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Finding ecological limits of hydrologic alteration in rivers flowing in the Brazilian Pantanal

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The Pantanal, world's largest floodplain (140k km 2), is set within the Upper Paraguay Basin (360k km 2) in Central South America. The Pantanal is a recognized World and Brazilian Heritage for its socio-ecological values. The annual flood pulse (considering water, sediments and nutrients) is the single most important ecological function maintaining its productivity and diversity. Actually, there are 36 dams for hydro-energy production (1093MW) built on the rivers feeding the Pantanal, most of which have been constructed in the last decade. In the next years the construction of more 84 dams (751 MW) is planned. Downstream, the dams will mainly affect sediment and nutrient pulses as well as fish migration. Upstream, the reservoirs will alter riparian habitat over more than a hundred linear kilometers. The overall goal of this work is to provide instruments for the sustainable use of the hydroelectric resources of the Pantanal affluence basin allowing society to discuss the equilibrium between energy production and the supply of ecosystem services. One specific aim is to understand which parameters of the physical habitat that are disturbed by dams mostly influence fish biodiversity in order reduce their impacts on fish community structure. Another objective is to provide a more efficient design for future dam implantation in order to find a compromise between energy production, migration routes preservation and sediments/nutrients pulse conservation. The results show that the Froude Number (FN) is the most significant variable to explain the relative abundance of the over 100 fish species found in the basin. A gradient analysis reveals that reservoirs lower FN and may cause local extinction of some fish species as well as substantially affecting the community structure. Minimizing backwater extent is obviously one way of reducing dam impacts, but it implies lowering dams' projected water lines causing a reduction in energy production. The results also show that the actual dam building scenario will lead to a blocking of almost all fish migration routes. It is possible to design dam implantation scenarios to preserve several migration routes but this will come with energy

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losses ranging from 337 to 626 MW. These strategies to diminish the impacts of hydroelectric power plants on the fish diversity and on the sediment/nutrients pulses in the Pantanal amount to a loss of only 0,5% of the Brazilian hydroelectric potential. At the basin scale, and even more at the scale of the Brazilian nation, various measures, such as power plants re-potentiation, alternative energy sources and energy conservation should compensate for this small deficit.