IHA analyzes and environmental flow in the Upper Paraná fluvial macrosystem (PR-MS-Brazil).

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The conservation of rivers in the Anthropocene is one of the significant scientific challenges of our era. The environmental degradation processes of these systems have critically compromised their functioning and biodiversity. The alteration of the natural hydrological regime due to damming is one of the principal causes that exacerbate the loss of integrity of rivers. The hydrological alteration of the fluvial macrosystem of the Upper Paraná River (PR-Brazil) was evaluated using the IHA program, analyzing 33 hydrological variables and quantifying their variation through the variability range approach (RVA), comparing 1964-1998, pre- damming, and 1999-2019, post-damming periods. Likewise, the environmental flow components (EFC) were evaluated in terms of low flows, extremely low flows, high flow pulses, and their variation summarized in 34 variables.

Additionally, the levels of connectivity previously defined were reevaluated to assess the processes they entail through the analysis of satellite images and use them as input to determine the environmental flow. Their persistence and change after damming were also determined. It was established that at 9 900 m³/s, the partial flooding of the Paraná River is activated; at 12 745 m³/s, the lateral overflow begins, at 16,356 m³/s generalized flooding occurs, and at 19,335 m³/s, the maximum wet perimeter is reached. Analysis reveals an intermediate level of 15 000 m³/s which the crevasses splay are reactivated, and most of the macrosystem is flooding. This connectivity level is recommended to be used as environmental flow. Changes were found in terms of the magnitude, frequency, period of occurrence, and duration of floods between both periods. The persistence of connectivity levels of 12 745 m³/s, 15 000 m³/s, 16 356 m³/s, and 19 335 m³/s was lower in the post-damming period. The environmental flow determined through satellite images was more functional concerning previous biological data than the one calculated with the routine incorporated into the program, although both have little persistence after damming.