Capture fisheries, dams, mitigations measures and alternative sources of fish production

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PRESENTATION

Capture fisheries in the Mekong: some comparative figures

Dam projects in the Mekong Basin

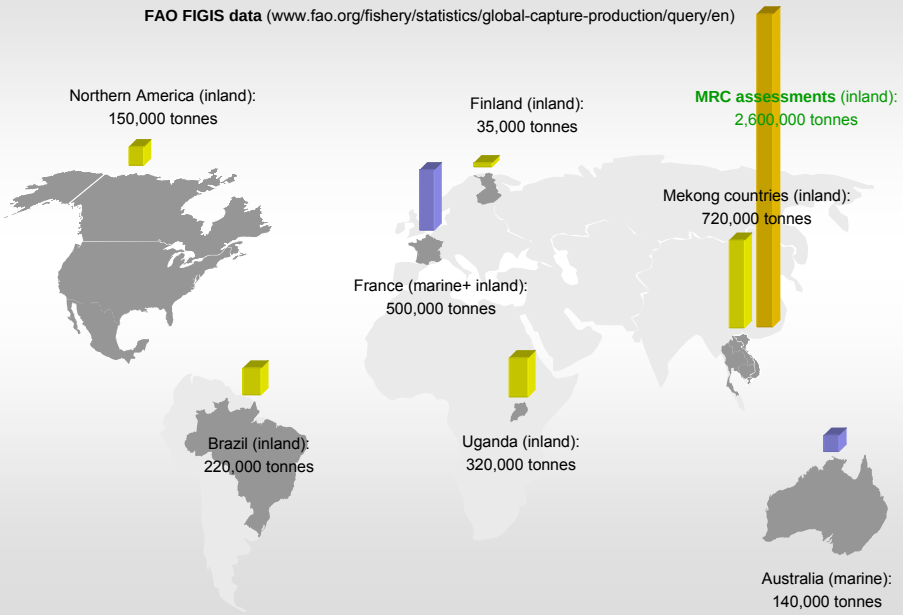
Impacts of dams on fisheries: lessons from other countries

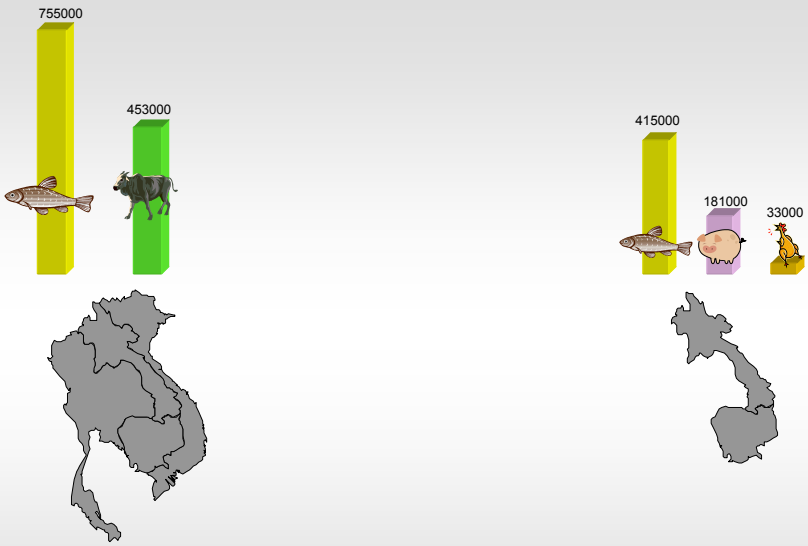
Mitigation measures: options possible, efficiency, limitations

Aquaculture and alternative sources of fish production

Capture fisheries in the Mekong: some comparative figures

FAO FIGIS data (www.fao.org/fishery/statistics/global-capture-production/query/en)





Capture fisheries are essential to food security in the Mekong Basin

Dam projects in the LMB

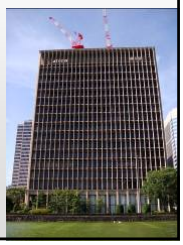
212 dams ≥ 1 MW existing or planned in the LMB

