FISHERIES IMPACTS AVOIDANCE AND MITIGATION

Outline

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Reminder about Impact Assessment

I. Introduction

II. Strategies for avoidance and mitigation:
- A) Before dam construction
- B) During dam construction
- C) After dam construction

III. Conclusions

Reminder about Impact Assessment

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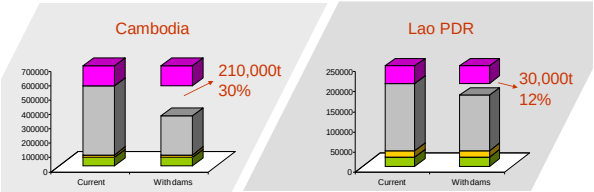
This SEA predicts that the 11 dams, if built as planned, would result in a loss of fish production ranging between 700,000 and 1.4 million tonnes. The most conservative estimate common to all studies is a loss of 600,000 tonnes of annual fish production.

600,000 tonnes of fish correspond to the whole freshwater fish production in West Africa (15 countries). A loss of this magnitude would have a major impact on food security basinwide, in particular in Cambodia

	600,000t at risk	
Cambodia: 35% of LMB fish production	210,000t	Pig meat
Laos: 5% of LMB fish production	30,000t	Freshwater fish
Thailand: 30% of LMB fish production	180,000t	Chicken meat
Vietnam: 30% of LMB fish production	180,000t	Cattle meat



Thailand:

loss <5% of protein supply

Vietnam:

loss <5% of protein supply

BUT impact on coastal resources not quantified

Reminder on Impact Assessment

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Reservoir fisheries from mainstream dams will not compensate for losses in capture fisheries, since they will produce at best 30,000 tonnes per year (5% at most of the loss in capture fisheries)

Certain dams having more impact than others:

Latsua → blocking the large Mun/Chi system

Stung Treng/Don Sahong → blocking Khone Falls
(and Don Sahong would blast 1.6 million m^3 of river bed)

Sambor → largest dam blocking migration in 81% of the Mekong

If all 11 dams are built, then 55% of the Lower Mekong mainstream will be turned into a reservoir

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Important aspects relating to fisheries remain to be addressed:

- Impact of sediment retention on water and fish production
- Impact of changes in species composition on nutrition and income

The magnitude of possible impacts calls, in each country, for **detailed assessment of impacts on food security and livelihoods**, **identification of realistic solutions** and **early development of alternative food supply options** before any decision is taken.
This process would take several years.

Avoidance and Mitigation

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INTRODUCTION

What are the possible avoidance and mitigation strategies for the fisheries impacts of dams?

Which of these strategies are appropriate in the context of the planned mainstream dams on the Mekong?

STRATEGIES FOR AVOIDANCE AND MITIGATION

The focus is often on mitigation only, but avoidance measures can also reduce both impacts and the costs of mitigation.

We detail below 9 types of avoidance and mitigation measures

A) **Before** dam construction

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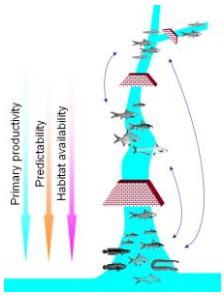
Measure 1: Reassessing dam location

Dams upstream are biologically less damaging than those downstream.

But caveats for the Mekong



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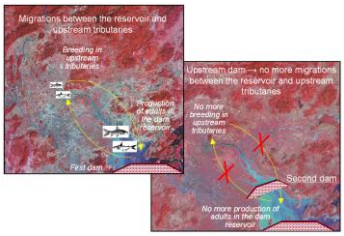
In order to sustain reservoir productivity, tributaries upstream of existing dams should **not** be dammed



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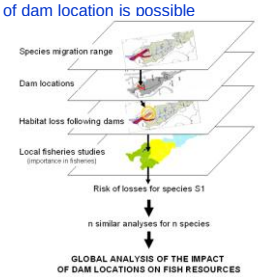
It is critical to maintain at least one intact migration system for fish, from the sea to breeding sites in upstream tributaries

e.g. Vu Gia - Thu Bon system in Vietnam, upstream of Da Nang

An integrated system including fisheries considerationsfor the selection of dam location is possible



