

Reviving Douro Basin

Task 4.1.5. Identification of barriers suited for re-adaptation, e-flows definition and removal, based on 3.1.4

Manuel Lopes Lima
Project Coordinator

SUMMARY

Based on other studies of the current project, of the almost 5,000 identified barriers on the Douro River Basin, more than 1,000 were detected in Portugal. Many of these barriers, mainly the large dams, have substantial negative impacts on the local habitat quality, such as siltation, eutrophication of reservoirs and sudden changes of hydrological regimes. Middle and smaller size barriers, like small dams and weirs, have shown to have smaller impacts on the biodiversity at the local scale. However, many of these barriers may have a considerable impact at a wider scale by avoiding the passage of pelagic taxa such as fish and other swimming organisms and therefore fragmenting and isolating their populations. The construction of physical barriers in the Douro Basin has started many centuries ago mainly for hydropower to watermills, irrigation, fishing, and recreation activities. However, with technological changes on flour production, changes on the agriculture practices and demographic desertification of the interior regions in Portugal, many of these structures are now abandoned and useless. More recently, the main aim of constructed barriers shifted for hydropower for electricity consumption and for water supplies to urban and agriculture areas. Again, some of these hydropower dams have a limited lifespan and some have now becoming obsolete or losing economical value.

The current report selected 20 of these barriers in Portugal to undergo broadened socio-economic and ecological studies to evaluate the potential mitigation of their impacts or even their complete removal. These barriers were selected based on the other reports provided by the present project, i.e. the multi-criteria scores for barrier removal prioritization, the fish connectivity indexes, the local biodiversity impacts, the biodiversity distribution and hotspots and the knowledge already available and gathered by the Researchers of this project in more than 300 visited sites across the Douro Basin.



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

AIM OF THE TASK

The study was delineated to select obsolete or low functional value barriers for a more detailed socio-economic and ecological study for potential mitigation or removal.

TEAM

The assessments were made by a multi-disciplinary team composed by:

- Manuel Lopes Lima (CIBIO/InBio, University of Porto, Portugal)
- Amílcar Teixeira (CIMO-ESA, Polytechnic Institute of Bragança, Portugal)
- Ronaldo Sousa (CBMA, University of Minho, Portugal)
- Simone Varandas (CITAB-University of Trás-os-Montes e Alto Douro, Portugal)

Background

River fragmentation due to dams, weirs, and other anthropogenic barriers is one of the main threats to Iberian river habitats ecosystems. From the work of Tasks 3.1.4 and 3.2.1. we have identified the important areas for freshwater diversity within the basin and the main ecological impacts of barriers in four case-study basins, i.e. Tâmega, Tua, Sabor and Paiva, where biodiversity is high and had under-construction or planned new dams. Other teams relied on remote sensing and other available data to identify all the barriers in the Portuguese side of the basin, to estimate the permeability of these barriers to fish passage and develop a multi-criteria decision support system for dam removal/mitigation in Douro River Basin in Portugal. The enormous amount of data gathered and the numerous visits to more than 300 site in the Douro basin on the course of this project, allowed us to have a comprehensive view about the biodiversity and status of many sub-basins of the Douro. Using the above-mentioned knowledge, the main aim of the current study was and validate this knowledge in the field to identify and characterize barriers that are both of low or none functional value and have obvious negative impacts to biodiversity.

