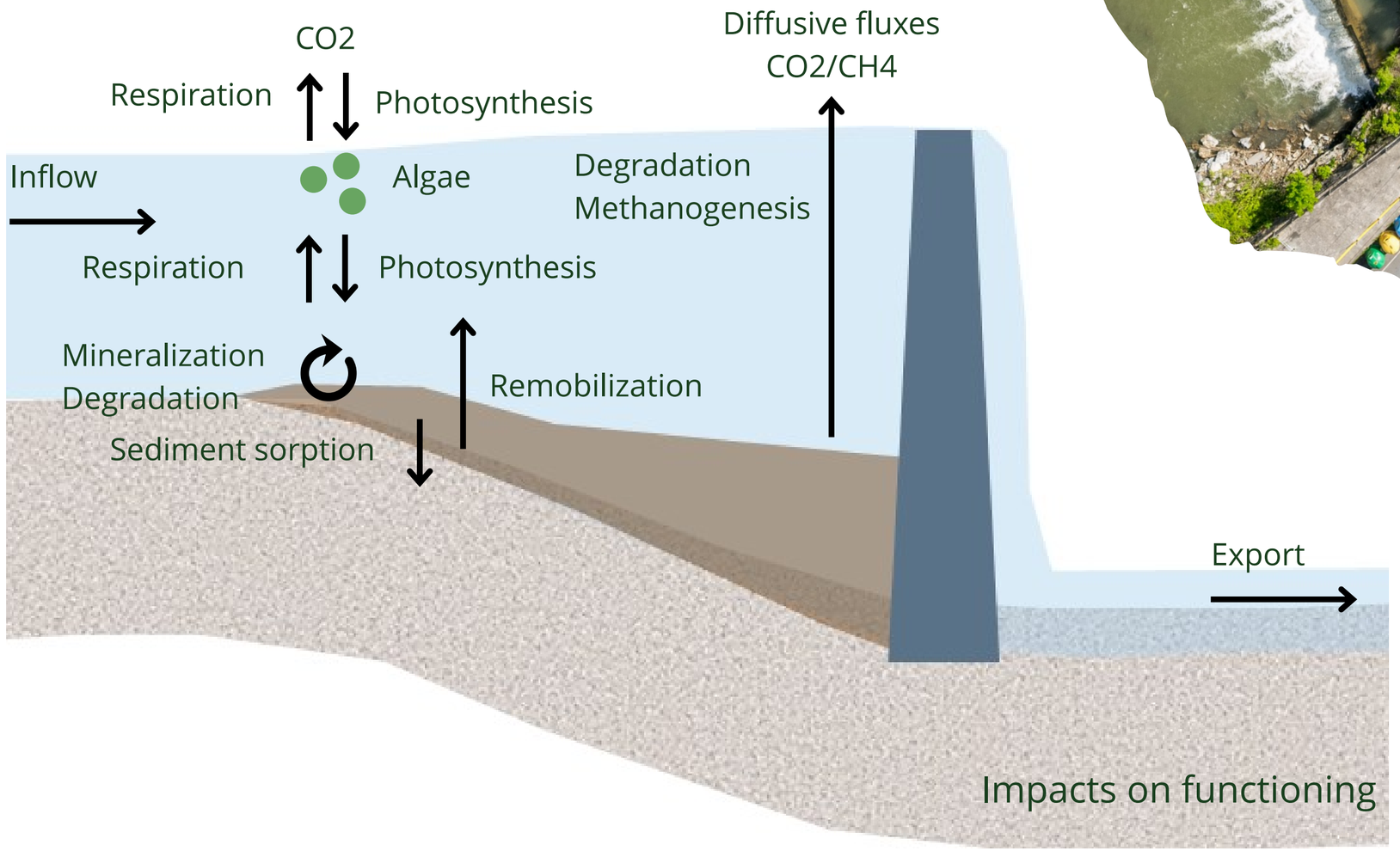
Introduction

Imapct of Ponding barriers

Sediment dynamic alteration



Impacts on fish migration



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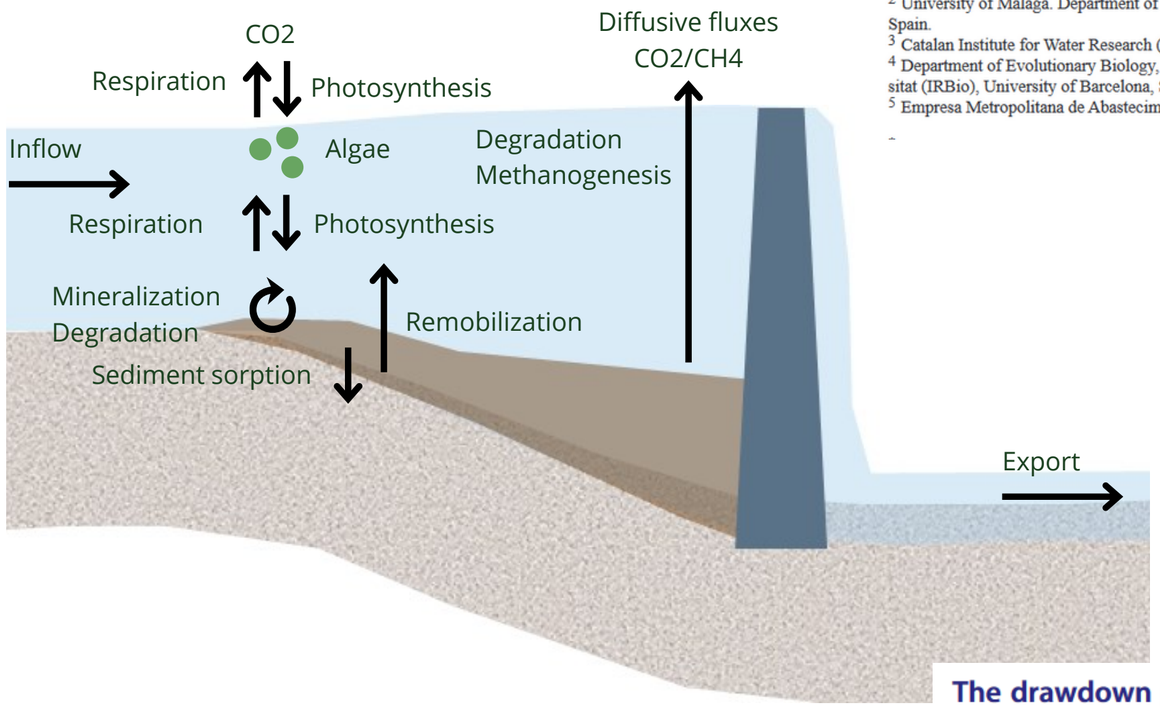
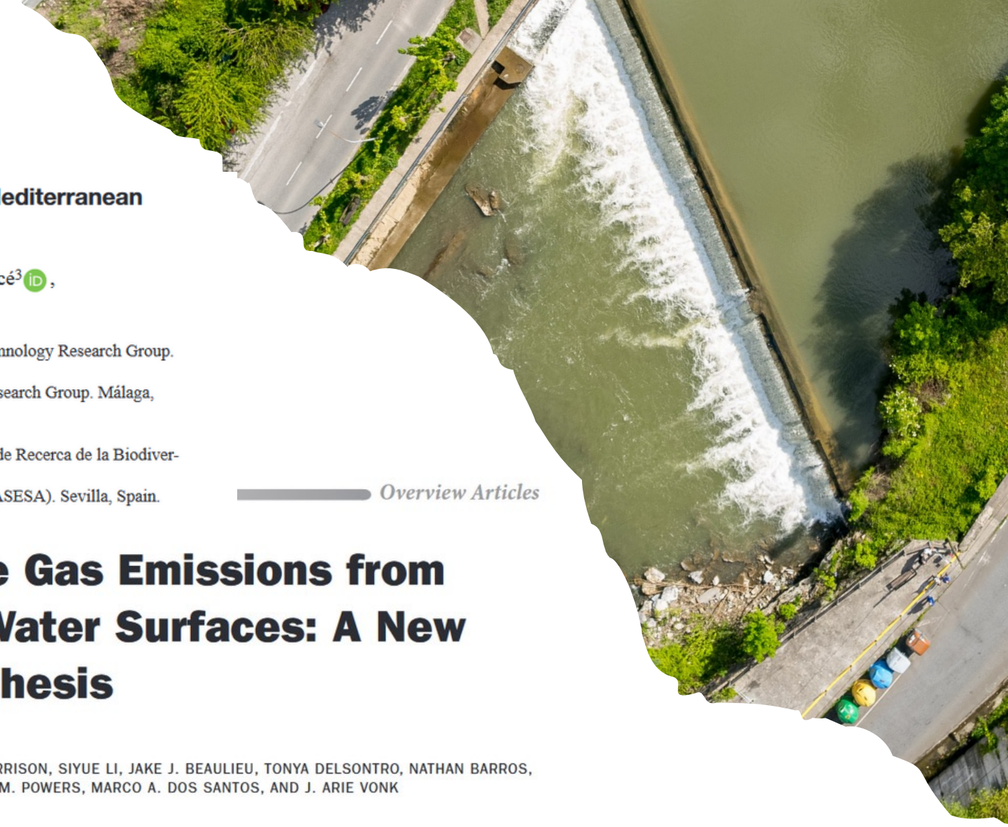
GHG emissions





Carbon dioxide emission from drawdown areas of a Mediterranean reservoir

L. J. Pozzo-Pirotta[1], J. J. Montes-Pérez[1], S. Sammartino[2], R. Marcé[3], B. Obrador[4], C. Escot[5], I. Reyes[5] and E. Moreno-Ostos[1,*]

[1] University of Málaga. Department of Ecology and Geology. Marine Ecology and Limnology Research Group. Málaga, Spain.
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Greenhouse Gas Emissions from Reservoir Water Surfaces: A New Global Synthesis

BRIDGET R. DEEMER, JOHN A. HARRISON, SIYUE LI, JAKE J. BEAULIEU, TONYA DELSONTRO, NATHAN BARROS, JOSÉ F. BEZERRA-NETO, STEPHEN M. POWERS, MARCO A. DOS SANTOS, AND J. ARIE VONK

Integrated assessment of the net carbon footprint of small hydropower plants

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The drawdown phase of dam decommissioning is a hot moment of gaseous carbon emissions from a temperate reservoir

Mabano Amani[a,b], Daniel von Schiller[a,c], Isabel Suárez,[a] Miren Atristain[d], Arturo Elosegi[d], Rafael Marcé[e,f], Gonzalo García-Baquero[g,h] and Biel Obrador[a,b]