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Measure 2: Derivations and integrat

Diversion canals can utilize only a fraction of river volume for hydropower – leaving the natural river intact for fish migrations

E.g.: 18 plants on the Rhone River between Switzerland and France produce ~3000 MW without blocking the river

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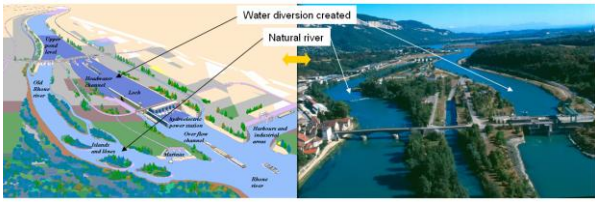
Integrated projects can combine hydropower with several other uses



E.g.: multipurpose river management downstream of Lyon, France

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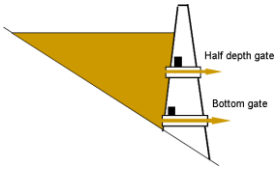
Measure 3: Offtake management

Using multiple levels of offtake from the reservoir can reduce the anoxic condition of water downstream, and increase water quality



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Measure 4: Spillway design and downstream aeration

Spillways can improve improved water quality downstream (re-oxygenation and release of methane)

A) **During** dam construction

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Measure 5: Vegetation clearing

Partial clearing of vegetation is the best option for reservoir fisheries and water quality

Remove 'soft' material → less decay, improved water quality

Leave some 'hard' material → fish habitats/sanctuaries

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Measure 6: Filling schedule

Reservoir filling schedules which block too much of the natural flow devastate river ecology

It is best to mimic pre-project seasonal flows and **not reduce downstream flow by more than 10%**

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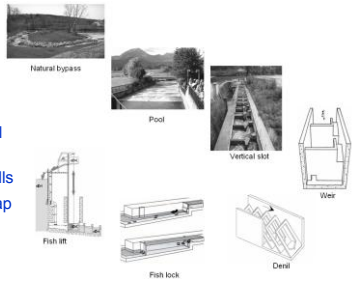
Measure 7: Fish passes

There are **seven types** of fish passes



Migrations:

- ~50 species of commercial long-distance migrants
- 8 pulses/year in Khone Falls
- 30 tonnes/hour in Tonle Sap

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(i) Natural bypass channels

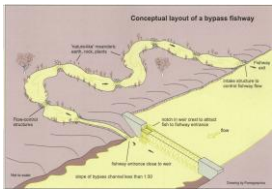
Made via excavation of one of the river banks

Can mimic a 'real' stream

Common in Europe and North America

Only possible in certain areas and for very low dams.

Mekong Mainstream Dams (MMD): possible for Don Sahong.



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Laos

USA

Finland

France

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(ii) Pool fish passes

Divides the height of the dam via a series of staggered pools (steps of 15-40 cm)

Common throughout North America and Europe

Appropriate for passes that must accommodate numerous species; best for low dams (<10m).

MMD: not suitable given the height of mainstream dams

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Colombia river, USA

France

Thames river, UK

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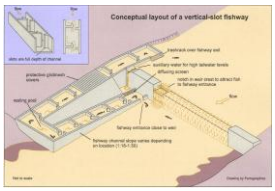
(iii) Vertical slot fish passes

Vertical slots in the baffles allow fish to swim at any preferred depth through each slot

Good for migrations involving multiple species

No proven efficacy beyond 30m high dams

MMD: cannot accommodate the size and diversity of mainstream migrations



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Colorado, USA

Germany

Stung Chinit, Cambodia

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(iv) Weir-type passes

Notches and orifices modulate flow and provide different kinds of passages to fishes

Generally small in size, and often used for salmon in North America

MMD: cannot accommodate the size and diversity of Mekong mainstream migrations

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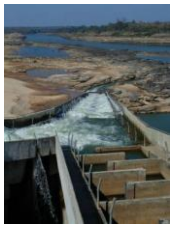
France, Drome



Pak Mun, Thailand (pool and weir type)

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v) Denil-type passes

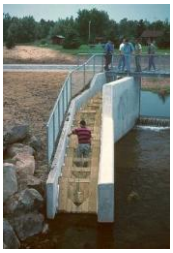
Use spaced baffles on the sidewall and the floor so that current speed does not exceed swimming capability of target species

