



Mekong River Commission

For Sustainable Development



SUMMARY

STATE OF THE BASIN REPORT 2018

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Foreword

The Mekong River Commission's (MRC) State of Basin Report is a flagship product of the organisation and an integral part of the MRC's strategic planning cycle. Compiled about every five years based on the facts and figures of the available data and information, the report assesses conditions within the basin and the impacts, both positive and negative, that development and use of the water and related natural resources are having. The report thus provides a comprehensive basis for the Member Countries and other key stakeholders to discuss and determine appropriate actions by which to realise the MRC's aims for optimal and sustainable development of the basin as set out in the 1995 Mekong Agreement.

This is the third State of Basin Report published by the MRC, but the first to be presented within a new framework of a comprehensive and consistent set of indicators that address all aspects of the MRC's mission. The MRC's Indicator Framework and this report cover five critical dimensions associated with this mission: environmental, social and economic conditions, climate change and cooperation. In addition, and for the first time, this SOBR includes a review of conditions within the upper basin, known as the Lancang Basin in China.

This report recognises that, in recent years, development pressures have increased as a result of growing populations and expanding economies. Whilst living conditions within the basin generally are rapidly improving, this has come at some considerable cost to the environment. Key areas of concern that require our specific attention are the seemingly permanent modification of mainstream flow regime, the substantial reduction in sediment flows due to sediment trapping, the continuing loss of wetlands, the deterioration of riverine habitats and the growing pressures on capture fisheries. At present, although temperature and sea level rise are the only discernible impacts of climate change within the basin thus far, I am pleased to note that Member Countries are actively putting measures in place to address the predicted future changes.

This report also recognises that use of the water and natural resources within the basin is giving rise to substantial economic benefits. At present, we should take note that these are not equally shared as some Member Countries have only recently started to develop their potential. Concerns naturally exist, however, at the evident trade-offs between some of these developments and their negative impacts upon the environment.

The 1995 Mekong Agreement recognises the need for active cooperation between Member Countries in order to achieve their collective aims for the basin. Whilst the foundations for cooperation have been established through the joint efforts of all parties, we must all take note that the challenges identified in this report underscore the need to further strengthen cooperation through enhanced basin planning and strengthened ties with the upstream dialogue partners. Furthermore, I also recognise that increased efforts are needed to find better and more cost-effective ways for the MRC to fulfil its core function of monitoring relevant conditions within the basin.

In the light of the above, this State of Basin Report concludes by offering six key recommendations for Member Countries, partners and stakeholders to consider when next updating the Basin Development Strategy:

- A. Continue and enhance monitoring of flow conditions and water quality
- B. Develop and implement a MRC Data Acquisition and Generation Action Plan
- C. Address the problem of reduced sediment concentrations
- D. Address the need to take urgent action to preserve and protect remaining environmental assets

- E. Adopt a more proactive approach to basin planning and the management of trade-offs between sectors and countries
- F. Maintain and strengthen cooperation with Dialogue Partners and other stakeholders

I do believe that this State of Basin Report, with its new approach structured around the MRC's Indicator Framework, does indeed provide us with a comprehensive overview of conditions within the Mekong basin. It brings into focus critical issues we must seek to address in the coming years if we are to truly fulfil the aims and objectives set out in the 1995 Mekong Agreement.

I am also pleased to note that much new and up-to-date data and information have been collected during the development of this document. However, it is important for readers to note that, in the absence of verification by the Chinese Government, we must be circumspect over the quality and reliability of data and information used for the Upper Mekong Basin. Thus, whilst we have sought to provide for the first time an indication of the complete picture of the status and trend in the Mekong Basin as a whole, the information on the Chinese part of the basin may be subject to further refinement and may not be applicable for use beyond the scope of this report.

I look forward to all parties working together to build upon this report and to agree and implement necessary actions that will serve to enhance the state of the basin to the benefit of all future generations.

An Pich Hatda
CEO of the Mekong River Commission Secretariat

The Mekong River Basin

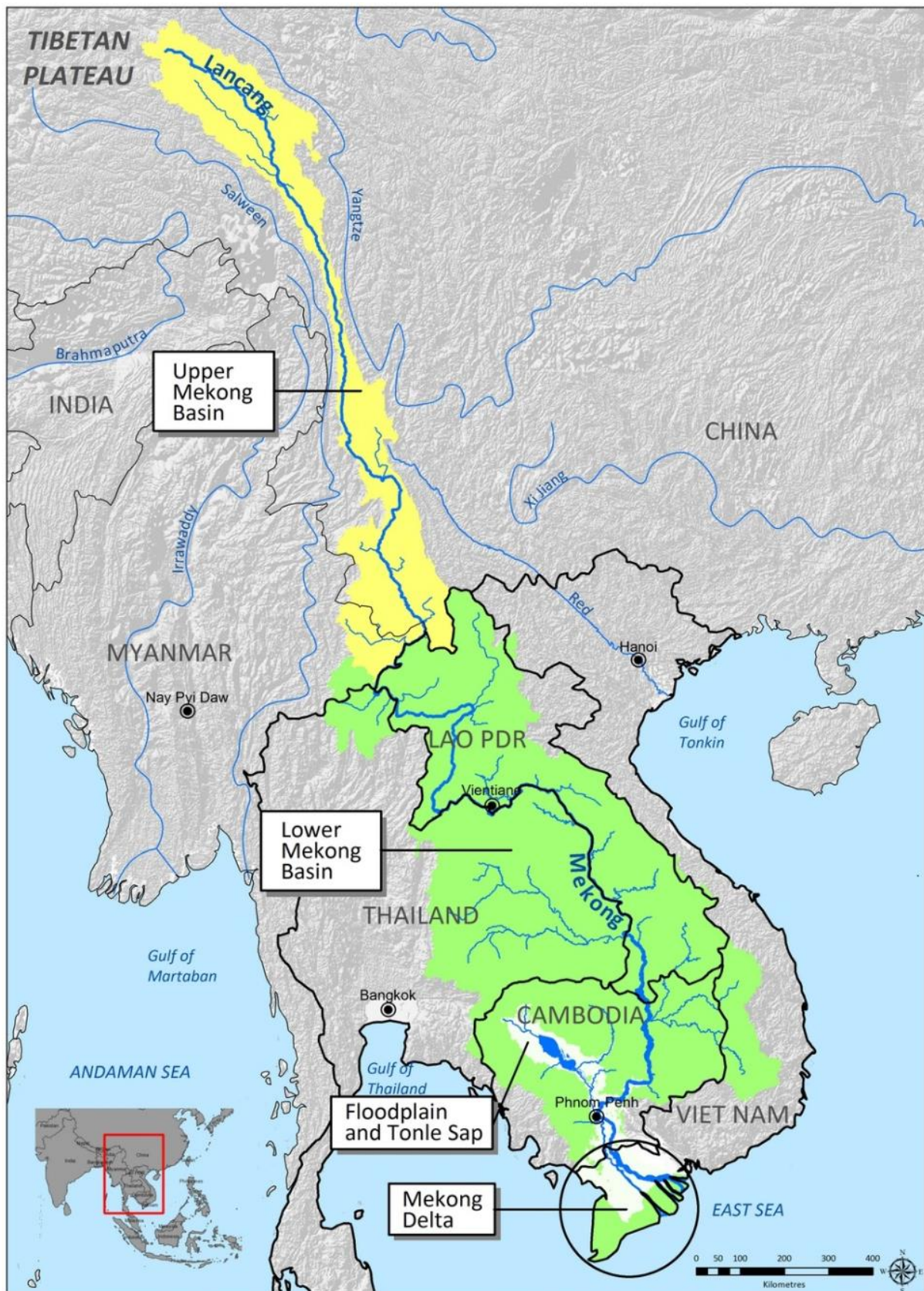


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1. Introduction

The Mekong River Commission's (MRC) State of the Basin report (SOBR) aims to provide an overall picture of the Mekong River Basin in terms of its ecological health and the social and economic circumstances of its people, and the degree to which the cooperation between riparian countries envisaged under the 1995 Mekong Agreement is enhancing these conditions. In addition, and for the first time, this report also includes reviews of conditions within the upper basin in PR China and Myanmar, both dialogue partners of the MRC, in order to better understand the dynamics of change that are occurring within the basin.

