



Aquatic and terrestrial eco- systems

SEA of Mekong mainstream dams
Regional workshop on SEA Mitigation measures
June 2010
Ho Chi Minh City

Outline of presentation

- Key Issues + Questions + Indicators
- Summary of trends without the mainstream dams
- Summary of predicted impacts on aquatic and terrestrial system
- Mitigation

Key issues

- **Mekong aquatic productivity and biodiversity –**
 - Will changes in aquatic habitats caused by the construction of the mainstream dams reduce the **productivity and biodiversity** of the Mekong aquatic systems?
- **Mekong aquatic ecosystem services –**
 - Will **other ecosystem services** provided by the Mekong River and its floodplain be changed by the mainstream dams?
- **Terrestrial ecosystems and biodiversity:**
 - Will there be significant changes in **terrestrial ecosystems and biodiversity** associated with the hydropower projects on the mainstream?
- **Land use patterns and Agriculture:**
 - How will the mainstream dams influence **land use patterns and agriculture** along the mainstream?

Impact Indicators of key questions

Aquatic systems

- ▣ **Productivity** of aquatic habitats in the Mekong
- ▣ **Biodiversity** of aquatic habitats in the Mekong
- ▣ The capacity of the Mekong's ecosystem **regulating services** – purification and water quality
- ▣ Value of Mekong River's **cultural ecosystem services** – inspiration, recreation and tourism

Terrestrial systems and agriculture

- ▣ **Habitat loss and degradation**, forest cover and protected areas
- ▣ Changes to **patterns of agriculture**
- ▣ Value of **paddy agriculture** in each zone
- ▣ Changes to **agricultural and land use patterns** along the mainstream, especially river bank gardens

Existing situation and trends without mainstream dams - Aquatic

- **Habitat Diversity – Relatively natural at the moment**
 - High diversity and productivity of aquatic habitats – rapids, deep pools, sandbars, in-stream and riparian wetlands, flood plain wetlands – dependent upon flood pulse.
 - The Mekong Basin also extends to the sea to include a “Mekong Plume”
- **Biodiversity Very high**
 - Development of upstream dams in China and tributaries alter the hydrology and patterns of sediment discharge,
 - River morphology and habitats beginning to change and will continue.
- **Water quality - River is relatively clean and in good ecosystem health at present**
 - Increasing point and dispersed sources of pollution
 - Mitigated by the large dilution effect of the river flow.
 - Existing signs of decreasing water quality
 - Water quality expected to decrease in the future with growth of population.
- **Cultural ecosystem services - immense cultural value for Mekong communities and tourism.**
 - Inspirational and religious values
 - Festivals and Recreation values
 - Tourist attraction of a large, dramatic, near-natural river, expected to continue to increase
 - Feature of the GMS tourism strategy

Existing situation and trends without mainstream dams - Terrestrial

- **Forest cover:** extensive forest cover in Zones 1 and 2, decreasing markedly as the river passes through zones 3, 4, 5 and 6
 - But riparian forests generally degraded
- **Agricultural land use** - progressively higher percentage, especially in NE Thailand, southern Laos, and below Kratie in Zone 5 and in the Delta.
 - Government policies - **intensification of agriculture**, with increased irrigation in Laos and Cambodia.
 - In NE Thailand water for **further irrigation is a limiting factor**,
 - Mekong Delta producing **half of the staple food** in VN.
- **Terrestrial biodiversity:** The terrestrial ecosystems recognized as **globally important** for biodiversity
 - Of 2600 km of the Lower Mekong, lengths of over **1000 km are considered as Key Biodiversity Areas**,
 - BUT only about **100 km** of the river actually lies within a nationally protected area.
- **River bank gardens** recognized as an important part of riparian livelihoods,
 - RBG contribution in each zone ranges from **10 – 60 million US per year**.



Predicted Impacts

Predicted Impacts with mainstream dams – aquatic ecosystems

Loss of habitats and biodiversity

- Loss of significant **proportions of aquatic habitats** in zones 2, 3 and 4
- Conversion of river to reservoir
- Loss of fish species that **can not survive under reservoir conditions**
- Increase of species that **can survive and thrive in reservoir conditions**
- Loss of charismatic and **endangered species**, e.g. Irrawaddy Dolphin
- Break in **connectivity** between zones and the sea
- **Blockage** of upstream and downstream movement of fish

Changes in Primary production

- **Reduction of primary productivity** due to in-channel wetlands
- Fish catches in reservoirs likely to **increase initially**, followed by a decline to levels **lower than before**