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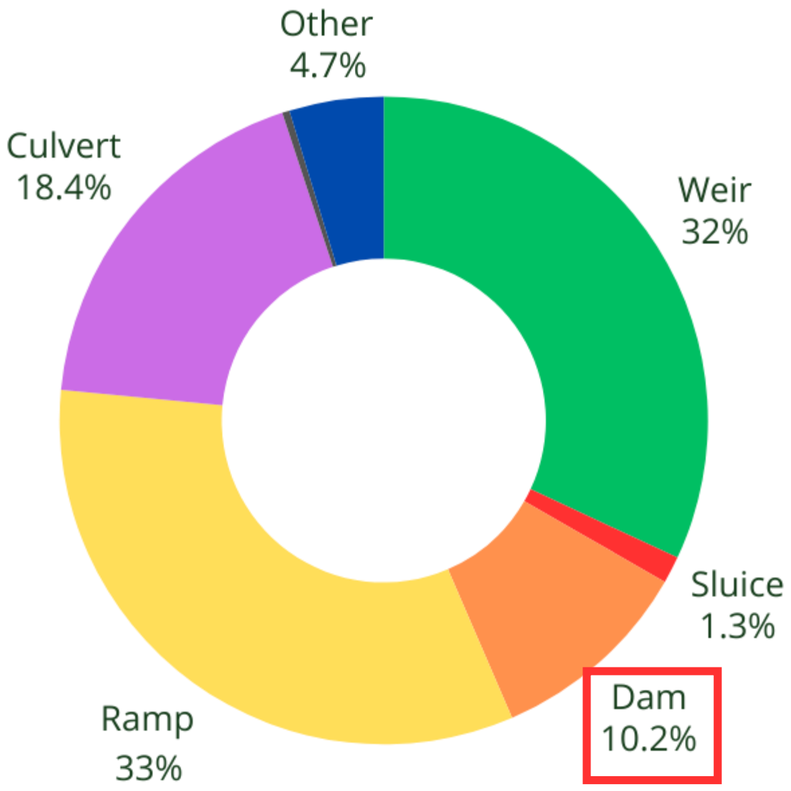
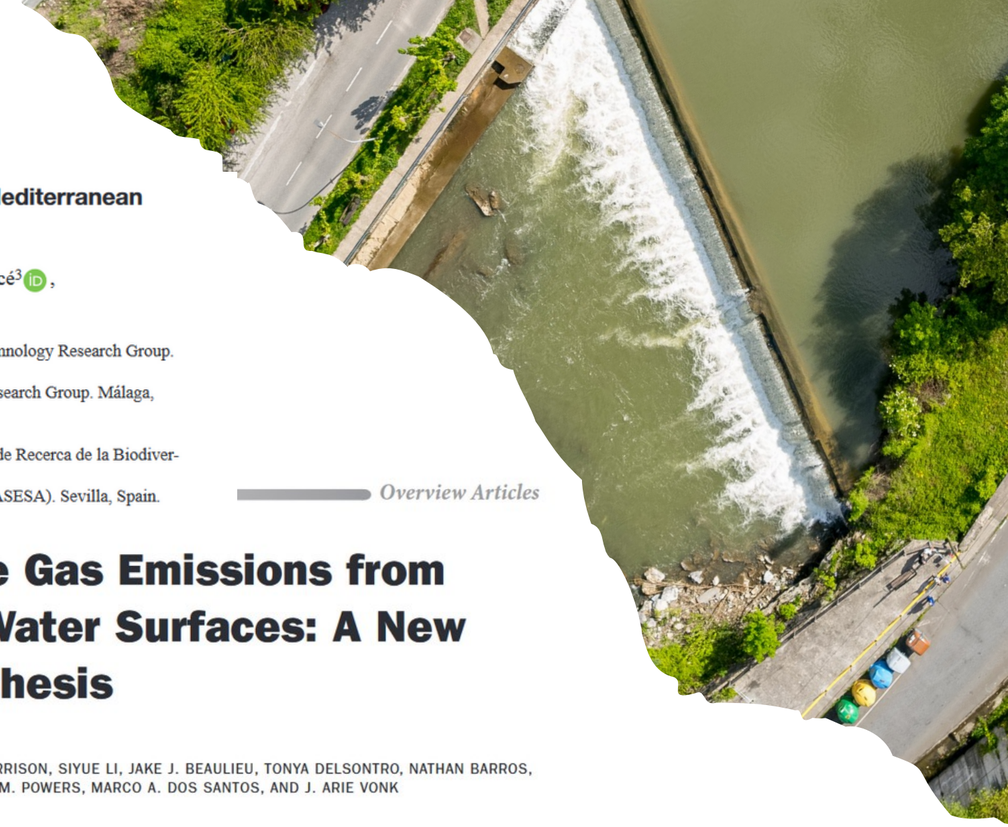
GHG emissions