The refreshed strategic planning process adopted by the MRC has facilitated the Member Countries to collaboratively explore ways by which optimal and sustainable development may be achieved and regional benefit sharing promoted. The process follows a five-year planning cycle in which the SOBR is to be a key input for the updating of the Basin Development Strategy. In this planning cycle, the SOBR can be seen as an instrument in: (i) establishing the key issues that the next Basin Development Strategy should address and (ii) measuring the effectiveness of implementing the current Basin Development Strategy (2016-2020).

In this regard, the SOBR is intended to provide (to the extent that data are available) a statement of past trends and current conditions within the basin, which will be updated and compared at five yearly intervals to track changes brought about by the cooperation envisaged under the Mekong Agreement. The SOBR also seeks to highlight significant issues as well as apparent development opportunities that the Member Countries may wish to take up. Further studies, such as future scenario assessments as were undertaken under the BDP Programme in 2011 and more recently under the Council Study in 2017, are likely to be needed thereafter to determine the best way by which to address the issues and opportunities raised in the SOBR¹.

In contrast to earlier versions of the SOBR published in 2003 and 2010, the 2018 SOBR and future SOBRs are to be structured around a set of indicators, referred to as the MRC Indicator Framework. The framework comprises a hierarchy of water related strategic and assessment indicators supported by monitoring parameters, all of which are intended to provide a full and integrated picture of how the cooperation between countries through the MRC is benefiting and impacting upon the basin and each country. This framework will also be used when future basin-wide scenarios are assessed to ensure a consistent approach to planning and monitoring of basin developments.

At the highest level, the MRC Indicator Framework is structured around five dimensions, being environment, social, economic, climate change and cooperation, within which 15 strategic indicators (see box) have been agreed by the Member Countries to provide policy level decision takers with a concise set of information

Dimension	Strategic indicators
Environment	<ul style="list-style-type: none"> ▫ Water flow conditions in mainstream ▫ Water quality and sediment conditions ▫ Status of environmental assets ▫ Overall environmental condition
Social	<ul style="list-style-type: none"> ▫ Living conditions and well-being ▫ Employment in MRC water-related sectors ▫ Overall social condition
Economic	<ul style="list-style-type: none"> ▫ Aggregate economic value of MRC water-related sectors ▫ Contribution to basin economy
Climate change	<ul style="list-style-type: none"> ▫ Greenhouse gas emissions ▫ Climate change trends and extremes ▫ Adaptation to climate change
Cooperation	<ul style="list-style-type: none"> ▫ Equity of benefits from the Mekong River system ▫ Benefits derived from cooperation ▫ Self-finance of the MRC

¹ In the MRC's planning cycle, the SOBR normally precedes scenario assessment, which in turn underpins the updating of the Basin Development Strategy. In the current period, a preliminary version of this SOBR was prepared in 2015, in advance of concluding the scenario assessments under Council Study in 2017, thus preserving the sequence of the MRC's planning cycle.

relating to the development and management conditions within the basin. Underpinning these strategic indicators, some 55 draft assessment indicators were selected to provide more detailed information and to support the evaluation of the strategic indicators. This report follows this structure and seeks to quantify and/or provide commentary on each of the strategic and assessment indicators.

2. Environmental Dimension

Three strategic indicators have been selected to characterise the environmental conditions within the LMB. These are:

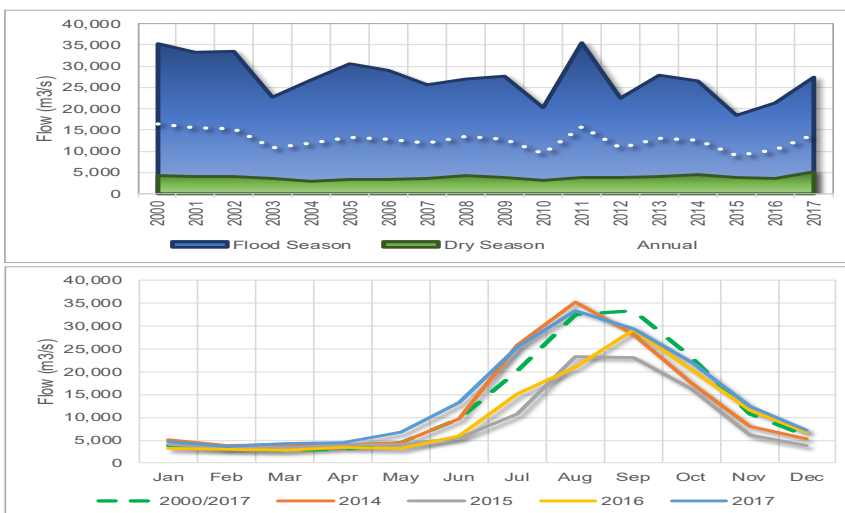
- Water flow conditions in mainstream
- Water quality and sediment conditions
- Status of environmental assets

(i) Water flow conditions in the mainstream

The condition of mainstream flows is regularly monitored in accordance with MRC’s Procedures (and Guidelines) for the Maintenance of Flows on the Mainstream (PMFM). The Guidelines set thresholds within which flows are expected to be maintained. In addition, the timing and onset of wet season flows is

considered a valuable indicator as it influences, *inter alia*, the triggering of fish migration.

Trends in stream flow at Kratie



It was found that both **dry season and wet season flows** over the last five years are generally in conformity with PMFM thresholds, with occasional but apparently not systemic exceptions. **Reverse flow in Tonle Sap**, which is a function of the size of floods in the mainstream pushing water up to the Tonle Sap Lake (which then flow back out during the flood recession period), are also broadly in line with the

Guidelines, with the maximum (severe) flow threshold breached on average 10 days per year and the more modest low flows threshold somewhat more frequently. Continued monitoring is recommended, particularly with respect to Tonle Sap reverse flows. It is noted also that the **timing of onset of wet season flows** has been quite variable in recent years along with the lengths of the wet season. It is also observed that **below average flows are seen during the flood recession period**, particularly in the downstream reaches of the mainstream.

Whilst the findings above demonstrate that the requirements of the PMFM are generally being met, the flow monitoring data for Chiang Saen (the northern most station in the LMB mainstream) shows that, although total annual flow volume remains broadly the same, flood season flows have reduced somewhat and the dry season flow is markedly increased following the development of the large reservoirs in China. The data for Kratie show a similar but less marked increase in dry season flows. However, the data for Tan Chau show no discernible trend as yet, notwithstanding the increases predicted in both the modelling undertaken in MRC’s Scenario Assessments reported in 2010 and the recent MRC Council Study in 2017.

In part the reasons behind this are that the augmentation of dry season flows provided by the reservoirs of the Upper Mekong Basin (UMB) becomes a smaller proportion of the total flow the further downstream this is

considered. Furthermore, the dry season flows at Tan Chau are influenced, especially in the early part of the dry season, by outflows from Tonle Sap, which are in turn a function of the magnitude of the preceding flood season flows (2015 was a particularly mild flood season). The variability of Tonle Sap outflows is of a similar magnitude to the predicted flow augmentation at Tan Chau.

Previous modelling studies predicted that, in the short term (2020), the UMB dams plus the other existing and under-development storages in the LMB, would provide sufficient storage to regulate mainstream flows in a manner that would allow for a significant increase in abstractions upstream of Tan Chau (in line with national plans) without diminishing critical dry season flows into Viet Nam. Beyond 2020, further development of tributary storage was thought to be needed to cope with long term irrigation development plans of the countries. Such a conclusion, if shown correct, is of immense significance in so far as, in contrast to many river basins around the world, there appears to be sufficient resource to meet all likely future consumptive demands with only a relatively small further increase in LMB tributary total storage.

The evidence presented in this SOBR is that, thus far, the predicted modest augmentation of dry season flows at Tan Chau is not yet evident, bringing into question whether the earlier modelling studies provided a correct forecast of flows or not. Either way, this evidence raises the question as to whether additional abstractions upstream can be countenanced or not at this time.

