

EcoPeak – hydropeaking indicators

Summary

In most regulated rivers, the fish biota is subsequently subject to hydropeaking downstream a hydropower plant (HPP), a term widely used to express extreme and short-duration fluctuations of discharge during daily peaks of energy demand. Numerous studies have documented the adverse impacts of hydropower production in the ecological condition of rivers, especially in fish populations. In fact, the Water Framework Directive claims hydropeaking as one of the main stressors on aquatic ecosystems. Despite the growing awareness of hydropeaking impacts, it is still largely unknown how fish react under peak events, especially cyprinids, and how we can quantify these impacts. Little research has dwelt into the search of sub-daily metrics to quantify the peaking operation and understand the threats fish populations are subjected downstream HPPs.

Hydropower production can cause severe daily and sub-daily fluctuations in discharge and water level, in order to respond to energy demand. Common statistics to define the degree of hydrologic alteration are based on daily-averaged flow records and, therefore, cannot capture flow metrics of short-term flow fluctuations. To understand the influence of hydropeaking, the quantification of key-components at the sub-daily scale is needed.

Due to this short-term fluctuations fish species are subjected to stranding - i.e., when fish are left in dewatered areas as a result of declining river stage due to the stop of the turbines (Figure 1). These rapid reductions of flow most of the times persistent, challenge the natural ability of organisms to immediately respond to the quickly changing hydrophysical environment, and, over time, to cope with the associated energetic and

time costs related to frequent hydropeaking. Also, variations in water level may dry up spawning grounds, thereby resulting in the death of the all offspring in these habitats. And it is well known that fish populations' success is directly related to access and existing suitable spawning grounds.

EcoPeak intends to contribute to the knowledge of hydropeaking impacts in a multidisciplinary approach applied to a case-study. This project aims to quantify the degree of alteration of a river reach due to the operation of a HPP and link the hydropeaking impacts to the fish biota in terms of fish stranding and dewatered spawning grounds.

The major output of EcoPeak project will be the quantification of hydropeaking indicators linked to fish stranding and the dry up of spawning grounds. Also, the development of a methodology to assess the trade-offs between power production and habitat preservation focused in the fish biota will take place. These goals will also enable us to identify a few bottlenecks for achieving cost-effective energy production and self-sustained fish populations in hydropower affected rivers.



Figure 1. Fish stranding in the north of Portugal.

Project Reference

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Leading Institution

CERIS – Civil Engineering Research and Innovation for Sustainability (Portugal)

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Project Website

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