Useful for large fish species

Mainly used in N. America and W. Europe

Best suited for a maximum height of 30; can tolerate only moderate variations in upstream water level

MMD: too specific, cannot accommodate size of migrations and variabililty in reservoirs



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Scotland, UK

Germany

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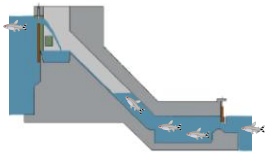
(vi) Fish locks

When fish enter the lock, the lower gates close and the upper gates open

Can be used for dams up to 60m high

The locks have low capacity and depend on the ability to attract fishes

MMD: cannot accommodate the size of mainstream Mekong migrations



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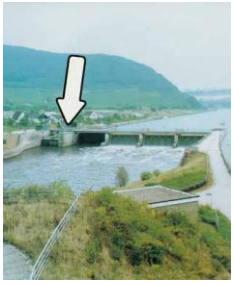

Saar River, Germany

Belver, Portugal

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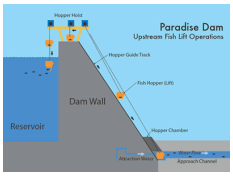
(vii) Fish lifts

Literally lift fish from tailwater up to reservoir

Can be used for very high dams

Suitable only for large fish species; need to attract fish; only a few dozen individuals are moved at a time.

MMD: totally inappropriate given the size and diversity of Mekong migrations



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Paradise dam, Australia

St. John river, Canada

Garonne river, France

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2 remarks about fish passes

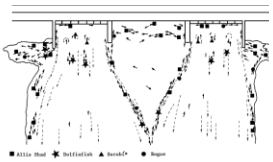
One of the problems is to attract fish towards fish passes

Dimensions of the Mekong at Latsua: 15m x 500m

Dimensions of the fish pass at Lastua: 3m x 10m

Swimming behaviors very considerably between species

Salto Grande dam, Argentina



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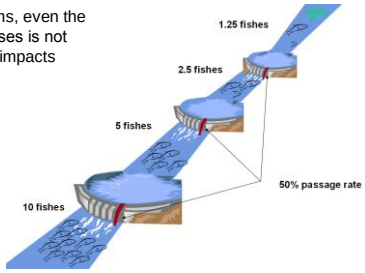
2 remarks about fish passes

In case of successive dams, even the presence of 'efficient' passes is not sufficient to mitigate dam impacts



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"Fishways have a generally poor record in mitigating such impacts […]. In addition, it is impossible to design one fish ladder that can cater for the different biology (e.g., swimming speeds, endurance, urge to move upstream) of the multitude of fishes in a species-rich river such as the Mekong".

MRC 2002 Fisheries in the LMB. Tech Paper no 6.

"It was expected that efficient fish passages would lead to the maintenance of fish populations above reservoirs, without damaging downstream populations. However, this does not appear to be a simple task, as seen so far."

Neotropical Ichthyology, 2007, Special issue on fish passes in South America

"Existing mitigation technology cannot handle the scale of fish migration on the Mekong mainstream"

MRC 2008 Expert consultation on dams as barriers

C) **After** dam construction

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Measure 8: Reservoir aerators

Improved aeration means improved conditions for fish (↓ contaminants, ↑ food production) in reservoir & downstream

Reservoir aeration can become expensive for large reservoirs

(c) Mitigation **after** dam construction

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Measure 9: Mitigation of downstream effects

Concept: mimic pre-dam 'natural' flow conditions

How? Maintain environmental flows of (minimum) 20-50% of pre-project levels

Very complex, requires case-by-case studies to determine appropriate management scheme

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CONCLUSIONS

Many measures aimed at minimizing impacts on fish resources are only possible or effective when considered from the earliest dam planning stages. This is particularly true for dam location and design aspects. **Avoidance measures are the measures which could most reduce impacts.**

While there are promising measures that can help mitigate impacts for small dams and on tributaries, it is clear that **existing mitigation techniques will only address a very small fraction of the dramatic impacts of mainstream Mekong dams on fish resources.**

Thank you!