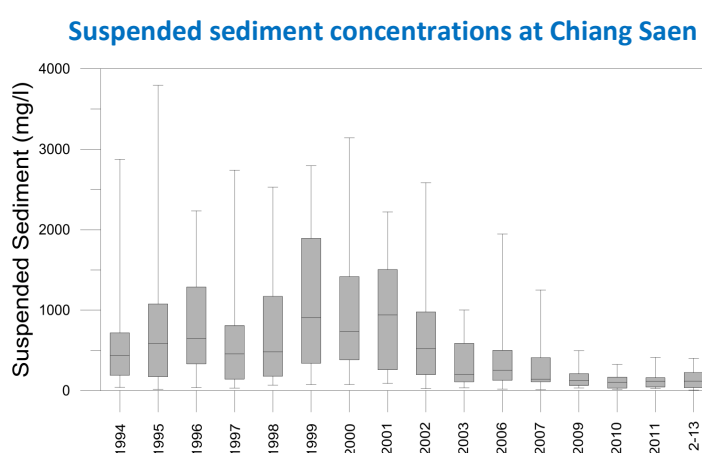
(ii) Water quality and sediment conditions

Water quality conditions within the LMB are regularly monitored in line with the MRC's Procedure for Water Quality Monitoring (PWQ) and Technical Guidelines (TGWQ), taking into consideration the requirements for human health, aquatic life and agricultural use. Between 2010 and 2017, water quality for the protection of human health was almost always good or very good along the mainstream, with only a few stations during 2010-14 occasionally having a lower but still acceptable rating.

For aquatic life, records for 2010-17 show that the average rating across all stations has been good, with only one station in Viet Nam, My Tho, having consistently a lower rating due to failure to meet targets for total phosphorous and nitrate-nitrite. For agricultural use, over the same period, again only one monitoring station, My Tho again, was rated less than very good. This was due to a failure to meet the target for electrical conductivity in 2016 only.

The data show no apparent trend over time and therefore there should be no immediate concern over water quality conditions within the LMB in the near future. Nevertheless, with increasing industrialisation, growth in urban centres and rising fertiliser and pesticide use, continued monitoring of water quality is recommended.

Suspended sediment concentrations have been monitored since 1994, demonstrating that the concentration and the variability of suspended sediment have decreased considerably since 2001. At Chiang Saen, sediment flows have decreased from about 85 Mt/yr to 10.8 Mt/yr, meaning that the sediment contribution from China to the Mekong mainstream sediments has decreased to about 16% of all sediments in the LMB as compared to about 55% historically. A similar trend is seen downstream at Pakse, where average loads have decreased from 147 Mt/yr to 66 Mt/yr between 1994 and 2013.



These changes in sediment concentrations, brought about by the construction of storage reservoirs principally in China, signal a substantial and seemingly permanent change in the river's morphology. Impacts of these changes can be expected all along the river as it seeks to readjust to its new regime. Furthermore, few nutrients will reach the remaining wetlands and the delta and coastal building processes will be modified. Understanding how these changes will impact on the river, the environment and the socio-economic development of the LMB needs to be strengthened, so that coping strategies can be determined.

Salinity intrusion within the Viet Nam delta is a function of the flow volumes that reach Viet Nam. Typically, each year, a total of 1.85 million ha are affected annually by elevated salt concentrations. There are no time-series data available to demonstrate whether there are any trends in the extent of area affected, although the fact that dry season flow volumes at Tan Chau have changed little in recent years suggests that the area affected is unlikely to vary much.

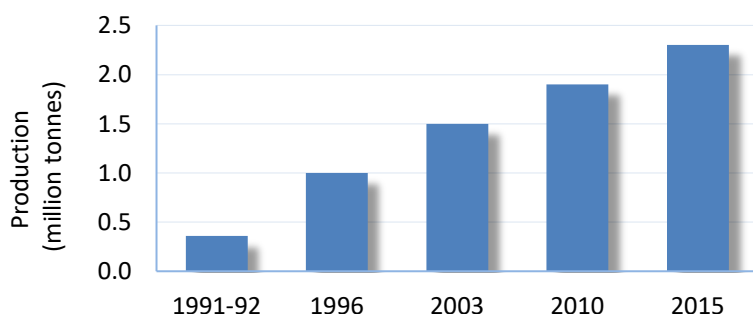
(iii) Status of environmental assets

The **LMB wetlands** are important biodiversity hotspots which play an important role in the economy, society and culture of the region. Nevertheless, LMB wetlands are being gradually either lost or degraded, mostly as a result of agricultural and other developments. With a little over 100,000km² of wetlands left in the LMB in 2010, MRC has estimated that less than two per cent of the original wetland area in the Mekong Delta remains. Data for the extent of wetlands in 2015 are being compiled at present and are expected to show a continued reduction in area. If this trend continues, the remaining wetlands may all but disappear, with the consequent impacts that will have on the bio-diversity of the basin. Steps are urgently needed to go beyond assessing individual projects and to develop a strategy by which all, or at least a large number, of the remaining wetlands can be both protected and nurtured on behalf of future generations.

Exposed sandy and rocky **riverine habitats** are important habitats for vegetation, herpetofauna and birds in the dry season. Deep pools in the LMB are recognised as important geomorphic features, providing refuge and spawning habitat for a variety of fish species. Whilst no up-to-date information is available to state whether there has been a significant change overall in their condition, it is expected that rising dry season water levels from increased flow regulation, together with backwaters from planned reservoirs and the resulting changes in sediment concentrations, pose a threat to these environmental assets. Well-prepared and sensitive design guidance remains important to minimise these potentially damaging impacts remains important.

The Mekong River system hosts one of the most diverse and prolific **freshwater capture fisheries** in the world. Recent estimates of the biota of the greater Mekong region include up to 1,148 species of fish, as well as 20,000 plant species, 430 mammals, 1,200 birds and 800 reptiles and amphibians. However, accelerating

Total capture fisheries production in the Lower Mekong



economic development, population growth and increased consumption patterns are placing pressure on the environment. Currently, 14 species listed as critically endangered (including the Irrawaddy dolphin and Mekong giant catfish), 21 species are listed as endangered and a further 29 species are considered vulnerable.

Over the last decade and a half, the amount of reported wild fish catch has risen from 0.4 MT in 1991-92 to 2.3MT in 2015. However, fishing effort has increased and smaller fish now make up an increasing proportion of the total catch. Separately, with increased urbanisation, changing consumption patterns and growing export markets, the aquaculture sector is growing rapidly and is increasingly important to the basin's economy and food security. **Aquaculture production** has grown

significantly from 0.7 MT in 2002 to 2.1 MT in 2012, 86% of which was in Viet Nam. With growing pressures on capture fisheries from new developments and increased consumption, a proactive approach is needed to manage the sector in a sustainable manner.

Ecologically significant areas encompass a range of different ecosystem types, including rivers, wetlands, forests and grasslands. A substantial number are under some form of protection as Ramsar sites, biosphere reserves, national parks and others. After decades of declining forest cover there are recent signs of an increase in forested area, especially in Lao PDR. Increasing protection for important natural habitats should over time help support the LMB's threatened plants and animals. Connecting habitats through biodiversity corridors and taking a cooperative landscape approach to management and enforcement of regulations with the engagement of local communities will be important.

3. Social Dimension

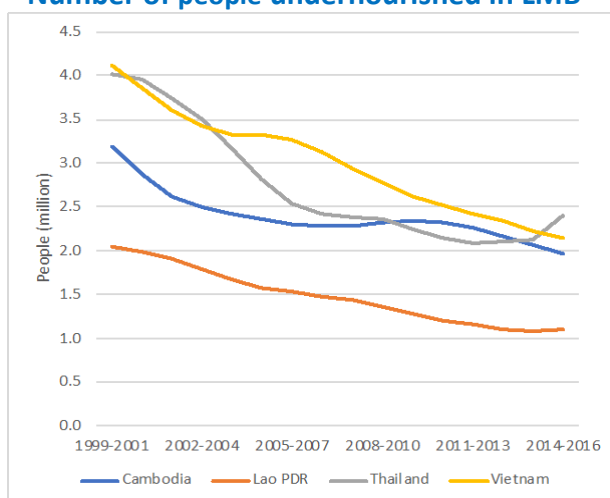
Two strategic indicators have been selected to characterise the social conditions within the LMB. These are:

- Living conditions and well-being
- Employment in MRC water-related sectors

(i) Living conditions and well-being

Living conditions and well-being are characterised in this report in terms of **food, water and health security and access to electricity**. At present the analysis for some strategic and assessment indicators is limited due to a lack of socio-economic data, both in terms of applicability to conditions within the basin and the degree

Number of people undernourished in LMB



of disaggregation of those data to identify variability within the basin. As a result, the approach taken here uses the best available evidence, often national level data, in the cases of some monitoring parameters diverging from the approach required by the Indicator Framework. Examples are also provided of specific situations in individual Member Countries of data available within the LMB. It is to be noted that further development of this analysis along the lines envisaged by the indicator framework will require significant additional data.

