Are fisheries impacts of riparian deforestation in Siphandone already eclipsing hydropower effects?

Returning — via the Mekong's Siphandone ("four thousand islands") wetlands just above the Lao-Cambodia border to continue research and imaging the Don Sahong hydropower scheme while en route to Phnom Penh, where I would be presenting at the GRI-RUPP March 2017 conference, I heard from local sources that there was considerable concern over the viability of the extremely valuable pangasid catfish fisheries.

The *pangasidae,* which includes the critically endangered giant Mekong catfish *(Pangasianodon gigas),* obligatorily lay their adhesive eggs within the tangled roots of seasonally submerged trees in the aquatic forests characteristic of certain river reaches in Champassak, Lao and above Stung Treng, Cambodia, and I erroneously understood that these trees —mostly in the genus *Gmelina*— were being cut for the commercial charcoal trade.

As I was refocusing in part my studies of Don Sahong onto the aesthetic impacts to the Khon Phapeng waterfalls, I then created several new stitched virtual reality (VR) dry-season image sets of specific viewsheds of the falls to compare them with the previous VRs I had produced in July, 2017, near the height of the monsoon. I was surprised to discover when superimposing them, that the difference in easily-observable seasonal river stage within the Hou Phapeng channel was much less than expected.

This was notably consistent with first-hand observations made a year earlier of monsoonal stage far upstream at Chiang Saen, Thailand, where local enviro NGOs asserted that the stage then was at least several meters below what would have been expected prior to the recent conversion of at least 300 km of the *Lançangjiang* (i.e., the name of the upper Mekong within Yunnan, PRC) into stair-cased hydropower reservoirs: of which the largest entailed storage exceeding 20 km^3. I was also struck by how many of the most mature gmelina trees were uprooted from within channel shallows (and less so from the higher-elevation sandbars) and displaced as a result —as so it seemed— of extreme floodflows.

Later I was advised that the actual cause of those trees dying was their absolute dependence on seasonal dewatering and root oxygenation, and that this was being rendered impossible by heightened dry season river stage as a function of upbasin reservoir releases —both of turbinated hydropower effluent, but also to facilitate transit, mostly by Chinese cargo ships in the reaches between the present head of navigation at Xishuanbanna and the little-discussed Chinese dam project site at Pak Beng, below where the Mekong flows entirely within Laos.

I also became increasingly interested in how the "compression" of river stage —i.e., with monsoonal flows reduced and dry-season flows increased, resulting from reservoir operations throughout the upper and middle Mekong Basins— would impact the extraordinary flow reversing hydrology of the Tonle Sab river in Cambodia, which accomplishes annually the quasi-total dewatering of the Great Lake, and it's subsequent re-filling: the process on which much of the capture fisheries ecology both above and below the the Tonle-Mekong confluence at Phnom Penh is extremely contingent.

Khone Phapeng waterfalls (late-July, 2016)

Khone Phapeng (late-February, 2017

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Original Abstract

Siphandone (i.e., "four thousand islands" in Lao/Thai) describes the extraordinary region at the Lao-Cambodian border where tectonic geomorphology has led to the Mekong mainstem broadening to a width of c. 10 km —seemingly a braided channel, but non-alluvial structurally— encompassing rapids, escarpments and waterfalls, interspersed with inhabited and uninhabited islands: some essentially unvegetated, i.e., inundated completely during the monsoon and stripped clean by currents; while others display natural vegetation, including trees and shrubs, and also lowland rice and horticulture.

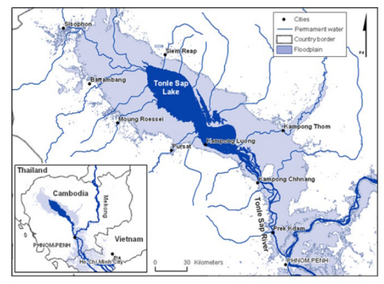
The construction well underway of the 260MW Don Sahong hydroelectric scheme has been controversial, although the Project obstructs only one channel out of the dozens within the Siphandone reaches of the Mekong: *Hou Sahong,* which atypically lacked an impassible escarpment at the fall line; hence, critical to upstream dry season fish migrations.

Ecological mitigation strategies there would foreclose unsustainable fishing, and enable fish passage through alternate instream pathways. The ecological consequences of bank-to-bank mainstem channel blockage; of sediment and nutrient interception and impoundment; and of significant alteration of hydrology and hydraulics at the crux of the Mekong hydropower/fisheries imbroglio are arguably of minor concern at Don Sahong. A key factor of fisheries management there that has hardly yet surfaced is the accelerating loss of riparian vegetation from riziculture intensification and —hand-in-glove— from commercial charcoal production.

For the *Pangasiidae* "shark catfishes" figuring so large in both the capture and the culture fisheries —the latter still often dependent on harvesting wild-produced juveniles— the Siphandone ecosystem is quintessential, as their sticky eggs are deposited upon the exposed roots of such rheophilic (i.e., preferred habitat is fast-moving waterways) trees as *Gmelina asiatica* Linn. (Lamiaceae): possibly now being extirpated by riparian deforestation.

The prospective new research carries forward from *Siphandone Wetlands* (G. Daconto *et. al.,* 2001); and *Fishes and Forests: the Importance of Seasonally Flooded Riverine Habitat for Mekong River Fish Feeding* (I.G. Baird, 2007)

Threatened Lake of the Year 2016:
Tonle Sap Lake in Cambodia



Tonle Sap Lake

Size:
2,500 km² (dry season)
16,000 km² (rainy season)

Length:
160 km (dry season)
250 km (rainy season)

Depth:
1 - 2 m (dry season)
8 - 11 m (rainy season)

Sea level:
0,5 m

Global Nature Fund report, 2016, on Great Lake ecological risks and scenarios: perhaps unduly weighing climate change and over-fishing

Pangasius concophilus

Dead and dying riparian Gmelina forest along the Hou Sahong right bank

Uprooted mature Gmelina trees within the Hou Sahong "flooded forest" reach

Undamaged trees on emergent sandbanks, and exposed egg-deposition root tangle