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Communicating complex hydropower-ecological tradeoffs and their uncertainties to decision makers: A hydroinformatics challenge in the Lower Mekong.

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Home to one of the world's most biodiverse and productive freshwater fisheries, the Mekong River provides food and economic security to some 60 million people. The planned extensive hydropower development in the river basin has the potential to degrade this ecosystem. The basin's most impactful and southern-most proposed main stem dam, the 18-km long Sambor mega Dam, is to be located just upstream of critical fishery habitats such as Tonle Sap Lake and the Mekong Delta. This study explores the potential to modify Sambor's siting, design and operation (SDO) to achieve more balanced hydropower-ecological outcomes. Probabilistic seasonal measures of fish life cycle processes, energy production and sediment passage were used to explore alternative SDO options and their ecological and energy impacts. Both ecological concerns and energy production were considered in the analyzed SDO alternatives for Sambor, which is a first among any of the world's large dams. While significant difficulties remain for establishing credible ecological measures, our results strongly suggest that opportunities exist to achieve more balanced ecology-energy outcomes. Our results emphasize the need to address ecological concerns in advance of signing power purchase agreements that could limit the site-specific and integrated SDO modifications needed to achieve them. Although emerging scientific capabilities are improving the identification and evaluation of key hydropower-ecology tradeoffs, there remains considerable uncertainty in our understanding of the resilience of impacted ecosystems. Achieving more balanced outcomes will require significant improvements in characterizing, monitoring and flexibly exploring ecologically informed SDO options. The hydroinformatics challenge we faced was effectively communicating these complex multiple tradeoffs and their uncertainties to the decision makers, including the ministers of appropriate government agencies.