TECHNICAL COMMENT

SUSTAINABILITY

Comment on "Designing river flows to improve food security futures in the Lower Mekong Basin"

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The designer flow regime proposed by Sabo *et al.* (Research Articles, 8 December 2017, p. 1270) to support fisheries in the Lower Mekong Basin fails to account for important ecological, political, and economic dimensions. In doing so, they indicate that dam impacts can be easily mitigated. Such an action would serve to increase risks to food and livelihood futures in the basin.

Sabo *et al.* (*1*) propose that dams in the Lower Mekong Basin (LMB) could produce an artificial ("designer") hydrograph to mitigate impacts on downstream fisheries that feed millions of people. Modeling studies that predict responses of tropical river fisheries to hydrological variation are not new, even in the LMB (*2–4*). A study similar to (*1*) was recently undertaken by the Mekong River Commission (MRC) (*5*) using a shorter segment of the same CPUE (catch per unit of effort) time series for the Cambodian Dai fishery. Hydrology was measured in the Tonle Sap River where the fishery takes place, not several hundred kilometers away at Stung Treng as in (*1*).

This MRC study showed that a flood index, termed "FPExt" (flood pulse extent) (*1*), is the primary driver of fisheries yields; fish growth increases exponentially with the flood index, likely reflecting improved feeding opportunities (*6*). The response was modeled "allowing predictions to be made of how…fishery yield is likely to vary under different flooding conditions, whether natural, or modified [by] climate change and/or water management projects [dams]" (*5*).

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Sabo *et al.* also found this flood index to be a significant driver of CPUE, together with a composite index of dry-season anomalies. However, the authors appear to have disregarded the MRC findings (*5*): "…previous work suggests two hypotheses to explain how dams diminish production of inland fisheries: (i) by reducing connectivity and dispersal, and (ii) by reducing primary productivity through the entrapment of sediment supply and associated nutrient delivery from headwaters to downstream nursery habitats" (*1*).

Sabo *et al.* explain that their positive relationship between CPUE and FPExt "…may in part be related to increased catchability of fish at high water levels." However, catchability declines in large floods because fish density decreases. Therefore, fishermen in tropical rivers typically fish during the receding flood and dry seasons rather than peak flood (*7*).

The model of Sabo *et al.* also does not take into account other serious impacts of dams besides modifying downstream flows, such as creating barriers to fish migrations. Passage through dams increases mortality and diminishes reproductive success in fish populations. Dams trap nutrient-bearing sediments important for maintaining primary production and fish habitat, thereby diminishing water quality (*8*, *9*). The barrier effects of dams alone could end important fish migrations in the LMB, irrespective of the availability of designer flows (*10*).

The "Good" design flow of (*1*) features large, almost rectangular, flood pulses, punctuated by long dry seasons, and very rapid transitions—approximately 15 days, versus 4 to 5 months under natural conditions. Power production is the primary function of the Mekong dams, which are designed and financed according to predefined operating procedures. Existing (and planned) dams generate downstream flows that are the inverse of the "Good" design flow (i.e., diminished flood pulse and elevated dry-season flow). The "Good" flow would compromise the economic viability of dams in the LMB (*11*). We estimate that Cambodia alone would not have necessary storage (approximately 28 km^3) to generate the "Good" design flow regime (Table 1). Creating the "Good" design flow would require coordination of dam operations by all six countries in the Mekong Basin, only three of which have a major stake in the Lower Mekong River fisheries (Table 1).

Even if the flow could somehow be generated, the designer flow regime is an extrapolation of an empirical model of a pattern that has never been observed in the LMB. The rapid changes in flow between dry and wet seasons threaten fish populations upon which the Dai and other fisheries in the LMB depend (*12*) by removing migration cues, hampering upstream spawning migrations, and sweeping downstream-drifting eggs and larvae past suitable nursery habitats. Stranding and diminished reproductive success under rapidly changing water levels will further diminish fish catch (*13*). Other flow-dependent sectors of the economy, such as flood recession agriculture (rice farming) and navigation, would also be affected by these new flow regimes.

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Table 1. Estimates of live storage in existing and planned dams in the LMB and estimated annual fish catch in each LMB country. Estimates are from (*14*) and (*15*), respectively. The necessary live storage to generate the "Good" design flow proposed by Sabo *et al.* (*1*) is approximately 28 km^3.

Country	Live storage (km^3)	Proportion of total live storage	Total annual catch (tonnes)	Proportion of total annual catch
Lao PDR	57.5	68%	208,503	8%
Cambodia	18.9	22%	481,537	20%
Thailand	5.4	6%	911,485	37%
Vietnam	3.2	4%	852,823	35%
Total	85.0	100%	2,454,348	100%

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