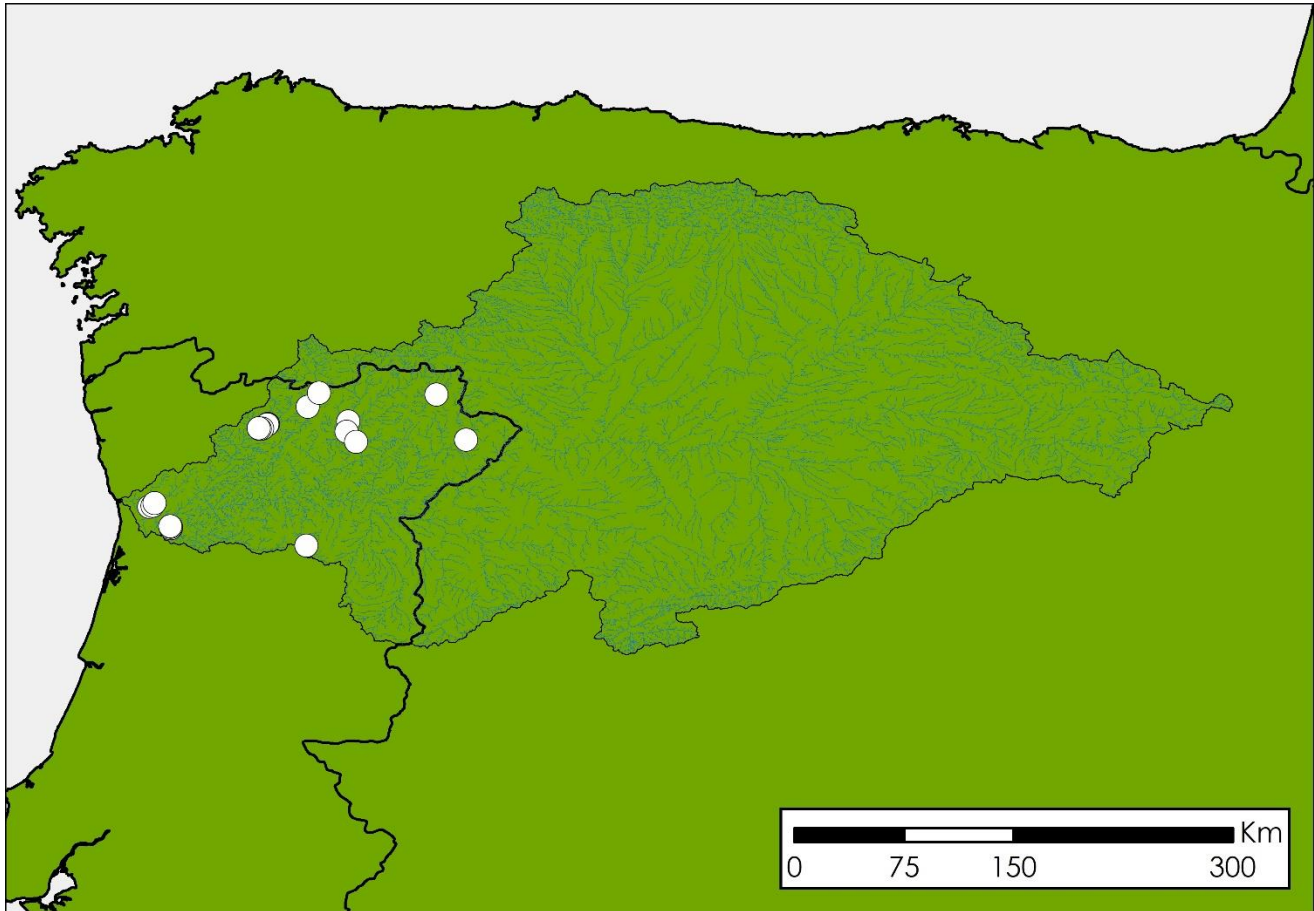


Figure 1. Map of the 20 selected physical barriers in the Douro River Basin to undergo broadened socio-economic and ecological studies to evaluate the potential mitigation of their impacts or potential removal

METHODOLOGIES

All the barriers identified by the UTAD team and validated in the field for barrier removal prioritization, were analysed. Given that the scores and indexes estimated on a wider scale relied mainly on remote sensing, the barriers for removal were only selected among those that were validated in the field or by acquiring local knowledge. For this, each previously identified barrier was then evaluated, either with previous knowledge from the research team or consulting with regional partners or visiting and characterizing the barrier on site, for their level of functionality, conservation status, fish fragmentation index and eventual mitigation measures and their status. Additional information regarding the biodiversity occurring in the area helped to select the 20 barriers that, confirmed their poor-functional and high negative impact value after validation.



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

Fieldwork

The fieldwork was accomplished during 2019-2020.

Surveys

From all barriers identified by remote sensing in the Douro River basin in Portugal, 220 were validated in the field, for a closer inspection of the conservation status of the barrier, their permeability, and the potential historical and present functionality. The occurrence of potential mechanisms for fish passage were also analysed. Barriers that showed a low level of fragmentation due to the deteriorated condition of the barriers or presence of water bypasses in good condition and/or by apparent strong functional value were discarded from the selection.

RESULTS

Selection

We selected 20 physical barriers in nine distinct basins by their good preservation status, level of functionality, low permeability to fish and location in critical areas of biodiversity.

Table 1. Barriers selected to undergo a detailed study about their potential removal or mitigation.

Name	ID	Latitude	Longitude	Basin
Valpaços Camping Park Dam	260	41.629809	-7.248003	Rabaçal, Tua
Miradeses Fluvial Beach Weir	299	41.567335	-7.258986	Rabaçal, Tua
Mirandela Camping Park Dam	230	41.504592	-7.196798	Tua
Vila Verde de Raia Weir	423	41.805669	-7.428120	Tâmega
Vale da Anta Weir	461	41.718969	-7.497725	Tâmega
Canedo Weir	428	41.615883	-7.741173	Beça, Tâmega
Unnamed Beça Weir 1	1320	41.613907	-7.741948	Beça, Tâmega
Unnamed Beça Weir 2	1319	41.609908	-7.745137	Beça, Tâmega
Unnamed Beça Weir 3	416	41.586048	-7.776925	Beça, Tâmega
Unnamed Beça Weir 4	1315	41.584479	-7.791846	Beça, Tâmega
Bragadas Weir	1314	41.587023	-7.798404	Beça, Tâmega
Gimonde weir	1154	41.794848	-6.704200	Sabor
Vila Chã weir	1415	41.517597	-6.521466	Angueira, Sabor
Unnamed Arda Weir 1	1516	40.972436	-8.338381	Arda
Unnamed Arda Weir 2	570	40.981038	-8.337708	Arda
Balaído Dam	572	40.983979	-8.341767	Arda
Unnamed Dam	558	40.864698	-7.505039	Távora
Conchadas Weir	495	41.104439	-8.472120	Sousa
Serra Weir	498	41.110963	-8.451025	Sousa
Aguiar do Sousa Weir	1198	41.127706	-8.438358	Sousa

Tua River Basin

From the River Tua basin we selected the most impacting barriers in the lower section of the Rabaçal River and, after merging with Tuela, the upper section of Tua river. The river Rabaçal and especially the lower sections are extraordinarily rich in threatened species of fish and mussels and is one of the most important strongholds of these species. The area has few threats, but population and habitat fragmentation are among the most important.