Predicted Impacts with mainstream dams – aquatic ecosystems

Changes in Water quality

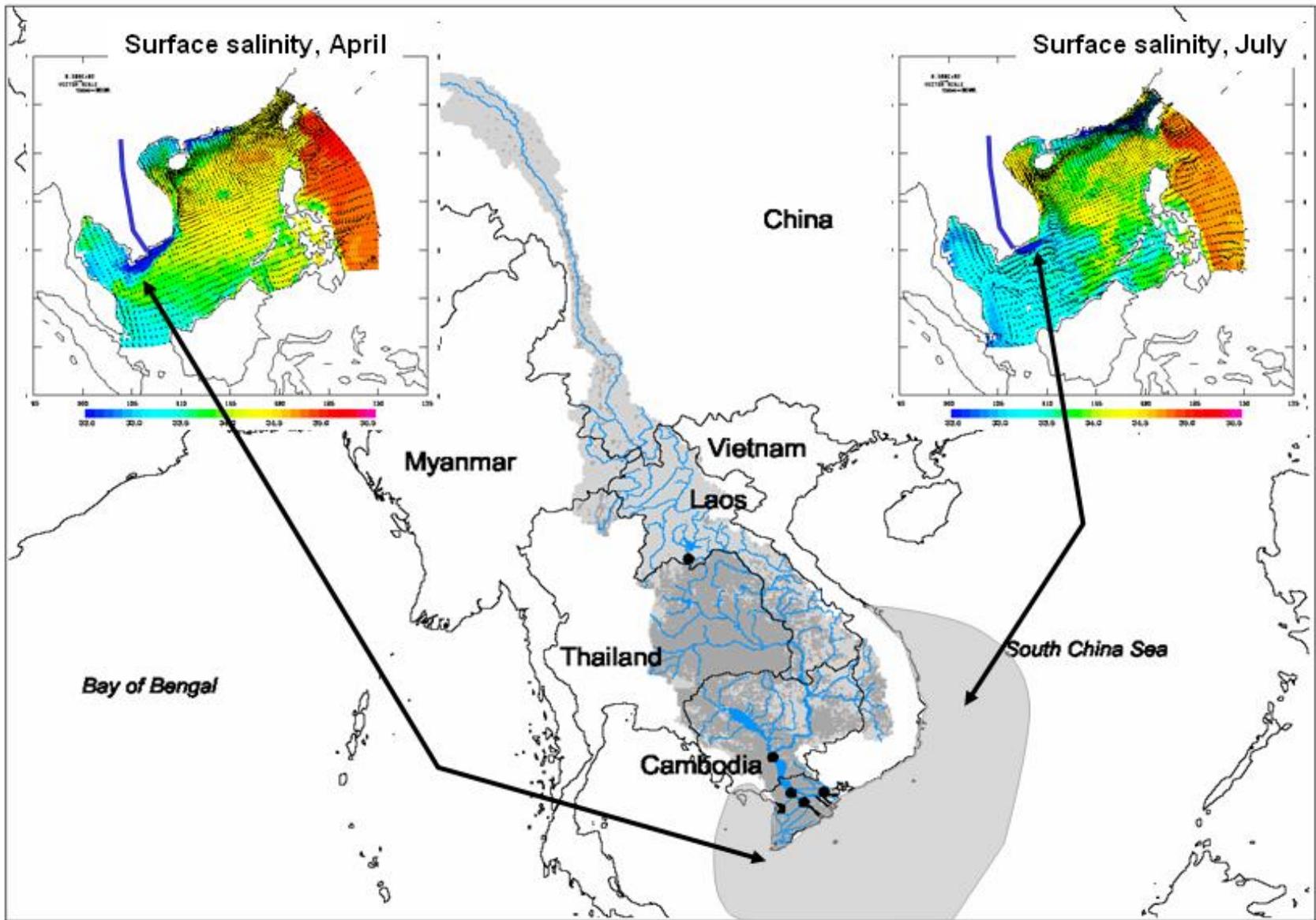
- Risks of **contamination** of river during construction, accidents and spillage, high sediment load, turbidity
 - ▣ Reduced fish production, fish kills,
 - ▣ Reduced ecosystem health,
 - ▣ Reduced quality of water supplies
- **High sediment load** during flushing operations
- Loss of nutrients on fine sediments, **reduced fertility of river and floodplain**
- Lowered indicators of **ecosystem health** downstream of dams

Changes in cultural ecosystem services

- Changes and reduced relevance of river-based **culture and festivals**
- Severely **disrupted river-based tourism** during construction
- Changes in **river-based tourism attractions**

Loss of productivity of the Marine Mekong Plume

- The Mekong Basin **does not end at the coast**, but include a sea area
- **Productivity of the Mekong Plume** depends on nutrients from the Mekong River