That said, overall living conditions and well-being the in LMB have improved significantly over the last fifteen years. All countries have experienced improvements in **food security** with greater access to adequate levels of nutrition, declines in

undernourishment and declines in levels of malnutrition. Indicators of **water security** have generally improved, including access to potable water supplies. Although drought susceptibility remains a problem in some areas, this may be off-set by a decline in dependence on agriculture for livelihoods.

There are some indications that **damage due to flooding** is increasing, although again this may be the result of greater investment in the region putting more capital assets at risk. Health security indicators have also seen improvement in terms of improved access to basic sanitation and access to health services.

Health outcomes have seen significant improvements with declining mortality rates and increased life expectancy. **Access to electricity** has also improved rapidly, Thailand and Viet Nam have close to 100% access even in rural areas, and Lao PDR has improved access significantly in recent years. Cambodia has made improvements in electrification but continues to perform badly, with low levels of service particularly in rural areas.

Nevertheless, there remains **significant variation in performance between LMB countries** largely reflecting the differing stages of development. There is also likely to be substantial sub-national variation in performance which is not picked up by these largely national level indicators.

(ii) Employment in MRC water-related sectors

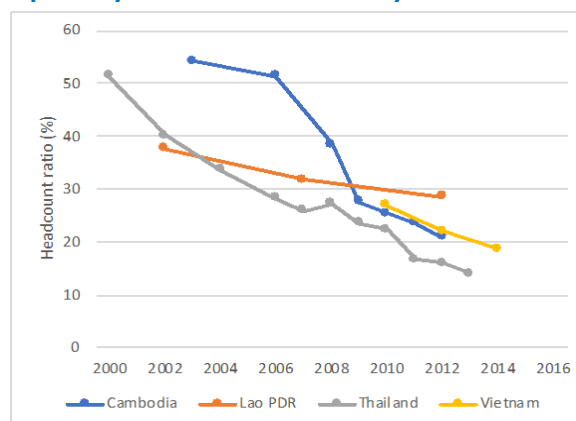
Employment in MRC water-related sectors is assessed in terms of **economic security** and **gender equality in employment and economic engagement**. As above, insufficient data have been made available to fully address the requirements of the Indicator Framework and to explore the assessment indicators to the depth they merit.

The main water related economic sectors in the LMB are agriculture, fisheries and navigation and to a somewhat lesser extent, hydropower, tourism and forestry. **Employment in water related sectors** in the LMB remains high, although the importance of direct employment, particularly in agriculture is declining as work opportunities in other sectors (often services and manufacturing located outside the LMB) develop. Employment in capture fisheries also remains important for livelihoods, although often as a source of secondary or supplemental employment. Tourism also stands out as an important source of employment in the LMB, and one that is likely to grow rapidly. Employment in navigation is also likely to be significant in some parts of the basin, such as the delta and potentially to grow rapidly in the future.

At the same time, the **poverty rate** has fallen dramatically across all LMB countries, approximately halving in the last decade and by around three-quarters since the turn of the century. This indicates increased economic security across the basin and is probably linked closely to changes in patterns of employment and improved productivity in the primary sectors.

Limited evidence on **gender equality** in employment and economic opportunity has been available. Gender disaggregated data on employment in agriculture and related sectors points to small but persistent differences in male and female employment patterns. However, the implications of these differences are difficult to interpret with regard to gender equality. The Gender Parity Index (GPI) for primary school enrolment, on the other hand, is a concrete indicator of continuing gender disparities in the region, with boys clearly getting preferential access to primary education, particularly in Lao PDR and Cambodia.

Rural poverty headcount ratio at national poverty line from LMB country national data



Overall, available data points to general improvement across most social indicators. However, the analysis is limited by the lack of comprehensive sub-national data for the LMB. It is likely that there is significant variation in terms of all indicators at the provincial and sub-provincial level.

Understanding this geographic variation is critical to achieve a better understanding of the causal factors determining these outcomes, and ultimately the design and targeting of appropriate policy interventions. Moreover, the availability of sub-national data would allow the development of more accurate estimates of indicator values for the LMB than is currently the case when using national level data. This approach is particularly problematic for Thailand and Viet Nam, for which the population within the LMB only constitutes a small share of national population.

4. Economic Dimension

Two strategic indicators have been selected to characterise the economic conditions within the LMB. These are:

- Aggregate economic value of water-related sectors
- Contribution to basin economy

(i) Aggregate economic value of water-related sectors

This Strategic Indicator is defined as the net economic output of water-related economic sectors in the Lower Mekong Basin. However, for the purposes of this report, and due to data limitations, this has been modified to the “gross economic output of water related sectors in the LMB”. Not all sectors have been possible to assess so far due to data limitations.

Irrigated agriculture is the main water user in the basin. It has grown from virtually nil in the 1950’s to in excess of 5.7 million hectares (Mha) in 2013 (nearly 80% of which is in Viet Nam), with a total economic value of US\$ 7.7 billion per year. As noted above, obtaining accurate figures on irrigation and irrigated coverage is not easy, particularly given that significant amounts of irrigation are in small schemes, which are not necessarily included in the official records. However, given the likelihood and significance of further expansion of irrigation, improved monitoring appears to be very important to guide strategic management of the basin.

The Mekong basin has considerable potential for **hydropower development**, serving both domestic and export markets, enhancing both regional economic integration and energy security. By 2015, 59 hydropower projects of between 1 MW and 4,200 MW had been developed in the LMB with a total installed capacity of 10,017 MW, representing some 35% of the total estimated technical hydropower potential for the LMB. The gross economic value of hydropower production has increased from US\$ 0.55 billion per year in 2005 to over US\$ 2 billion in 2015 (excluding investment and other related development costs), over 50% of which accrues to Lao PDR with a further 40% to Viet Nam.

The Mekong River has long been an important **inland waterway for traditional cargo and passenger transport** between the numerous riverine communities along the Mekong. In addition, the river has also emerged as an increasingly important international trade route connecting the six riparian states, and the lower reaches of the basin to the sea and wider international markets. The IWT cargo in 2007 was worth US\$ 6.8 billion annually and, notwithstanding stiff competition from road transport, IWT cargo has since risen to 23 million tons in 2014. Over the same period, total passenger numbers have risen from 37.6 million annual to 69.4 million, over 800,000 of whom were tourists.

Sand mining in the LMB is extensive and provides a critical input into construction and industrial sectors. Extraction of sand in the region has increased rapidly with the increased demand, much having been driven by infrastructure upgrading on the delta, as well as for export to regional markets. Data for sand and sediment mining activities in the basin is not systematically collected, but the sector is believed to be worth in the order of US\$ 175 million annually.

An evaluation has been made of **wetlands** and the services they provide. Although there are a number of caveats to the method used, the annual value of wetlands in 2010 is estimated to have been US\$ 2.9 billion, down from US\$ 3.6 billion in 2003, due to a 20% reduction in the extent of wetlands during that period. It seems probable that the current value is somewhat less for similar reasons.

The overall unit value of **capture fisheries** in LMB is derived from first-sale prices of wide variety of fish species. Based on average first-sale prices in each of the four Member Countries, the economic value of the 2.3 million tonnes of annual capture fish production was calculated at about US\$ 11.2 billion, representing about 65% of the total value of all types of fisheries production. Of this, the economic value from capture fisheries in Thailand is the largest at US\$ 6.3 billion and Cambodia second at US\$ 2.8 billion annually.

The economic value of **reservoir fisheries** is significantly lower based on a yield of 230,000 ton annually worth US\$1.2 billion in 2015, up from US\$ 0.7 billion in 2010. In contrast, **aquaculture** has grown rapidly and was valued in 2015 at US\$ 5.8 billion, up from US\$4.6 billion in 2010 and US\$0.7 billion in 2003. Viet Nam is by far the largest producer, accounting for 86% of the basin's production value.

Timber is an important good supplied from the forests of the LMB. At present, and despite regulation, wood it is not extracted in a sustainable manner in some LMB countries and is a key source of forest loss. Initial estimates made of **forestry** output value in the LMB suggest that the annual sustainable fuelwood production in the LMB 2010 could be worth up to US\$ 0.4 billion, and that by 2016 the gross economic value of annual sustainable timber production in the LMB could be up to an estimated US\$ 1.4 billion.