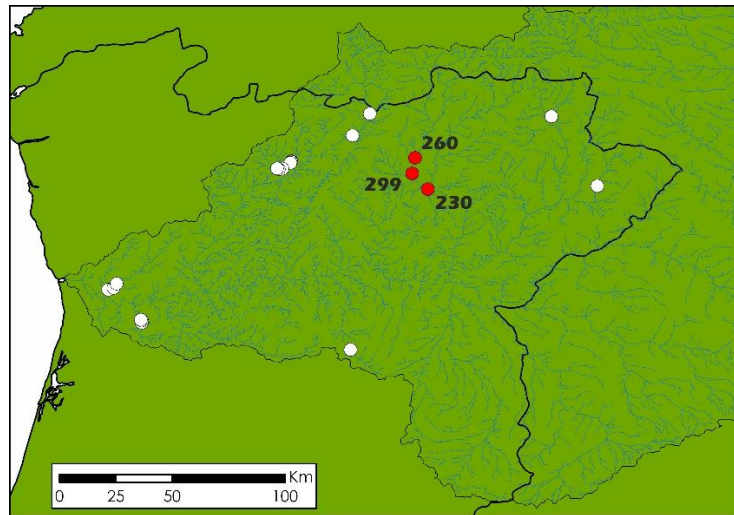


Figure 2. Red dots: Location of the selected barriers on the Tua River basin.
Numbers refer to the ID (code) of each barrier.

1. Valpaços Camping Park Dam

Barrier ID: 260

GPS coordinates (WGS84: 41.6298087, -7.248003)

Closest location: Valpaços, Vila Real

Typology: Middle size dam

Description: Middle size dam with recreational utility of the reservoir for a fluvial beach. Highly impermeable to fish, it has two ramps that are too steep for efficient fish transposition.

Rational: This barrier was chosen due to the high fragmentation level and the high importance of the area for biodiversity. The barrier is located on the middle of important endemic threatened fish species such as the Iberian nase *Pseudochondrostoma duriense* and the Calandino *Squalius alburnoides*, and highly threatened mussels, such as *Potomida littoralis* and *Margaritifera margaritifera*. The Tua River populations of these and other species already suffered from the huge impact of Tua dam and are now locked in the upstream area of the basin.

Suggested Action: Given the presence of the Camping Park by the reservoir that is used as a river beach, the complete removal of this barrier should be difficult due to the high socio-economic



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

impacts it might have. Therefore, we suggest mitigation by the construction of a bypass channel on the right riverbank.



Figures 3. Valpaços Camping Park reservoir and dam



Rede
Douro
Vivo



CIBIO



Centro de
Investigação
de Montanha



CBMA
Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

2. Miradeses Fluvial Beach Weir

Barrier ID: 299

GPS coordinates (WGS84: 41.567335, -7.258986)

Closest location: Miradeses, Vila Real

Typology: Concrete weir

Description: Large weir built for recreational utility of the area downstream and for irrigation of small agriculture areas upstream. Highly impermeable to fish, no fish passage.

Rational: This barrier was selected due to its high fragmentation level and the high importance of the area for biodiversity (the same as in barrier 260).

Suggested Action: Given the low impact on the agriculture practices and the recreation area we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is impossible, an efficient fish passage or ideal a lateral bypass should be implemented.



Figure 4. Miradeses Fluvial Beach Weir



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

3. **Mirandela Camping Park Dam**

Barrier ID: 230

GPS coordinates (WGS84: 41.504592, -7.196798)

Closest location: Mirandela, Vila Real

Typology: Middle size dam

Description: Middle size dam with recreational utility of the reservoir for a fluvial beach. Highly impermeable to fish. No fish passage is present.

Rational: This barrier was chosen due to the high fragmentation level and the high importance of the area for biodiversity (the same as in barrier 260).

Suggested Action: Given the presence of the Camping Park by the reservoir that is used as a river beach, the complete removal of this barrier might be difficult due to the high socio-economic impacts it might have. However, due to the high biodiversity importance of this barrier linking the main Tua River and the upstream confluence of two important Rivers (Rabaçal and Tuela), we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders, especially the camping park. If removal is impossible, an efficient fish passage or ideally a lateral bypass should be implemented.