53 dams in operation or under construction or committed/priority

China	Operating	4	8
	In construction / Committed	4	
Laos	Operating	12	23
	In construction / Committed	11	
Thailand	Operating	8	8
	In construction / Committed	0	
Cambodia	Operating	1	2
	In construction / Committed	1	
Vietnam	Operating	7	12
	In construction / Committed	5	

…+ 66 projects under study + 93 candidate sites

Average height of the 32 dams in operation: 51 meters



Impacts of dams on fisheries: lessons from other countries

North America
Columbia River: from 10-16 million migrant fish/year down to 2.5 million.
Mortality of migrants: 37-51% on way up, 77-96% on way down
Missouri River: loss of 80% of the catch
Tennessee River: 60% loss in species richness

Europe
Original biodiversity and biomass low → not much to lose

Asia
Quiantang river: - 22-38% fish biodiversity
Pak Mun: 60-80% loss in catches upstream,
64% loss in biodiversity
reservoir prod.: 10kg.ha^{-1} instead of the expected 220 kg.ha^{-1}
no study of downstream impacts
Yali: loss of 58% of livelihoods for downstream communities

Africa

Senegal River: loss of 90% of fish production (no compensation by reservoir)

Niger River: loss of 10% of fish production (Mali) and of 30% (Nigeria)

Zambezi River: loss of 60% of coastal prawn production; poor reservoir production

South America

Parana River: 20% loss of biodiversity; only 2% of species cross the fish ladders

Tocantins River: 26% loss in biodiversity (but new species); loss of 65-70% of fish catches downstream

Sinnamary River: 37% loss in biodiversity; new species appeared.

Generic patterns

- Unregulated streams → catch of large high value fish
- Regulated streams → lower catches of migrant but smaller fish
- Highly regulated rivers → fisheries collapse; only black fish remain

Results from three different assessment methods indicate that the migratory fish resource at risk from Mekong mainstream dam development is in the range 0.7 – 1.6 million tonnes per year.

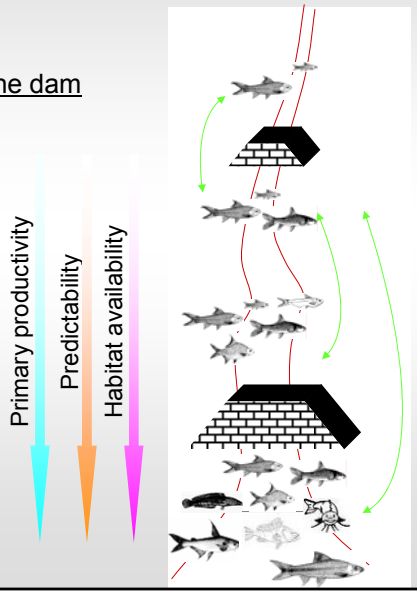
That amount of fish is equivalent to 1.6-3.5 times the entire beef production of Cambodia, Lao PDR, Thailand, and Viet Nam

Mitigation measures: options possible, efficiency, limitations

Multiple options exist before construction,
during construction and after construction

Before construction

Location of the dam



Dams located higher on streams are less damageable to fish resources than those located downstream

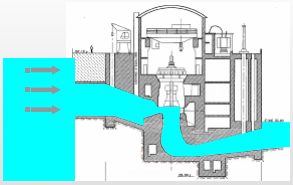
Studies also show cumulative impacts of multiple dams

Spillway design

Spillway design should integrate ecological considerations

Off-take management

Multiple level off-take improves water quality downstream



During construction

Clearance of vegetation

Optimal option: partial clearing, with areas for navigation and fishing, and uncleared areas for fish.