Since 1980, international **tourism** has developed rapidly in all the LMB countries. Tourism now makes an important contribution to GDP in all the LMB countries ranging from 5% in Viet Nam to 11% in Cambodia. In 2016, the LMB countries attracted around 51 million international visitors generating about US\$65 billion. However, figures for tourism to the LMB specifically have not been available, although the national figures for Cambodia (US\$3.5 billion in 2016) and Lao PDR (US\$0.7 billion in 2016) may provide some guide to international tourism in the LMB in these two countries (but not so in Thailand and Viet Nam as most of their sites are outside the basin). Nevertheless, the value of tourism to the basin is clear, as is the rapid growth in the sector. In this context, it is important to stress the significance of sustaining the riverine environments in order to continue attracting tourists to the basin.

Estimates of **river bank and coastal erosion** have been generated for the LMB countries with the exception of Thailand. These show a wide disparity between estimates of eroded area between countries, reflecting possibly different geomorphological conditions, gaps in the data, and also different assessment methodologies making comparisons difficult. Over the seven-year period the value of land lost in Lao PDR is in aggregate estimated to be US\$ 0.7 million, or about US\$ 100,000 per year. Estimates for Cambodia have not been possible to make and reported losses in Viet Nam in recent years, whilst prompting concern, are very limited. However, coastal erosion is seen as a large and growing problem in the delta, where it has been estimated that 500 ha of land is being lost annually, worth about US\$ 12.5 million per year.

The economic value of **flood damages** is annually reported by the Member Countries for the Annual Mekong Flood Reports. Data for 2010-2014 shows that the annual cost varied between US\$ 0.02 billion (2012) up to US\$ 0.5 billion (2011), with an average of this 5-year period of US\$ 0.2 billion per year. Damages and losses are indicated for floods, in general, but damages and losses related to river floods or flash floods are not specified. While this is too short a time-series to determine a trend with any confidence, there is some indication that damages are possibly increasing, probably as a consequence of greater investment in areas susceptible to flooding.

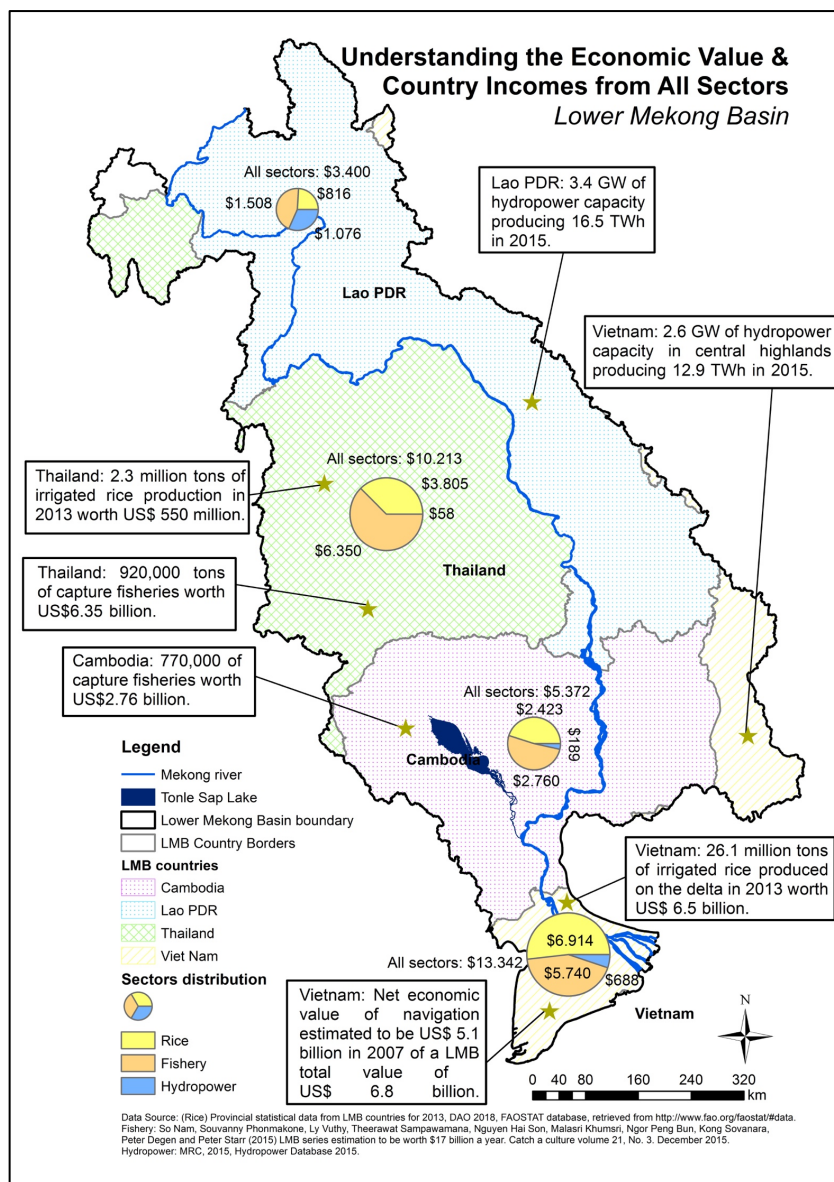
Overall, in aggregate, the annual economic value of the water-related sectors listed above is almost US\$ 35 billion per year, excluding tourism and forestry.

(ii) Contribution to basin economy

The contribution of basin economy made by the water-related sectors in the LMB is defined as the contribution to overall economic, food and energy security within the Basin and beyond. These are characterised by assessment indicators covering these sectors contribution to national GDP, food grain supply, protein supply and power supply.

Data were unavailable to allow the calculation of the contribution of all MRC water-related sectors in the LMB to national GDP or sectoral GDP. However, sufficient data was available to allow the estimation of the share of key MRC water-related sectors attributable to production in the LMB, namely rice production, fisheries, hydropower and tourism.

Understanding the economic value and country incomes from all sectors within the Lower Mekong Basin



The share of **national rice production** within LMB areas of Cambodia (84%) and Lao PDR (69%) is high reflecting the large proportion of these countries within the LMB. The share of national rice production produced in the LMB areas of Thailand and Viet Nam is lower at around 40-51%, reflecting the large proportion of these countries outside the LMB. Overall, the LMB produced 48.2 million tons of rice in 2013, around 51% of the 93.6 million tons of rice produced in the four LMB countries as a whole.

Protein supply from the rice sectors in 2013 and 2014 represented between 58% for Viet Nam and 68% for Thailand up to 131% for Lao PDR and 152% for Cambodia, expressed as a percentage of national demand. The fisheries sector (capture, reservoir and aquaculture) met between 8% (Viet Nam) and 25% (Cambodia) of national demand of the LMB countries.

LMB hydropower sources are clearly important for all LMB countries, accounting for 10% of electricity demand. According to the available data, Lao PDR obtains practically all its supply from LMB hydropower. Cambodia also obtains over a third of its electricity supply from hydropower plants in the basin. Thailand has the lowest share of LMB hydropower in its generation mix, including significant hydropower imports from Lao PDR. Finally, Viet Nam also generates around 9% of its demand in the LMB from plants in the central highlands.

The broad picture of the LMB as with the LMB countries as a whole is one of economic growth and productivity improvement. This is clear from increased production in sectors such as rice production and hydropower generation, as well as navigation, tourism, aquaculture. Overall, water and water related sectors in the LMB remain significant contributors to the national economies of LMB countries. The high shares of national production in all these sectors in Cambodian and Laotian portions of the basin reflects both share of the national territory of these countries in the basin. Similarly, the lower share of LMB located production in these sectors in national production in Thailand and Viet Nam reflects a lower portion of national territories in the LMB

		<i>US\$ million</i>				
		Cambodia	Lao PDR	Thailand	Viet Nam	Total
Rice production 2015	LMB production	2,423	816	3,805	6,914	13,958
	<i>LMB share of national production (%)</i>	<i>84%</i>	<i>69%</i>	<i>40%</i>	<i>51%</i>	<i>51%</i>
Total fisheries 2015	LMB production	3,001	1,508	6,718	5,740	16,967
	<i>LMB share of national production (%)</i>	<i>89%</i>	<i>91%</i>	<i>67%</i>	<i>25%</i>	<i>45%</i>
Hydropower 2015	LMB production	189	1,076	58	688	2,011
	<i>LMB share of national production (%)</i>	<i>32%</i>	<i>100%</i>	<i>0%</i>	<i>8%</i>	<i>9%</i>
Tourism 2017	LMB total	2,100	557	15,640	2,898	21,195
	<i>LMB share of national production (%)</i>	<i>86%</i>	<i>91%</i>	<i>37%</i>	<i>22%</i>	<i>36%</i>

There remain significant difficulties with accurately estimating the economic contribution of natural resources such as wetlands, sand mining, timber forests and capture fisheries leading to uncertainty around the values of these resources. Similarly, enumerating flood and erosion damage remains problematic. The development and expansion of hydropower and agriculture in the basin can be expected to have a negative impact on the economic productivity of some of these sectors. Without better valuations for these sectors it is difficult to identify and properly assess these trade-offs. Better data collection on all sectors is important but for these sectors, where economic values are less transparent and harder to establish, it is a priority.