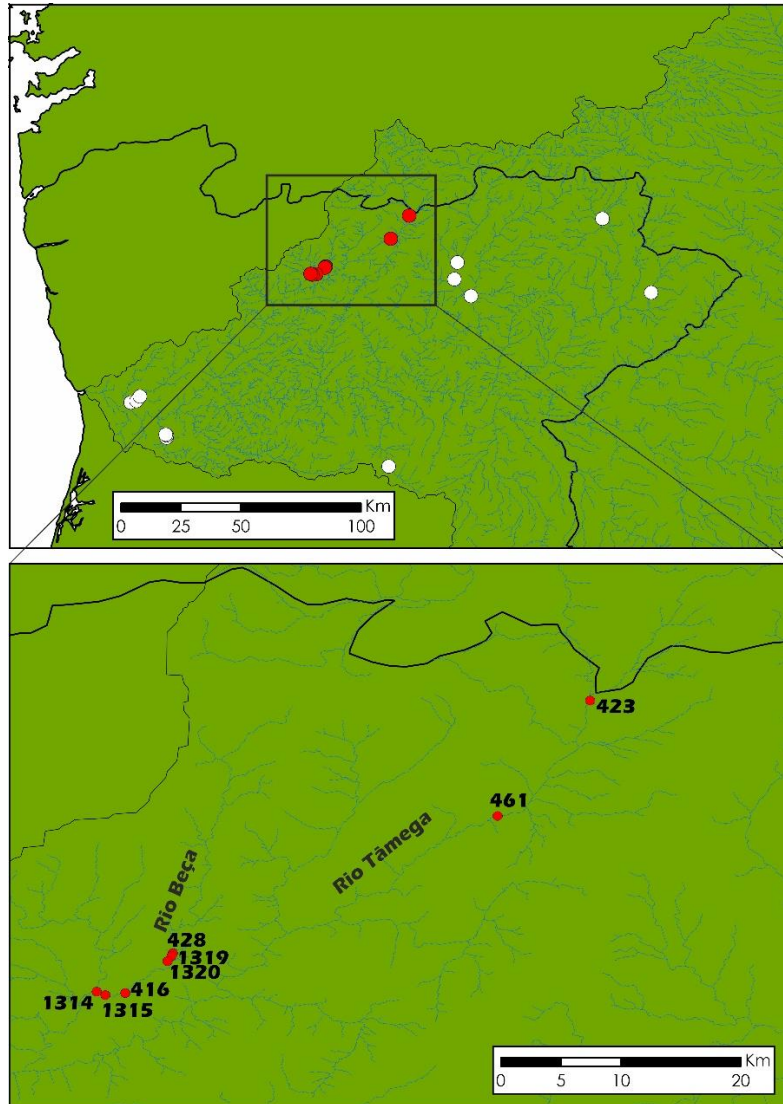




Figures 5. Mirandela Camping Park Dam

Tâmega River Basin

From the River Tâmega basin we selected the most impacting barriers in two sections: first two large barriers on the upper section of the main Tâmega channel, and six large weirs in the Beça rivers. The upper Tâmega channel in Portugal is free of large dams but is highly impacted with these two middle size barriers that fragment and emphasize the disruption of the normal hydrological condition, seasonally. River Beça is possibly the best in terms of ecological condition in the Tâmega basin being extremely rich in threatened species of fish and mussels. It holds the only viable population of the highly imperilled *Margaritifera margaritifera*. The river is in a low human population density and has few threats, but population and habitat fragmentation are among the most important. Unfortunately, the river is locked between two hydropower medium-size dams, one preventing the connection to the main Tâmega channel and the other limiting the dispersion of fish to the upper sections of the river. In between these dams, six large, mostly obsolete, weirs block and compartmentalize most of the river.



Figures 6. Red dots: Location of the selected barriers on the Tâmega River basin.
Numbers refer to the ID (code) of each barrier.

Tâmega River

4. Vila Verde de Raia Weir

Barrier ID: 423

GPS coordinates (WGS84: 41.805669, -7.42812)

Closest location: Vila Verde de Raia, Vila Real

Typology: Large concrete weir

Description: Large concrete weir with recreational utility in the section downstream, but mainly used for irrigation on the upstream section. Highly impermeable to fish, no fish passage.

Rational: This barrier was chosen due to the high fragmentation level it provides in the upper section of Tâmega channel. The barrier is located on the middle of important endemic threatened fish



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

species such as the Iberian nase *Pseudochondrostoma duriense* and the Calandino *Squalius alburnoides*, and important freshwater mussel populations, such as *Unio delphinus* and *Anodonta anatina*. The Tâmega River populations of these and other species already suffered from the huge impact of the many large dams in this river and are now locked in the upstream area of the basin.

Suggested Action: Given the strong presence of agriculture areas by the reservoir and its use as a recreation area, the complete removal of this barrier should be difficult due to the high socio-economic impacts it might have. Therefore, we suggest mitigation by the construction of a bypass channel for fish and other pelagic species transposition.



Figure 7. Vila Verde de Raia weir

5. Vale da Anta Weir

Barrier ID: 461

GPS coordinates (WGS84: 41.718969, -7.497725)

Closest location: Vale da Anta, Vila Real

Typology: Large weir

Description: Large concrete weir without apparent utility. Highly impermeable to fish, no fish passage.

Rational: This barrier was chosen due to the high fragmentation level it provides in the upper section of Tâmega channel. The barrier is located on the middle of important endemic threatened fish and mussel species (same as in barrier 423).

Suggested Action: Given the apparent lack of utility of this barrier and the huge impact on fish and mussel connectivity, we suggest that the complete removal of this barrier should be considered



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA
Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

pending a thorough socio-economical study with the relevant local stakeholders. If removal is impossible, an efficient fish passage or ideally a lateral bypass should be implemented.



Figure 8. Vale da Anta large weir

Beça River

6-11. Six large weirs between Canedo and Bragada

Barrier ID and GPS coordinates (WGS84): 416: 41.586048, -7.776925; 428: 41.615883, -7.741173; 1314: 41.587023, -7.798404; 1315: 41.584479, -7.791846; 1319: 41.609908, -7.745137; 1320: 41.613907, -7.741948

Closest location: Canedo in the upper section and Bragada in the lower.

Typology: Large weirs

Description: Except for the most upstream weir (ID 428) which serves as a concrete passage/bridge all the other barriers in this stretch comprehend old large water mill weirs highly impermeable to fish and low utility. The only functionality might be the few pasture fields occasionally lying on both sides of the river.