Predicted Impacts with mainstream dams – terrestrial systems

Terrestrial biodiversity and protected areas

- Changes in **Key Biodiversity Areas** associated with the Mekong River
- Changes in **Protected Areas and Ramsar sites** associated with the Mekong
- **Landscape** impacts
- Impacts upon **river dependent birds**

Changes in land use and forest cover

- Loss/changes in **wetlands due to inundation**
- Loss of **forest cover** through inundation and transmission lines
- Loss of **agricultural land**

Changes in agriculture and river bank cultivation

- Losses of sediments and **sediment-attached nutrients**
- Increased agriculture **production cost**
- Losses and gains in **irrigated agriculture**
- Loss of **river bank gardens** and source of livelihood



Mitigation Potential

Aquatic ecosystems

- The loss in aquatic biodiversity of the Mekong will be a **permanent and irreplaceable global loss**
- **No avoidance** of impacts on aquatic habitats and biodiversity possible
- **No adequate compensation** can be provided.

Decision to go ahead with the mainstream dams in full knowledge of this loss

Terrestrial ecosystems

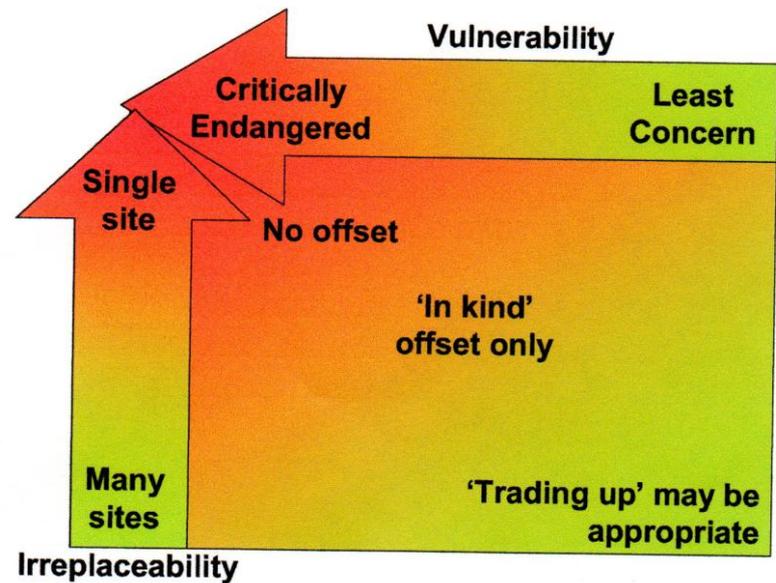
- For upstream of the Delta:
 - Most impacts **can be mitigated or compensated**
 - Many impacts are **locally specific to each dam** and can be addressed as part of Environmental Management Plans of each dam
- For the Delta, the loss of **food availability** has **national and international food security** implications (rice, inland fisheries, coastal fisheries)

Concept of biodiversity offsets

- A development could compensate for loss of biodiversity and ecosystem services in one location by supporting protection and management of biodiversity in another area – **a biodiversity offset**
- The goal - no net loss, or preferably a net gain, of biodiversity on the ground for:
 - species composition,
 - habitat structure and
 - ecosystem services, including livelihood aspects.

But some biodiversity can not be offset

- Potential for offsets is limited for Mekong, aquatic ecosystems
 - ▣ Globally important river
 - ▣ Unique habitats likely to be lost
 - ▣ Endangered species likely to become extinct





Avoidance and mitigation measures

Studies and Research required to support decisions

- Review, survey and **classification of aquatic habitats** in whole Lower Mekong (biodiversity and ecological importance)
 - ▣ Identify key **biodiversity hotspots** on Mekong mainstream
 - ▣ **Prioritise** key tributaries for the ecosystem integrity and health of the Mekong, highlighting those affected by proposed mainstream dams
- Assessment of the **ecological importance and productivity** of the seasonally exposed in-channel wetlands
- Research to enhancement of **multiple use of reservoirs**, including irrigation, navigation, fisheries and potential **downstream consequences of water diversion**.
- Research on **values of nutrients attached to sediments** and increased of **agriculture production cost** due to loss of natural nutrients.
- Systematic assessment of Mekong fish **species that can survive** in hydropower reservoirs, and those that will not.