5. Climate Change Dimension

Three strategic indicators have been selected to characterise the economic conditions within the LMB. These are:

- Greenhouse gas emissions
- Climate change trends and extremes
- Adaptation to climate change

(i) Greenhouse gas emissions

Greenhouse gas emissions of the LMB countries currently contribute less than 2% of the global emission. A first estimate is that for the LMB only this is even far below 1%, again compared to the total global emission. However, emission rates are growing faster than the global average increase due to rapidly developing economies and high rates of population growth. Electricity generation, industry, transportation, and agriculture are the main sectors contributing to GHG emission.

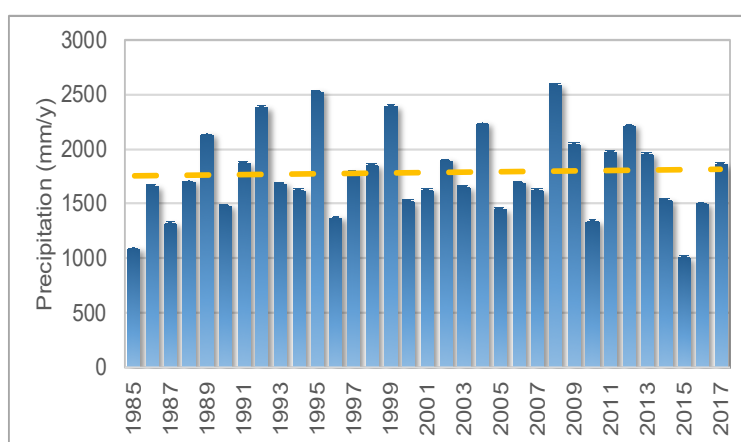
(ii) Climate change trends and extremes

A variety of trends have been examined in order to understand the extent of climate change already occurring within the LMB.

Tropical storms show neither an increasing or decreasing trend and are likely to remain constant. However, with rising sea levels the impact of storms might be greater, with a greater extent of damage. **Temperature** is gradually increasing by about 0.2°C per decade following the global trend. Whilst the number of cold days is expected to decrease, the number of hot days in a year exhibits no clear pattern as yet.

Clear evidence for **changes in precipitation patterns** have also not been found so far, which aligns with IPCC projections. However, a small increase in annual precipitation might happen after 2050. **The extent and severity of flooding** remains a critical component of the LMB and needs to be monitored carefully. However,

Trend in annual precipitation at Kratie



for the last ten years, no clear trend can be seen in the extent of flooding, possibly as a result of increased regulation. In the future, MRC basin-wide assessments of climate impact on flood behaviour suggests that flooded areas might increase by 2060 for floods of all return intervals by between 4,6% and 27.3%. **The extent and severity of drought** show a more favourable trend, suggesting that drought conditions seem to be reducing slightly, although models are predicting a potential increase of the drought in the future due to rising temperature and changes in rainfall patterns.

An overall judgement regarding the strategic indicator “climate change trends and extremes” is that climate change is happening already in the LMB, markedly in terms of rising temperatures and sea levels, and needs to be high on the agenda of the MRC.

(iii) Adaptation to climate change

Adaptation to climate change is defined as the extent to which the basin community is taking action to prepare and live with the effects of climate change. A number of these possible actions have been reviewed.

In terms of **institutional response** to climate change, all Member Countries have developed policies, strategies and/or plans to respond to climate change and have established both operational and oversight bodies to oversee adaptive actions. Furthermore, all Member Countries have ratified the United Nations Framework Convention on Climate Change (UNFCCC) and have submitted at least two National Communications to the Convention, acknowledging the importance of climate change adaptation and stressing the need for increased research in order to develop and implement effective response measures.

In addition, all four countries have ratified the Kyoto Protocol. At a regional level, in 2018 the MRC released the Mekong Climate Change Adaptation Strategy and Action Plan (MASAP), which provides guidance on climate change mainstreaming and implementation adaptation measures across the LMB.

With regard to physical measures to address climate change, **drought protection** is provided by irrigation facilities and through storage of water. At present, approximately 36% of land cultivated for rice and maize (the main food grain crops) is provided with irrigation. Water storage in the basin (including in China) is approaching 14% of the mean annual run-off, which is planned to increase to over 20% in the next two

decades. Few data are available on the extent of (and investment in) **flood protection** works, although clearly much work has been done, particularly in the main flood plains.

Disaster management at regional level is provided by MRC through the Regional Flood Management and Mitigation Centre in Phnom Penh. The centre supports Member Countries on Disaster Management throughout the LMB and provides flood forecasting over an area of approximately 43,000 km² in Cambodia and Viet Nam where the Basin's highest population densities can be found.

Studies are ongoing to identify the degree of **vulnerability of people** as well as infrastructure to floods and droughts and other climate change factors within the LMB. Understanding these relationships is a prerequisite to determining the extent of vulnerability to climate change and what to do about it.

On the one hand, therefore, it may be seen that measures such as irrigation, water storage and flood protection have long been practiced in the LMB, whilst the capacity to measure and interpret trends in climate change within the region is still at an early stage. Clearly, each Government has shown its commitment to tackling the issue and the next step is to ensure that spatial and development planning in the LMB fully mainstreaming climate change concerns in a coordinated and consistent manner.

6. Cooperation Dimension

Three strategic indicators have been selected to characterise the economic conditions within the LMB. These are:

- Equity of benefits from the Mekong River system
- Benefits derived from cooperation
- Self-finance of the MRC

(i) Equity of benefits from the Mekong River system

The benefits derived from the Mekong River system cover social, economic and environmental dimensions. Thailand and Viet Nam continue to draw the greatest economic benefits, particularly from agriculture and fisheries, including aquaculture, and agriculture. However, Lao PDR is increasing its economic performance from Mekong resources through investment in hydropower and there is some evidence of greater irrigation abstractions and enhancements of capture fisheries in Cambodia.

The environmental benefits are shared across the four countries with increased dry season flows seen in Lao PDR and Thailand more than Cambodia and Viet Nam at this stage. Wetland areas across all countries have declined substantially but could be under greatest ongoing threat in Cambodia and Viet Nam. The decline in sediment transport will affect all countries with likely impacts on fish and agricultural productivity, river and coastal erosion and to some potentially navigation also. The catch per unit effort of fish appears to be in decline in all countries, although more fish and other aquatic resources are being produced through aquaculture especially in Viet Nam.

Social conditions are generally higher in Thailand and Viet Nam due to their greater economic resources, although over recent decades all countries have made considerable progress on indicators of food, water and health security, as well as access to electricity.

(ii) Benefits derived from cooperation

A substantial level of cooperation is evident among Member Countries towards the objectives of the 1995 Mekong Agreement. Joint projects cover a range of MRC water-related sectors including in relation to integrated flood plain management, strategic planning and strengthened coordination, and navigation. The PNPCA process is being used by countries to notify the other countries of projects with potential trans-boundary impacts, notwithstanding some misunderstanding of the rights afforded to Member Countries

during the process, and the not always satisfactory reconciliation of issues identified even when substantial re-design occurs.

Further measures are needed however to improve the exchange of information and data, improve water use monitoring and to elevate cooperation to a level that includes the joint environmental monitoring effort, joint review of national water related sectors development planning every 5 years and joint overall planning of future strategic development as a means of optimising sustainable development and management of the basin's resources.

(iii) Self-finance of the MRC

The MRC appears to be on track to its 2030 objective of self-finance. In each of the past two years, the proportional contribution by Member Countries to the MRC budget has increased and is forecast to continue increasing through to 2020.