Rational: This barrier was chosen due to the high fragmentation level it provides in the Beça River, one of the Tâmega River tributaries with better ecological condition. This River contains one of the five viable populations of the Critically Endangered freshwater pearl mussel *Margaritifera margaritifera* in Portugal and the only in Tâmega basin. Due to the construction of the several dams on the Tâmega basin, this river holds important refuges for many endemic fish species like the Iberian nase *Pseudochondrostoma duriense*, the Iberian chub *Squalius carolitertii* and the Calandino *Squalius alburnoides*. This river might be used as a sanctuary for the freshwater fauna of the River Tâmega basin given the wide destruction of their habitats by the large dam's construction.



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA
Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

Suggested Action: As for barrier ID 428 we recommend that a study to convert this weir into a bridge should be considered. Given the apparent lack of utility of the remaining barriers, the huge impact on fish and mussel connectivity, and the high importance of this almost pristine river, we suggest that the complete removal of all barrier should be considered pending thorough socio-economic studies with the relevant local stakeholders. If removal is impossible, efficient fish passages or ideally lateral bypasses should be implemented for all.



Figure 9. Concrete weir 428 (Canedo)



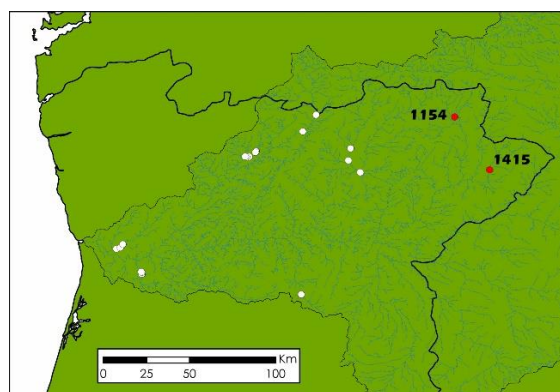
Figure 10. Large weir (ID 1314) in the Beça River



Figure 11. Large weir (ID 1319) in the Beça River

Sabor River Basin

One of the larger dams built in Portugal in this century was at the mouth of the River Sabor. This dam had a wide impact on the lower Sabor River basin making the middle and upper sections an their main tributaries as important refuges for the native fauna and therefore priority areas for conservation. There are many small weirs in the Sabor main channel and its main tributaries, Maças and Angueira. However, many of them are old and decaying and therefore semi-permeable to most freshwater taxa. We selected two by their large size and apparent lack of functionality.



Figures 12. Red dots: Location of the selected barriers on the Tâmega River basin.
Numbers refer to the ID (code) of each barrier.



Rede
Douro
Vivo



CIBIO



Centro de
Investigação
de Montanha



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

Sabor River

12. Gimonde Weir

Barrier ID: 1154

GPS coordinates (WGS84: 41.794848, -6.704200)

Closest location: Gimonde, Bragança

Typology: Large weir

Description: Large stone and concrete weir without apparent utility. Highly impermeable to fish, no fish passage. The area is surrounded by agriculture field, but the reservoir does not seem to be essential for the irrigation of the area.

Rational: This barrier was chosen due to the high fragmentation level it provides in the upper section of Sabor main channel and apparent low functionality. Due to the construction of the several dams on the Tâmega basin, this river stretch holds important refuges for many endemic fish species like the Iberian nase *Pseudochondrostoma duriense*, the Iberian chub *Squalius carolitertii* and the Calandino *Squalius alburnoides*, and mussels like the Iberian dolphin mussel *Unio delphinus* and the Duck mussel *Anodonta anatina*. The middle/upper sections of the Sabor River should be used as a sanctuary for the freshwater fauna of the River Sabor basin given the wide destruction of their habitats on their lower stretches by the construction of the large Sabor dam.

Suggested Action: Given the apparent lack of utility of this barrier and the huge impact on fish and mussel connectivity, we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is not possible, an efficient fish passage or ideally a lateral bypass should be implemented.



Figure 13. Gimonde weir in Sabor River

Angueira River

13. Vila Chã Weir

Barrier ID: 1415

GPS coordinates (WGS84: 41.517597, -6.521466)



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA
Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

Closest location: Aguiar do Sousa, Bragança

Typology: Large concrete weir

Description: Large concrete weir without apparent utility. Highly impermeable to fish, no fish passage. No agriculture fields or pastures surround this barrier.

Rational: This barrier was chosen due to the apparent lack of functionality, large size and high impermeability of this dam to fish and other freshwater taxa. Due to the construction of the Sabor Dam, the value of the Angueira River as refuge for the important freshwater fauna of the Sabor River has increased exponentially. This river stretch holds important refuges for many endemic fish species like the Iberian nase *Pseudochondrostoma duriense*, the Iberian loach *Cobitis paludica* and the Calandino *Squalius alburnoides*, and mussels like the Iberian dolphin mussel *Unio delphinus* and the Duck mussel *Anodonta anatina*. The Angueira River should be used as a sanctuary for the freshwater fauna of the River Sabor basin given the wide destruction of their habitats by the construction of the large Sabor dam.

Suggested Action: Given the apparent lack of utility of this barrier and the huge impact on fish and mussel connectivity, we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is not possible, an efficient fish passage or ideally a lateral bypass should be implemented.