Filling schedules

Filling of a reservoir at the end of construction should ensure:
- that water is released downstream
- that sufficient flows are released for environmental functioning and to keep a seasonal flow pattern

After construction

Reservoir aeration

Several aeration technique are possible to improve reservoir oxygenation

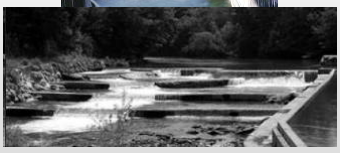
At all stages (preferably before and during construction)

Fish passes

Natural bypass channels

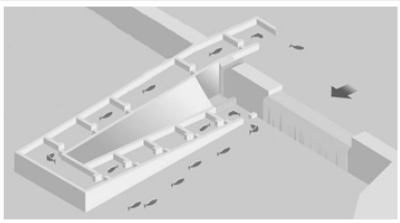
Only if low slope

Pool fish passes



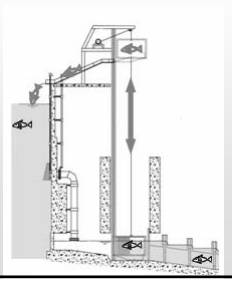
Mainly for small to medium-size streams

Vertical slot fish passes



Can work well if dam height < 10m

Fish locks and lifts



Expensive, very small passage rate

Fish ladder of the John Day Dam (Columbia River)

Best mitigation system by fish passes in the world: Columbia River; 2 million fish passed every year

Tonle Sap during the migration peak: 3 million fish passing EVERY HOUR

There are no fish passes that can accommodate the size and intensity of fish migrations
- in the mainstream
- during the peak season
- in the lower part of the Mekong

Fish passes are possible mitigation options for smaller dams on tributaries

Alternative sources of fish production

Enhancement and stocking in reservoirs 1

Enhancement

Fertilization of reservoirs,
Fish attraction, brush parks
Sanctuaries, closed seasons
Destruction of predators

Stocking

1) Native species, 2) introduced species

Yield and productivity

Much variability and disputes; depends a lot on management
From 200 $kg.ha^{-1}.year^{-1}$ to few $kg.ha^{-1}.year^{-1}$
Forecast of yield VERY difficult to make

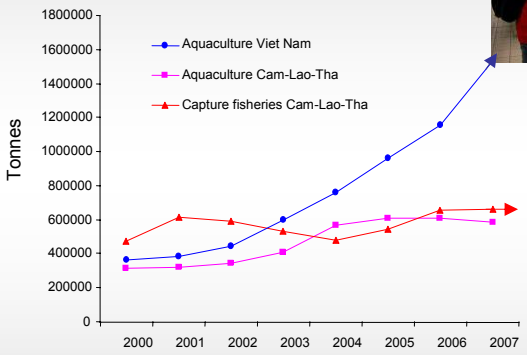
Economic viability not widely demonstrated

Enhancement and stocking in reservoirs 2

Can the fishery adapt to more lacustrine environment? Viability of new reservoirs created by Dams?

- Adaptation of species to deep water lakes and large volume pelagic zones. In South America few small species adapted and main biomass (80%) around lake fringes only.
- Lake Kariba, Zambezi River showed that resident *Clarias gariepinus*, *Labeo* spp., *Barbus* spp. all but disappeared. However small sardine-like species (Kapenta) took over and successfully dominated the fishery. Also Nam Ngum still a success after 30 years.
- However, generally loss in biodiversity (10-60%) and catch (10-90%) with few notable successes where a new species dominates. Indeed the World Commission on Dams concluded that 27% positive impact on biodiversity while 73% showed negative impacts.

Aquaculture



Vietnamese aquaculture is booming
but what about aquaculture vs. capture fisheries in the other riparian countries?

Replacing 'FREE' fish?

- Aquaculture requires inputs. Generate 1-2 million tons of fish to replace 'free' fish ?….. in the context of food crisis, food security for poor?
- Pond culture requires land – issues around smaller homesteads, replacing rice and not poorest.
- Some aquaculture tech demands fish seed and feed (small less valued species) from the wild capture fisheries. Sustainability?
- Environmental risk esp. intensive cages in rivers and reservoirs.
- Estimate 20% increase in fish demand over next 10 years. Aquaculture can fill this gap?

Conclusions

In the Mekong, fish production will be negatively impacted by dam development

There are multiple options for dam location and design

There are multiple options for mitigation

IWRM is well known. Integration of dam development with fisheries (for the sake of millions of fishery dependent households) should occupy very high stage in the assessment process.

Replacement of capture fisheries by aquaculture is a misnomer. Aquaculture will *ameliorate* fish supply after dam development but will not replace losses from capture fisheries.