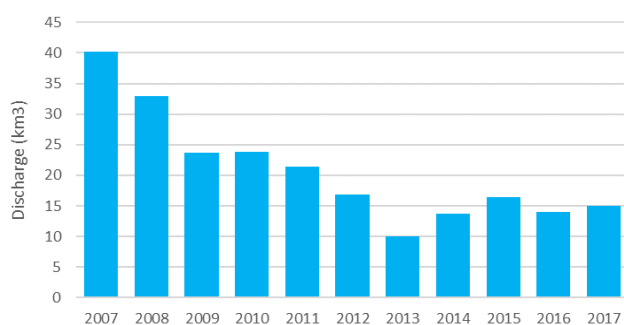
7. State of the Upper Mekong River Basin

For the first time, the State of Basin report includes a description of the situation in the Upper Mekong Basin, where the river is known by PR China as the Lancang River. Reviews have been made of those parts of the basin within the territory of both Myanmar and China, referred here to as the UMB-C and UMB-M respectively. The review of the Upper Mekong part is based on MRC data and information as well as credible secondary sources.

The UMB as a whole covers a total surface area of 186,356 km², which corresponds to 23.2% of the entire basin. Over 88% of the UMB lies within China and just 11.6% in Myanmar. On average, the UMB-C contributes approximately 18% of annual Mekong discharge, with an additional 1%-4% coming from Myanmar.

The UMB in China has been rapidly developed over recent years, with land use changes, industrial activities and hydropower construction and operation all affecting the river in various ways. In particular dam development has led to major changes in seasonal flows and sediment loads. Both are noticeable in the Lower

Wet season flow volumes downstream of Jinghong dam in China



Mekong Basin, with the impact on flow regime becoming progressively less visible further downstream. At Chiang Saen, the mostly northerly mainstream monitoring station in the LMB, average dry season flow in 2010-2017 has increased by 35% in comparison with 2000-2009, while flood season flows were reduced by 31%.

The commissioning of the Chinese reservoir cascade has also had a substantial impact on the sediment budget of the river, with clear reductions of 60-70% in sediment concentrations observed directly downstream of the main dams. This, along with

sand mining in both the Upper and Lower Mekong mainstream, has its implications across the basin, with total sediment loads at Pakse having fallen by 55% in 2015 compared to historic levels. These reductions in sediments have implications throughout the mainstream up to the delta and coastline, the full consequences of which in the LMB may yet to be seen.

Further alterations of the flow regime are expected over the next decades, as rising temperatures due to climate change are projected to shift the snowmelt contribution to streamflow to earlier months. An additional dam cascade is planned in Xizang (northern part of the Upper Mekong), which will further expand the storage capacity in the UMB in China, although these reservoirs will only impact on a minor part of flow volumes from a basin-wide perspective. Dam development in the lower part of the UMB in China (in Yunnan

province) can be considered largely complete, with about 10 dams, including 2 large storage reservoirs. Recent cancellation of the Mengsong Dam is regarded as positive for the maintenance of transboundary fish migration.

The development of storage capacity in the UMB in China has not only significantly altered river dynamics, but also provides an unprecedented opportunity to manage 18% of the overall Mekong flow volume. This illustrates the importance of continuing efforts to strengthen cooperation between China and the lower riparian countries to ensure effective Upper and Lower Mekong basin-wide river basin management, in order to allow for sustainability of all benefits provided by the river.

The UMB in Myanmar is largely undeveloped as a consequence of its remoteness and social and political issues. However, in recent years, rapid land use changes have seen a considerable part of previously natural forests converted to cropland, plantations and mining areas, and hydropower development has also started to take off.

Data availability on environmental indicators is quite limited, although with 4% of Mekong streamflow contributed from Myanmar the impact of UMB-M developments on basin-wide hydrology is small.

The completed and planned development of storage capacity in the UMB has significantly altered river dynamics, but also provides an unprecedented opportunity to manage a substantial part of the overall Mekong flow volume and thereby affect all water-related sectors, particularly in the upper reaches of the LMB.

8. Conclusions and recommendations

The following sets out the main conclusions that can be drawn from the assessments made in this report in terms of the management and development challenges and opportunities for MRC to achieve its aims.

(i) Summary of key conclusions on the State of the Basin

In its new format, this State of the Basin Report follows a structured approach to assessing the current status and past trends of conditions in the Mekong River basin. This approach, which is built on the foundation laid by the newly constructed MRC Indicator Framework, is intended to provide a comprehensive basin-level view of those conditions most relevant to the aims and intent of the MRC in fostering optimal and sustainable development and management of the basin's water-related resources.

The main conclusions that can be drawn from the findings of this report in terms of the management and development status, challenges and opportunities to achieve MRC's aims have been structured around the 13 agreed strategic indicators and the associated key questions (one for each indicator), intended to articulate the underlying issues that each strategic indicator is intended to address. These overall conclusions are summarised in tabular form overleaf. The key messages for each of the five dimensions covered by this report are:

- ❑ **Environmental conditions:** Reservoir developments in the basin have caused a significant change in the flow regime of the Mekong and are contributing to the observed substantial decrease in sediment concentrations. The long-term consequences of these changes need to be managed to minimise environmental harm whilst leveraging the benefits of more secure dry season flows. The loss of wetlands and riverine habitats continues alongside increasing pressures on capture fisheries and urgent actions are needed to protect remaining assets before they are lost.
- ❑ **Social conditions:** Living conditions within the basin are improving, but much better information is needed to identify specific water sector impacts and to determine where vulnerabilities lie.

Summary of conclusions and challenges and recommended priority actions



No immediate concerns



Some significant concerns to address











Considerable concern, urgent action needed



Insufficient data to form a view, requires action to address knowledge gaps

Strategic indicators	Key strategic questions	Status /condition	Challenges	Recommended priority actions	BDS Recommendation
Environment					
Water flow conditions in mainstream	<i>Are the conditions of water flow in the Mekong mainstream acceptable?</i>	Generally compliant with PMFM, but induced changes in flow regime are of some concern	Managing the impacts of an apparent decrease of wet season flow during the recession period, the increase in dry season low flows and the increase in daily fluctuation in flows experienced in some reaches of the mainstream.	Continue monitoring programmes and, in addition to PMFM reporting, monitor decreases in wet season flows and daily fluctuations and consider implications of impacts that may arise, Improve monitoring of water use for various sectors to ensure balance is maintained with increased development	A B
Water quality and sediment conditions	<i>Are the conditions of water quality and sediment acceptable?</i>	Generally compliant with PWQ, but sediment concentrations much reduced	Identifying and implementing practical measures to mitigate the effects of reduced sediment concentrations and minimise further reductions	Continue the sediment and water quality monitoring programmes. Address the implications of reduced sediment concentrations through mechanisms to better manage sediment flows and mitigate transboundary impacts of reduced concentrations	A C
Status of environmental assets	<i>Are key environmental assets in the Mekong basin being adequately preserved and protected?</i>	Loss of wetlands and riverine habitats continues, pressure on capture fisheries becoming evident	Taking urgent action to protect remaining assets and to better manage fisheries Addressing the lack of sufficient data on wetland and riverine habits	Agree clear regional objectives, joint strategies and action plans for protecting and sustainably managing the remaining environmental assets and fisheries. Establish regular monitoring and data collection to address knowledge gaps and conservation activities for wetlands and other environmental assets including fisheries.	D B
Social					
Living conditions and well-being	<i>What social benefits, direct and indirect, are being derived from water resource developments in the Mekong basin?</i>	Living conditions improving but water sector impacts unclear	Provincial and district levels data needed to better understand relationship with water-related sectors alongside greater consistency of data quality and accuracy.	Review and refinement of indicators and develop and implement a data acquisition, generation and requirements action plan to address knowledge gaps.	B
Employment in MRC water-related sectors	<i>How are the river-related livelihoods in each country being affected by land and water management decisions?</i>	More information is needed to form a view	As above	As above	B