Figure 14. Vila Chã Weir in Angueira River



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**

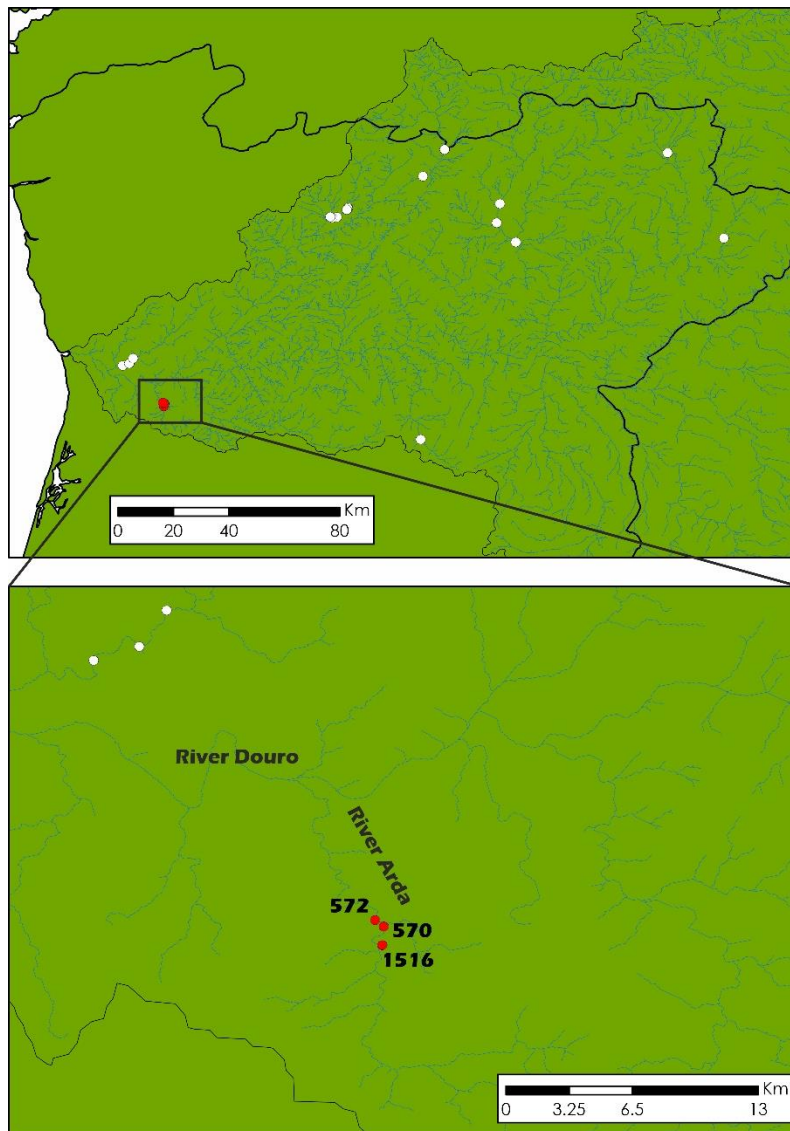


CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

Arda River Basin

The Arda River is a small tributary of the left bank of the Douro. Given that it occurs in a landscape with low population density and agriculture it has a good ecological status and therefore one of the rivers in best conservation condition on the lower Douro River basin. It has no large dams and is an almost free river. Therefore, it is incredibly important to mitigate the effects of the remaining barriers on this watershed. We have selected three big barriers impermeable to fish and other taxa that once mitigated will have a huge impact in the fish connectivity of the upper sections of this small basin.



Figures 15. Red dots: Location of the selected barriers on the Arda River.
Numbers refer to the ID (code) of each barrier.



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

14. Unnamed Arda Weir 1

Barrier ID: 1516

GPS coordinates (WGS84: 40.972436, -8.338381)

Closest location: Carvalhal Redondo, Viseu

Typology: Large concrete weir

Description: Large concrete weir without apparent utility. Highly impermeable to fish, no fish passage. No agriculture fields or pastures surround this barrier.

Rational: This barrier was chosen due to the apparent lack of functionality, large size and no permeability of this dam to fish and other freshwater taxa. This river holds important populations of many endemic fish species like the Iberian nase *Pseudochondrostoma duriense*, and the Calandino *Squalius alburnoides*. The Arda River should be used as a sanctuary for the freshwater fauna of the tributaries of the lower Douro Catchment given the wide destruction of other tributaries due to the presence of a high human density and excessive pollution among other threats.

Suggested Action: Given the apparent lack of utility of this barrier and the huge impact on connectivity, we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is not possible, an efficient fish passage or ideally a lateral bypass should be implemented.

15. Unnamed Arda Weir 2

Barrier ID: 570

GPS coordinates (WGS84: 40.981038, -8.337708)

Closest location: Near Almansor, Viseu

Typology: Large weir

Description: Large weir without apparent utility. Highly impermeable to fish, no fish passage. No agriculture fields or pastures surround this barrier.

Rational: This barrier was chosen due to the apparent lack of functionality, large size and no permeability of this dam to fish and other freshwater taxa. This river holds important populations of many endemic fish species like the Iberian nase *Pseudochondrostoma duriense*, and the Calandino *Squalius alburnoides*. The Arda River should be used as a sanctuary for the freshwater fauna of the tributaries of the lower Douro Catchment given the wide destruction of other tributaries due to the presence of a high human density and excessive pollution among other threats.

Suggested Action: Given the apparent lack of utility of this barrier and the huge impact on connectivity, we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is not possible, an efficient fish passage or ideally a lateral bypass should be implemented.



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

16. **Balaido Dam**

Barrier ID: 572

GPS coordinates (WGS84: 40.981038, -8.337708)

Closest location: Near Almansor, Viseu

Typology: Small Dam

Description: Small Dam without apparent current utility. Highly impermeable to fish, no fish passage. No agriculture fields or pastures surround this barrier.