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Overview Articles

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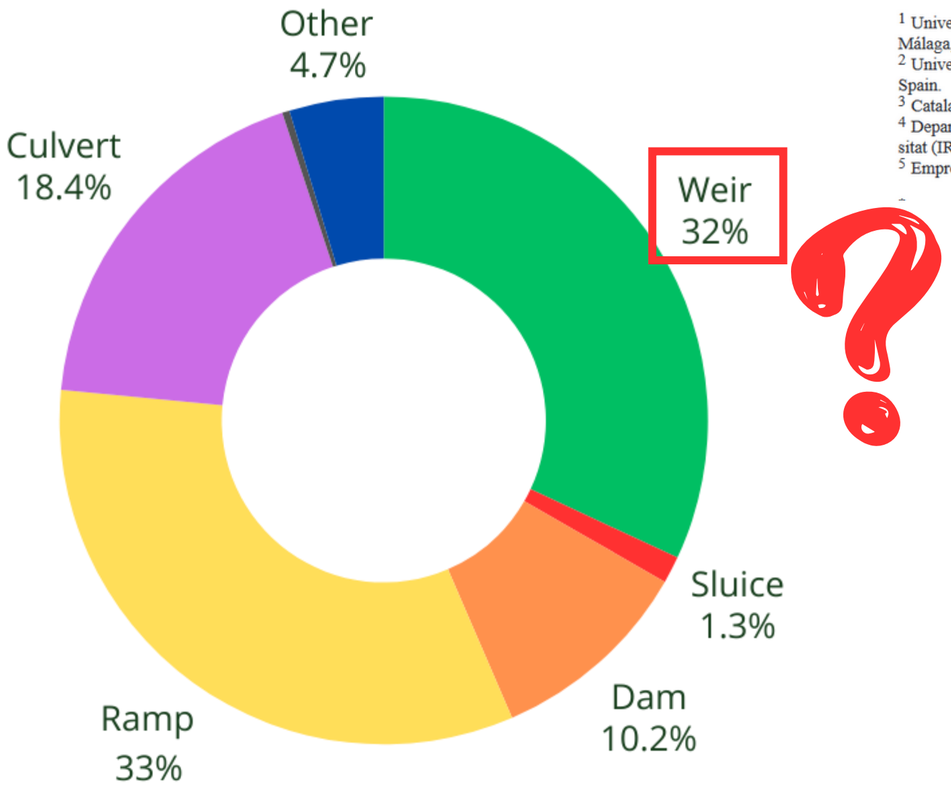

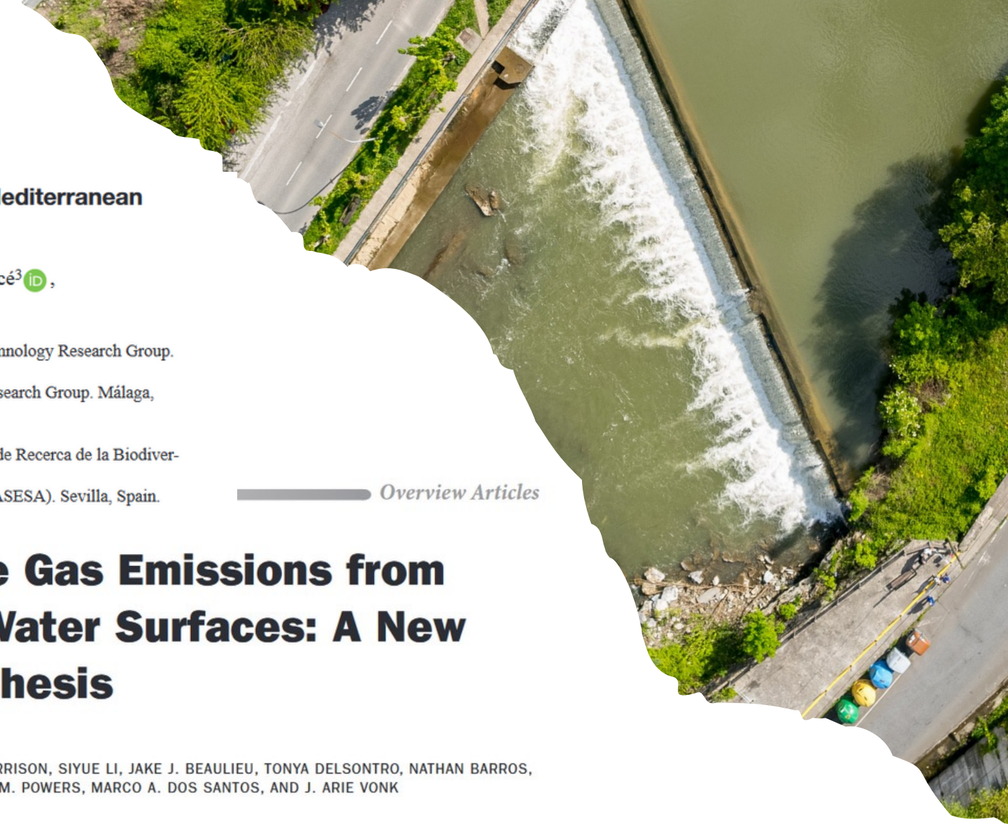

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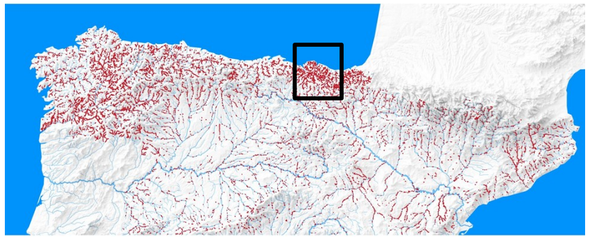
Objectives

- To estimate the impact of weirs on GHG production and emissions at catchment scale
- To identify the main differences in GHG production and emissions between dammed and undammed river sections