Studies and Research required to support decisions

- Cultural ecosystem services - Systematic review of all **cultural assets** associated with Mekong and with specific sites
- Carry out market assessments and feasibility studies for enhancing the **diversity of river-based tourism attractions** and recreational facilities of dams and reservoirs when constructed

Capacity required to support decisions

Specifically

- Cambodia to **inform Ramsar Convention** to put Stung Treng on Montreux Record of globally important wetlands at risk and to review status in light of decisions to build Sambor and Stung Treng dams, and Don Sahong

More generally:

- Improve the **quality of EIAs** to include comprehensive habitat, biodiversity and ecosystem assessments (not just fish)
- Improve **capacity of regulating agencies** to appraise biodiversity and ecosystem assessments
- Establish standards for monitoring of aquatic ecosystem and biodiversity and ensure that these are carried out to **establish a baseline** at least one year (or more) before construction starts
- Compile and assess all ecosystem and biodiversity **monitoring records from all hydropower schemes** on an annual basis – MRC to analyse and publish the results
- EIAs to include assessment of **river-based cultural assets**, sites and festivals

Recommendations for MRC prior notification and consultation process

- Establish a **regional framework** for protection and management of critical reaches of the Mekong and its tributaries
 - with and without mainstream dams
- Establish ecologically acceptable **measures for flow variation** discharged from the mainstream dams
- Establish environmentally acceptable **standards and guidelines for sediment flushing** from the mainstream dams
- MRC to undertake a **sustainability assessment of each dam** proposed for PNPCA process, using HSAP (hydropower sustainable assessment protocol)

Decisions at national and regional levels

- National governments to establish **protected reaches** of the Mekong River system.
- Specific **compensation measures** for loss of landscape amenity and aquatic biodiversity (Pha Taem and Phou Xiang Thong protected areas (Ban Koum))
- Consider **multiple use of the reservoirs**, in full knowledge of consequences of diversions of water on downstream areas (saline intrusion, acidification in the dry season)
- Ensure fair **compensation and/or alternative measures** for replacement of **river bank gardens** applied throughout the LMB
- Develop compensation measures for the **loss of agricultural and fishery productivities** in the Delta.

Construction

- Establish clear guidance for good **environmental management of construction activities**,
 - ▣ monitor the performance of contractors and developers and
 - ▣ ensure compliance
- Ensure that contractors and developers have **emergency response plans** in place, equipped and staff trained.
- Monitor **fish catches and aquatic ecosystem health upstream** and downstream of dam sites before and during construction, compile and publish results for all dams
- Monitor **agricultural productivity** in the Mekong Delta.
- Phase construction activities to **minimise disruption** to river-based tourism activities
 - ▣ provide alternative river based transport around the dam sites
- Assess and develop measures for **compensation of loss of tourism incomes** during construction phase, including for small-scale tourism service providers

Construction

- Provide adequate compensation for **loss of agricultural land** (dam site, inundation, access roads and transmission lines)
- Provide adequate replacement or **compensation for loss of access to river bank gardens**
- Compensate for **loss of forest land**, by replacement planting on degraded land near the lost land
- Review **lost wetland types** and attempt to re-create lost wetlands adjacent to the reservoirs

Operation

- Monitor **performance of dam operators** and ensure compliance with agreements and regulations in flow variability and sediment flushing
- Monitor **passage of fine sediment** and associated nutrients down the system, including in **the Mekong Plume**.
- Monitor **fish catches and aquatic ecosystem health** upstream and downstream of dams and in reservoirs, compile and publish results for all dams
- Monitor **fish catches in the Mekong Plume**
- Monitor **sediment load downstream and agricultural productivity** in the Mekong Delta
- Enhance the **ecological diversity of habitats** in reservoirs,
- Assess **discharges of effluents that may affect reservoir water quality** and develop treatment
- Establish and maintain measures for protection of **river-based cultural assets**, sites and festivals
- Ensure **compliance with standards** for compensation/replacement for river bank gardens

Institutional Issues

- MRC has key role in:
 - Carrying out **research and surveys on key components** of the aquatic and terrestrial ecosystemch
 - Development of **frameworks for protection of key habitats** of the river
 - Guidance for **flows and sediment flushing** of dams
 - **Analysing and publishing results of monitoring impacts** of all dams on Mekong – especially ecosystem health, fisheries, agriculture on annual basis
 - **Sustainability assessment** of dams for PNPCA process
 - **Culture and tourism** protection and development
- Ministries of water, environment, natural resources, agriculture, forestry and fisheries have responsibilities for
 - Ensuring the **quality of EIAs and EMPs** and management
 - Application of the **frameworks standards and guidelines** developed by MRC
 - **Ensuring compliance of dam developers, contractors and operators** with regulations, standards and agreements

Institutional Issues

Catchment Boards:

- The reservoir and the land surrounding them should be managed more sustainably and productively
- This **can NOT be the sole responsibility** of the dam operators
- Each dam or cascade of dams should have **a catchment and reservoir management board**
- **Membership** should include representation of dam operators, ministries or provincial departments of forestry, agriculture, fisheries, water resources, riparian communities, fishermen and farmers organisations
- Responsibility for **management of catchment, recreation of wetlands and improvement of habitat and biodiversity in reservoir.**
- Should be **established before** construction starts
- Activities should be financed from **dam operational budget**