Rational: This barrier was chosen due to the apparent current lack of functionality, large size and no permeability of this dam to fish and other freshwater taxa. This river holds important populations of many endemic fish species like the Iberian nase *Pseudochondrostoma duriense*, and the Calandino *Squalius alburnoides*. The Arda River should be used as a sanctuary for the freshwater fauna of the tributaries of the lower Douro Catchment given the wide destruction of other tributaries due to the presence of a high human density and excessive pollution among other threats.

Suggested Action: This dam seemed to be used for hydropower, but its present utility needs to be verified. If no current use is in place, due to the huge impact on connectivity, we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is not possible, an efficient fish passage or ideally a lateral bypass should be implemented.



Figure 16. Balaido Dam in Arda River



**Rede
Douro
Vivo**



CIBIO



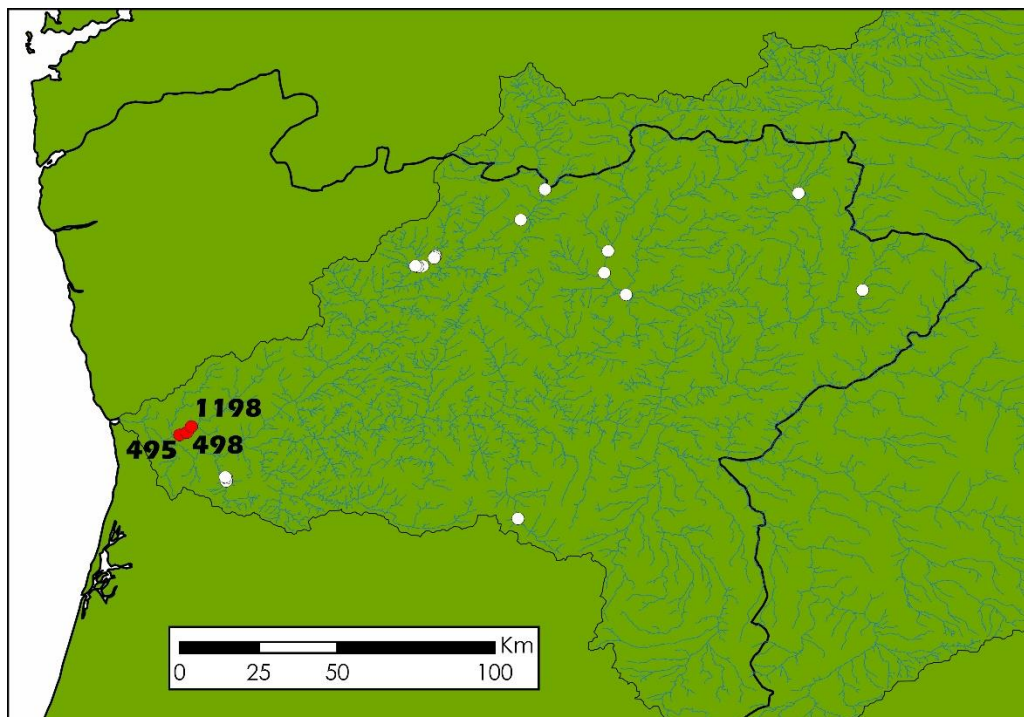
**Centro de
Investigação
de Montanha**



CBMA
Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

Sousa River basin

The River Sousa is a highly degraded river due to multiple stressors related with human activities. It has suffered over the last centuries from urban, agriculture and industrial pollution. The presence of many barriers and large weirs also contributed to the fragmentation, isolation and extirpation of fish and the once massive populations of the critically endangered freshwater pearl mussel *Margaritifera margaritifera* present in this river. Nevertheless, the water quality in this river system has been increasing substantially over the last two decades since the inception of wastewater treatment plants in major urban centres and industries. Furthermore, since the river mouth is downstream of the first large dam, it has the potential to become particularly important to migratory fish like the eels, salmon and lampreys that mostly disappeared from the Douro Basin due to the construction of these Large Dams. For this, it is critical that the barriers and dams on the lower section of the Sousa River are permeable to fish or that useless and obsolete barriers are removed.



Figures 17. Red dots: Location of the selected barriers on the Sousa River.
Numbers refer to the ID (code) of each barrier.

17. **Conchadas Weir**

Barrier ID: 495

GPS coordinates (WGS84: 41.104439, -8.472120)

Closest location: Conchadas, Porto

Typology: Large weir

Description: Large weir without apparent utility. Highly impermeable to fish, no fish passage. Low number of agriculture fields or pastures surrounding this barrier.

Rational: This barrier was chosen due to the apparent lack of functionality, large size and no permeability of this dam to fish and other freshwater taxa. This river holds important populations of many endemic fish species like the European Eel *Anguilla Anguilla*, the Calandino *Squalius alburnoides*, and the Bermejuela *Achondrostoma arcasii*. The Sousa River should be rehabilitated and used as a sanctuary for the local freshwater fauna of the tributaries of the lower Douro Catchment and especially of the diadromous migratory fish, since its mouth is located downstream of the first large dam of the Douro River.

Suggested Action: Given the apparent lack of utility of this barrier and the huge impact on connectivity, we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is not possible, an efficient fish passage or ideally a lateral bypass should be implemented.

18. Serra Weir

Barrier ID: 498

GPS coordinates (WGS84: 41.110963, -8.451025)

Closest location: Serra, Porto

Typology: Large weir

Description: Large weir without apparent utility. Highly impermeable to fish, no fish passage. Low number of agriculture fields or pastures surrounding this barrier.