Hypothesis

- Despite their small size, weirs increase GHG emissions

Study area and data collection



Deba River basin

Study Area and data collection

- 25 weirs --> 10 weirs detailed sampling
  --> 6 weirs simple sampling

Study Area and data collection

- 25 weirs --> 10 weirs detailed sampling
  --> 6 weirs simple sampling

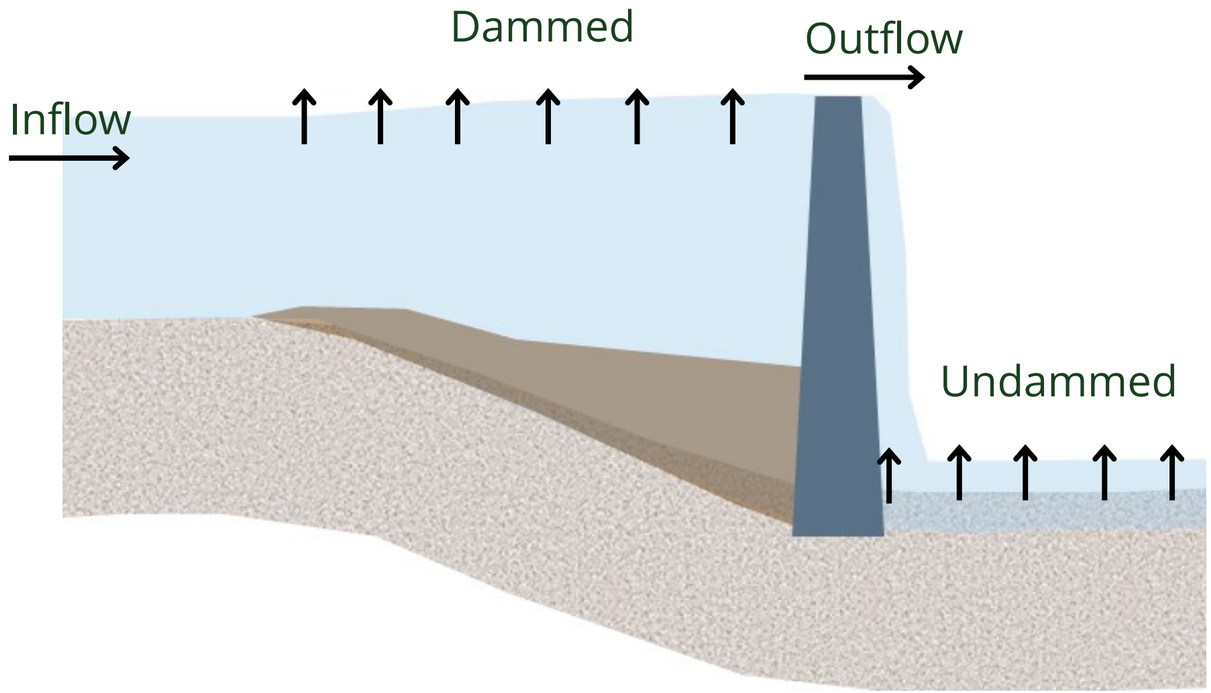
Selection criteria:

- weir size
- retention time
- basin position

River	Weir	Hight Weir (m)	Width Weir (m)	Length dammed scetion (m)	Surface area dammed section (m^2)	Volume dammed section (m^3)	Surface area catchment (km^2)	Q_m (m^3/s)	HRT_m (min)
Oñati	Garibai Errota	2.60	23.00	260.00	3,300.68	4,290.88	92.15	2.57	27.82
Oñati	Zubilaga	3.00	28.00	518.00	6,443.71	9,665.57	96.95	2.70	59.56
Oñati	Itavex	1.20	20.00	190.00	2,821.01	1,692.61	121.75	3.40	8.31
Deba	Barrena Errota	1.80	36.00	210.00	2,965.21	2,668.69	124.72	2.04	21.76
Deba	Bolubarri	2.50	43.00	706.00	16,277.59	20,346.99	325.49	7.56	44.89
Deba	Igarate	1.90	44.00	372.00	8,575.55	8,146.77	355.70	9.85	13.79
Deba	Laupago	4.10	58.00	392.00	9,300.57	19,066.17	424.26	9.88	32.15
Deba	Aitzetarte	5.00	56.00	259.00	5,421.31	13,553.28	424.60	9.86	22.92
Deba	Barrena Berri	3.50	37.00	235.00	6,625.30	11,594.28	429.16	9.96	19.40
Deba	Altzola	4.90	46.00	576.00	16,346.91	40,049.93	460.16	10.68	62.49