Rational: This barrier was chosen due to the apparent lack of functionality, large size and no permeability of this dam to fish and other freshwater taxa. This river holds important populations of many endemic fish species like the European Eel *Anguilla Anguilla*, the Calandino *Squalius alburnoides*, and the Bermejuela *Achondrostoma arcasii*. The Sousa River should be rehabilitated and used as a sanctuary for the local freshwater fauna of the tributaries of the lower Douro Catchment and especially of the diadromous migratory fish, since its mouth is located downstream of the first large dam of the Douro River.

Suggested Action: Given the apparent lack of utility of this barrier and the huge impact on connectivity, we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is not possible, an efficient fish passage or ideally a lateral bypass should be implemented.



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology

19. Aguiar do Sousa Weir

Barrier ID: 1198

GPS coordinates (WGS84: 41.127706, -8.438358)

Closest location: Aguiar do Sousa, Porto

Typology: Large weir

Description: Large weir without apparent utility. Highly impermeable to fish, no fish passage. Low number of agriculture fields or pastures surrounding this barrier.

Rational: This barrier was chosen due to the apparent lack of functionality, large size and no permeability of this dam to fish and other freshwater taxa. This river holds important populations of many endemic fish species like the European Eel *Anguilla Anguilla*, the Calandino *Squalius alburnoides*, and the Bermejuela *Achondrostoma arcasii*. The Sousa River should be rehabilitated and used as a sanctuary for the local freshwater fauna of the tributaries of the lower Douro Catchment and especially of the diadromous migratory fish, since its mouth is located downstream of the first large dam of the Douro River.

Suggested Action: Given the apparent lack of utility of this barrier and the huge impact on connectivity, we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is not possible, an efficient fish passage or ideally a lateral bypass should be implemented.

River Távora

River Távora is a highly fragmented tributary of the left bank of the Douro basin. It has a large dam fragmenting the basin in two sections. Nevertheless, its upper catchment still holds good populations of native fish, especially of the Ruivaco *Achondrostoma oligolepis* and an undescribed species of loach *Cobitis* sp., as reported in task 3.2.1. It is therefore important to connect the upper sections of this river and increase connectivity of these important native species.



Rede
Douro
Vivo



CIBIO

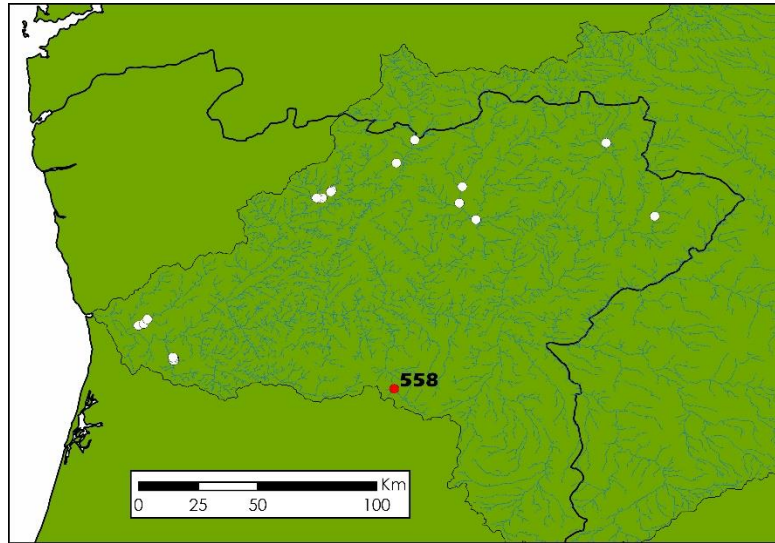


Centro de
Investigação
de Montanha



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology



Figures 18. Red dot: Location of the selected barrier on the Távora River.

Numbers refer to the ID (code) of each barrier.

20. Unnamed Távora Dam

Barrier ID: 558

GPS coordinates (WGS84: 40.864698, -7.505039)

Closest location: Sernancelhe, Viseu

Typology: Large weir

Description: Large weir with irrigation purposes. Highly impermeable to fish, no fish passage. Low number of agriculture fields or pastures surrounding this barrier.

Rational: This barrier was chosen due to its large size and no permeability of this barrier to fish and other freshwater taxa. This river holds important populations of important endemic fish species like the Ruivaco *Achondrostoma oligolepis* and an undescribed species of loach *Cobitis* sp. unique to this and the Torto River, within the Douro Basin. The upper Távora River needs urgent rehabilitation due to the water shortage and fragmentation. The removal and or mitigation of this barrier could be an incentive and call for attention of the poor conservation status of this basin.

Suggested Action: Given the apparent low utility of this barrier and the huge impact on connectivity, we suggest that the complete removal of this barrier should be considered pending a thorough socio-economical study with the relevant local stakeholders. If removal is not possible, an efficient fish passage or ideally a lateral bypass should be implemented.



**Rede
Douro
Vivo**



CIBIO



**Centro de
Investigação
de Montanha**



CBMA

Centro de Biologia Molecular e Ambiental
Centre of Molecular and Environmental Biology



Figure 19. Unnamed Weir (ID 558) in Távora River

Notes: The present report selects barriers for detailed socio-economic and ecological studies for mitigation or potential removal based on a consensus of all the studies performed under the Reviving Douro Basin project. It is by no means a selection of these structures for removal without the abovementioned studies.