Study Area and data collection

- 25 weirs --> 10 weirs detailed sampling
  --> 6 weirs simple sampling



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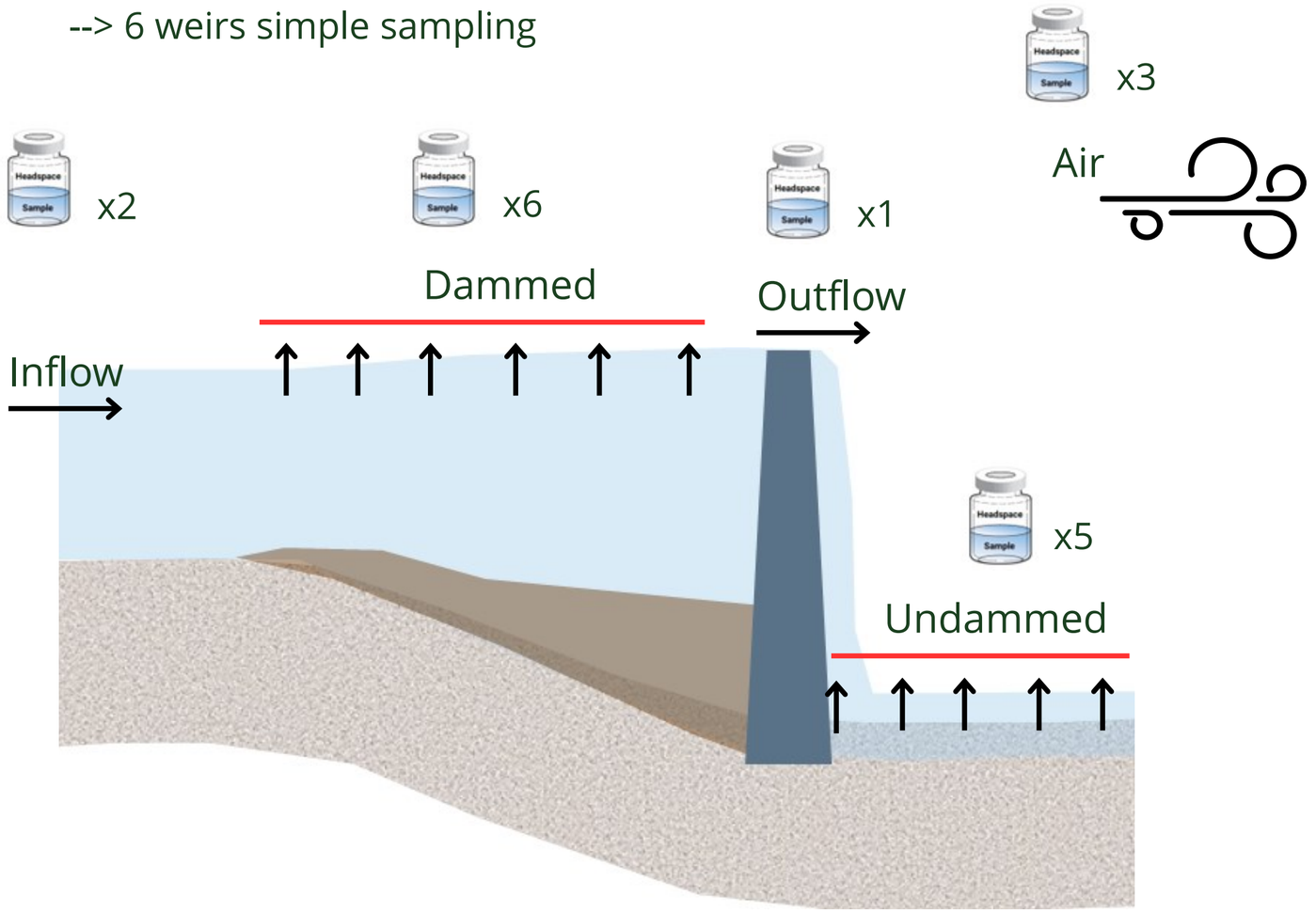

CO_2, CH_4, N_2O water concentration

Study Area and data collection

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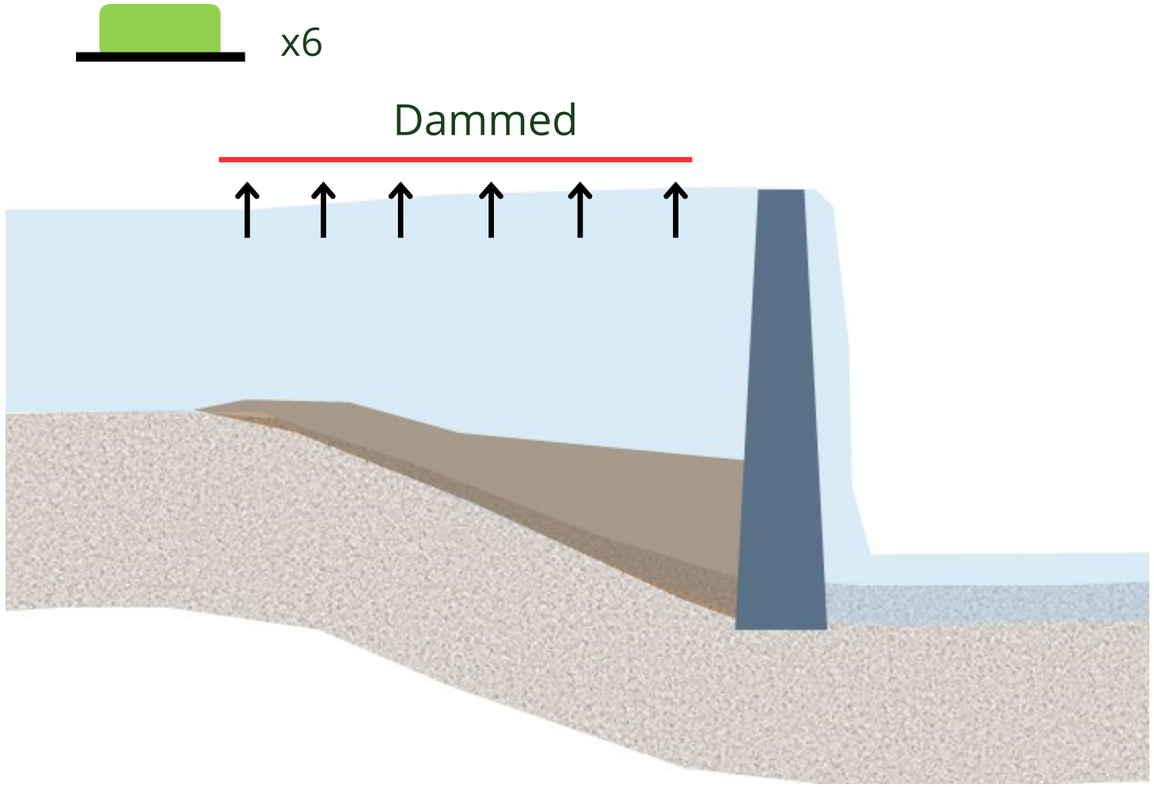
  --> 6 weirs simple sampling

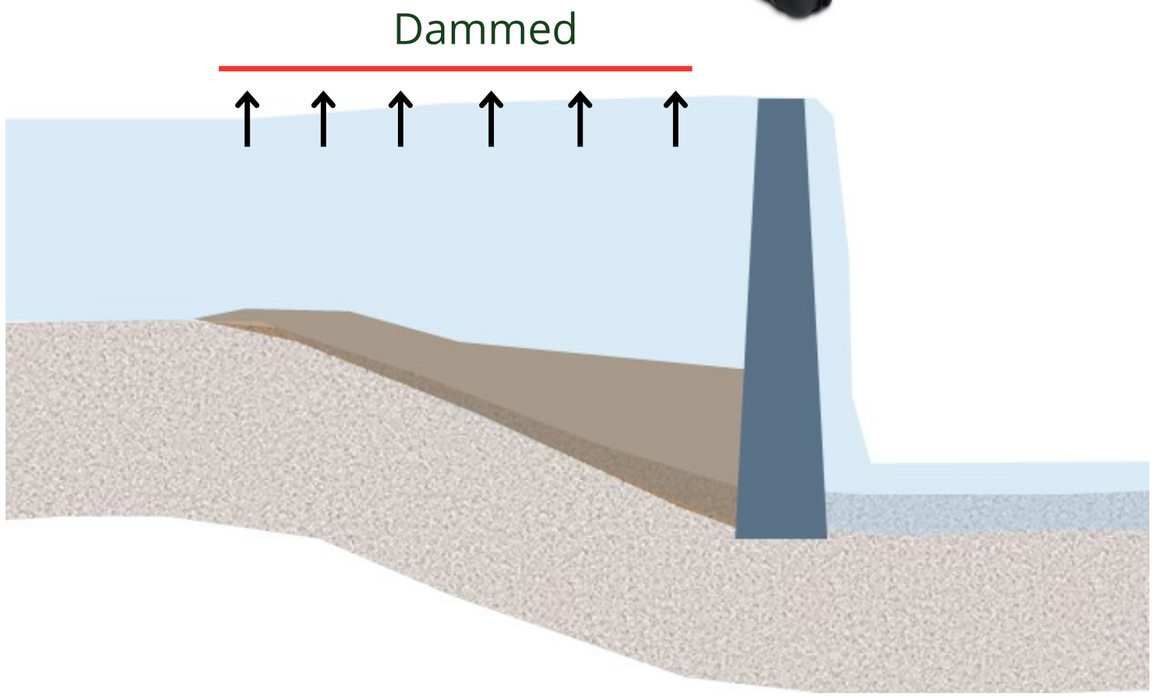


CO2, CH4, N2O Total Emissions

Study Area and data collection

- 25 weirs --> 10 weirs detailed sampling
  --> 6 weirs simple sampling

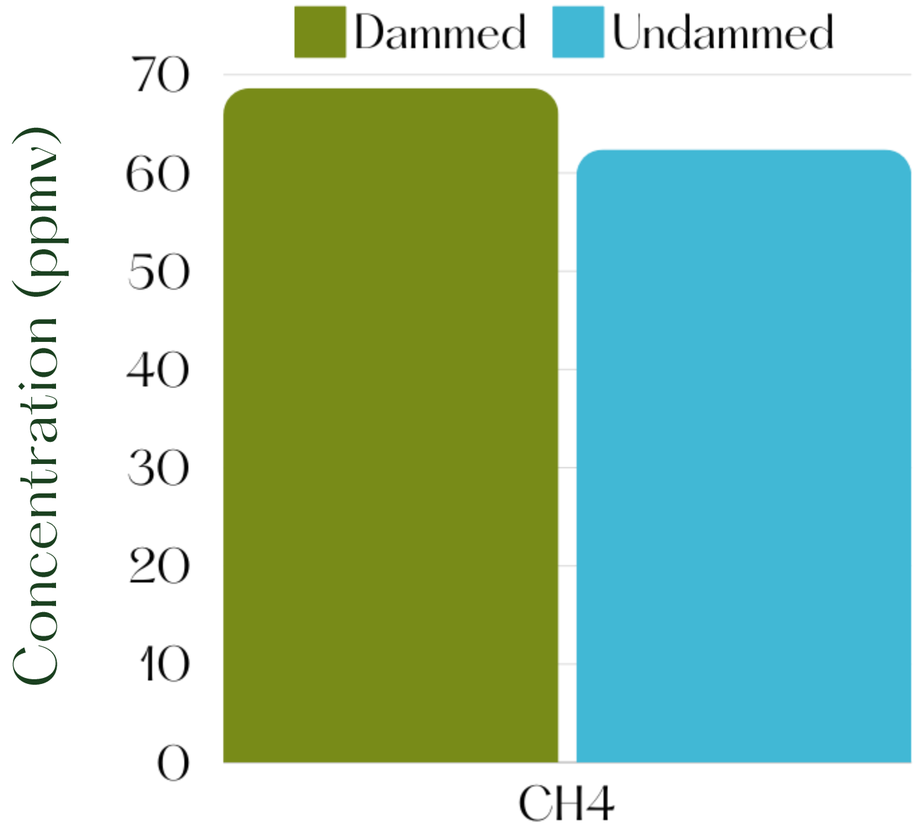
x6

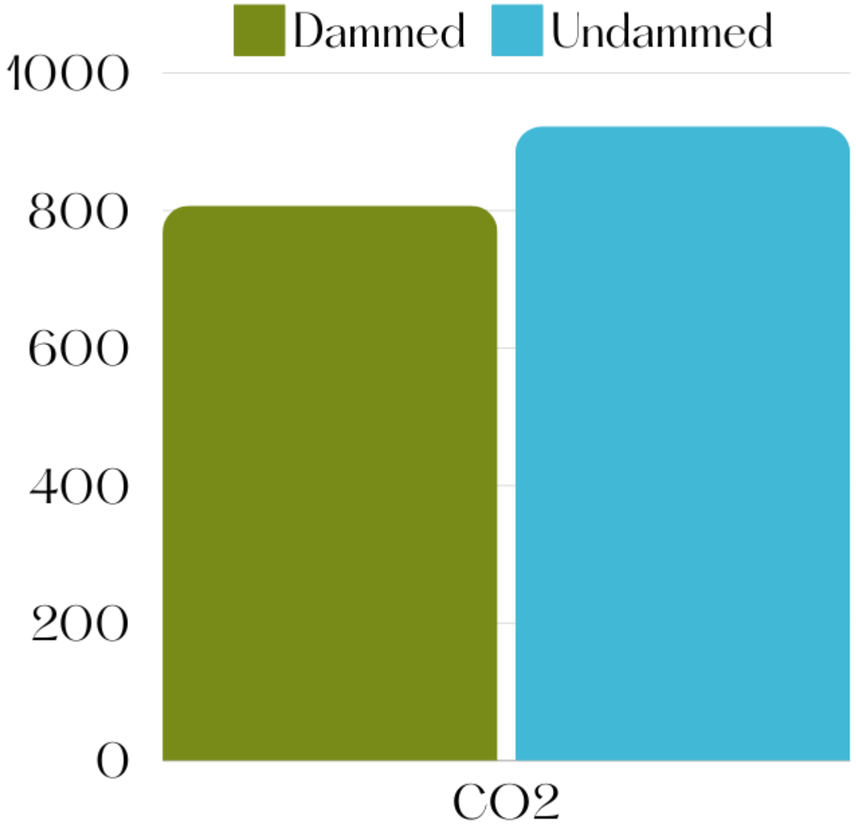


CO_2, CH_4, N_2O diffusive emissions

Results

Results


Dammed
Undammed
Concentration (ppmv)
70
60
50
40
30
20
10
0
CH4


Dammed
Undammed
1000
800
600
400
200
0
CO2

Results

Garibai Errota
(2.6m)
120
100
80
60
40
20
0
CH4 concentration (ppmv)
Dammed
area
Outflow
Just after the jump
Reference
concentration
0
80
81
101
121
141
Distance (m)

Results

Garibai Errota
(2.6m)
1400
1200
1000
800
600
400
200
0
CO2 concentration (ppmv)
Dammed area
Outflow
Just after the jump
Reference concentration
0
80
81
101
121
141
Distance (m)

Results

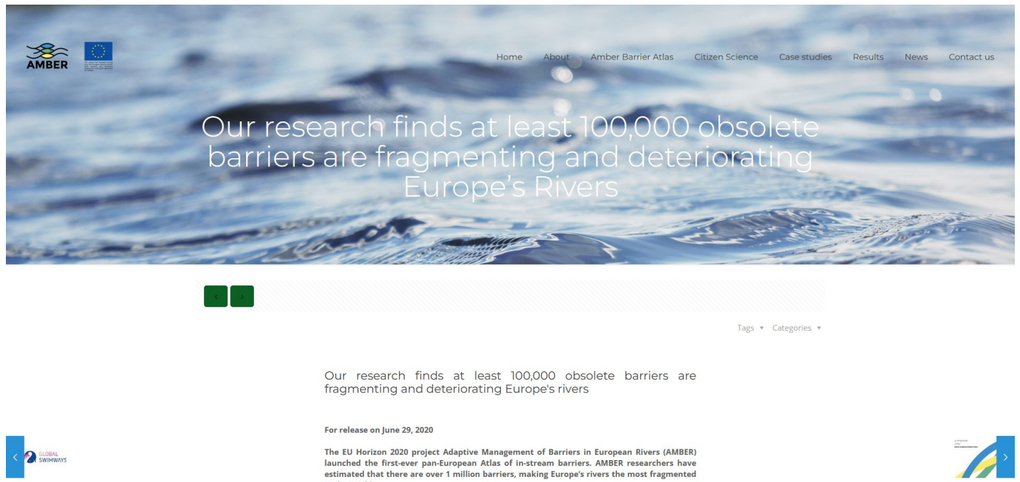
Laupago
(4.1m)
Aitzetarte
(5.0m)
Barrena Berri
(3.5m)
CH4 concentration (ppmv)
120
100
80
60
40
20
0
0
190
196
197
212
327
482
682
796
910
911
1181
1269
1356
1357
1372
1552
3732
7982
Distance (m)
Reference
concentration

Results

Laupago
(4.1m)
Aitzetarte
(5.0m)
Barrena Berri
(3.5m)
2500
2000
1500
1000
500
0
CO2 concentration (ppmv)
Reference
concentration
0
190
196
197
212
327
482
682
796
910
911
1181
1269
1356
1357
1372
1552
3732
Distance (m)

Take home message

- Independently of their size and retention time, weirs have and impact on GHG emissions from fluvial ecosystems.
- Nevertheless, obtained results suggest no-accumulative effect of systems of weirs.



Obsolete weirs removal can contribute to the reduction of green house gas emissions

University of the
Basque Country

Thanks

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MERLiN