Strategic indicators	Key strategic questions	Status /condition	Challenges	Recommended priority actions	BDS Recommendation
Economic					
Aggregate economic value of MRC water-related sectors	<i>What economic value does each Member Country derive from the use of the Mekong river system within the water-related sectors?</i>	 More information is needed to form a view	Comprehensive data on all water-related sectors need to be assembled and analysed. Promotion of economic development consistent with the aims of the 1995 Mekong Agreement.	Review and refinement of indicators and develop and implement a data acquisition, generation and requirements action plan to address knowledge gaps. Adoption of pro-active regional planning to promote optimal and equitable development through increased cooperation and to identify opportunities for both socio-economic development and environmental protection consistent with these aims	B E
Contribution to basin economy	<i>How important is the economic value of the water-related sectors to the economy of the basin?</i>	 More information is needed to form a view	As above	As above	B/E
Climate change					
Greenhouse gas emissions	<i>To what extent is the Mekong Basin contributing to global GHG emissions?</i>	 LMB countries (as a whole) emission is about 1.5% of global total	Promote development practices within the basin that minimise GHG emissions consistent with each country's Nationally Determined Contribution under the Paris Agreement	Promotion of development practices that minimise GHG emission. Develop and implement a data acquisition, generation and requirements action plan to address knowledge gaps.	E B
Climate change trends and extremes	<i>Is there evidence of climate change within the basin?</i>	 Some evidence of rising temperatures and sea-levels. Flood damages are also higher. Other CC impacts are not seen.	Continued monitoring needed Continued assessment of potential future CC impacts based on latest available global and regional forecasts	Incorporate sea level rise as an indicator in future SOBR. Continue hydro-meteorological data collection programmes.	B A
Adaptation to climate change	<i>How resilient are the current water infrastructure and plans to climate change?</i>	 All countries have policies and strategies in place and 166 climate adaptation projects identified (2016)	To ensure that climate change is fully factored into development plans and that resilience is assured	Adoption of pro-active regional planning to address climate change and promote optimal and equitable development through increased cooperation	E
Cooperation					
Equity of benefits from the Mekong River system	<i>How well is Mekong basin development moving towards optimal and sustainable development?</i>	 Significant development in all countries, but equity considerations need more data as above	Adoption of pro-active regional planning to promote equitable use of basin's resources, together with establishment of a clear mechanism to define equity of benefit and trade-off arising from development in throughout the basin in water-related sectors	Adoption of pro-active regional planning to address climate change, promote optimal and equitable development through increased cooperation and to identify opportunities for both socio-economic development and environmental protection consistent with these aims	E
Benefits derived from cooperation	<i>What is the added value of cooperation under the 1995 Mekong Agreement facilitated by MRC?</i>	 US\$838m of projects supporting cooperation identified in National Indicative Plans	As above	As above	E
Self-finance of the MRC	<i>Is the MRC on-track to self-finance by 2030?</i>	 MRC budgets in line with achieving self-finance by 2030, alongside renewed commitments to this end	Retain focus on core function activities and look to ways to improve efficiency in delivering these	Identify smart and cost-effective approaches to basin monitoring and information and knowledge sharing	B

- ❑ **Economic conditions:** Substantial economic benefits are being derived in water-related sectors, but a comprehensive assessment of equity between countries and trade-offs between sectors is not yet possible with the available data. A pro-active and cooperative approach to basin planning is needed to achieve optimal and sustainable development of the basin in line with MRC's aims.
- ❑ **Climate change:** Both temperature and sea level are rising, but other predicted aspects of climate change are yet to be evident. Member Countries are all engaged in managing climate change and this should be reinforced through MRC's supra-national basin planning efforts.
- ❑ **Cooperation:** New challenges arising from flow regime changes, sediment reductions and growing pressures on environmental assets and fisheries reinforce the need to build upon the existing cooperation through regional planning and joint projects, investments and monitoring.

(ii) Progress towards achieving relevant SDGs in the Mekong-Lancang Basin

As noted in this report, the MRC's aims overlap many of the UN's seventeen Sustainable Development Goals (SDG). Whilst SDG 6 (Clean water and sanitation) is seen as the strongest connection, it has been recognised that MRC's policies, strategies and activities have relevance also to Goal 2: Zero hunger; Goal 7: Affordable and clean energy; Goal 13: Climate action; Goal 14: Life below water; and Goal 15: Life on land.

Each of the selected six Goals has associated with it a set of targets and indicators determined by the United Nations. Not all these targets and indicators are directly relevant to MRC. In some cases, data are currently not available either at all or specific to the LMB part of each Member Country, notwithstanding the relevance of the SDG. In some instances, the SDG indicators are simply not covered by the existing MRC-IF and this SOBR. Nevertheless, a review on the current status of these indicators has been made, the key points of which are summarised below.

SDG6 Ensure availability and sustainable management of water and sanitation for all

As noted above, this SDG is the most relevant to the interests and activities of the MRC. Access to safe water supplies and sanitation is improving within the LMB and already widespread in many areas. Water quality remains generally good for both human and ecological purposes. Despite significant reported increases in irrigation coverage, mainstream flows continue to be within acceptable limits. MRC has policy, procedures and strategic guidelines in place covering entire LMB for equitable and sustainable use of Mekong water resources. The one major concern is the decline in wetland areas, deforestation and threats to eco-systems.

SDG2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Evidence points to the adequacy of Dietary Energy Supply nationally in 2016 in all four countries. Undernourishment, wasting and severe wasting have declined too, although there are evidently areas still to address. Drought resilience has improved with the expansion of irrigation coverage.

SDG7 Ensure access to affordable, reliable, sustainable and modern energy for all

In 2016 nationally, 100% of households in Viet Nam and Thailand had access to electricity and 87% of the total population and 80% of the rural population had access in Lao PDR. Cambodia reports overall access at 58% in 2016 rising to 72% in 2018. No data are available for the LMB by energy source.

SDG13 Take urgent action to combat climate change and its impacts

All four Member Countries have ratified UN Framework Convention on Climate Change and Kyoto Protocol. All also have relevant adaptation policies, strategies and institutional arrangements in place. Current National Indicative Plans for 2016-20 identify US\$ 827million of projects directed towards realising the sustainable potential of the LMB taking into account climate change.

SDG14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Whilst MRC's mandate does not extend to use of oceans, it is evident that the reductions in sediment and nutrient flows in the mainstream are likely to impact upon coastal fisheries. It is also seen that shoreline protection is threatened with the reduction in mangrove areas. However, none of the SDG14 indicators are actually covered by the indicators reported upon in this SOBR.

SDG15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

At a policy level, all four Member Countries have committed, inter alia, under the 1995 Mekong Agreement, to "utilize the waters of the Mekong River system in a reasonable and equitable manner" and have established procedures and cooperative planning and monitoring systems to fulfil this commitment. Throughout the LMB 255 protected areas have been established covering 27% of the LMB. However, wetland areas and forestry have declined considerably over the last 50-100 years. Pressures are increasing on capture fisheries and remaining environmental assets, and urgent action is needed to address these issues.

MRC will need to consider further how best support Member Countries in monitoring progress toward the SDG for future editions of the SOBR.

(iii) Recommendations for updating the Basin Development Strategy

In accordance with MRC's strategic 5-year planning cycle, the State of the Basin Report seeks to inform and help shape the updating of the MRC's Basin Development Strategy (BDS).

The BDS is a high-level document which identifies the key issues faced in developing and managing the water and related resources of the LMB and sets out a strategy by which the Member Countries agree to address these issues and promote optimal and sustainable development of the basin in line with the aims and intent of the 1995 Mekong Agreement. The BDS provides the rationale for and is implemented primarily through the MRC's Strategic Plan at regional level and through four National Indicative Plans.

Based on the conclusions presented in this report, the following six recommendations are made for consideration when updating the Basin Development Strategy.

Recommendation (A): Continue and enhance monitoring of flow conditions and water quality

With increasing development in the basin and the onset of climate change impacts, the need for hydro-meteorological, flow, water quality and sediment monitoring is of ever more importance. Changes in flow regime noted in this report may lead to undesirable impacts on both environmental assets and riverine communities as well as to opening the potential for increased irrigation abstractions, and need to be observed carefully. These monitoring programmes are designated as core functions of the MRC and it is recommended that they should remain so with sufficient budgets and resources allocated as needed.

Recommendation (B): Develop and implement a MRC Data Acquisition and Generation Action Plan

Preparation of this State of Basin Report and of the recent Council Study as well as other MRC projects and studies and the implementation of MRC Procedures and Guidelines have all been constrained by the availability of data. Comprehensive programmes to monitor environmental assets (including fisheries), water use, agriculture, land use, socio-economic and macro-economic aspects and some aspects of development infrastructure, including hydropower and flood control projects, are needed to fill these gaps.

Given that the costs of implementing the required monitoring programmes need to be kept to a reasonable minimum as the MRC move towards self-finance, smart ways of basin monitoring need to be considered for which some studies and surveys may be needed to accredit new methodologies. As above, MRC data acquisition and generation action plan and data storage and management must be seen as a priority core

river basin management function across all MRCS Divisions, with responsibilities at regional and national levels set out and appropriate investment included in MRC annual budget plans.

Recommendation (C): Address the problem of reduced sediment concentrations

Sediment concentrations in the mainstream are observed to be much reduced largely as a consequence of reservoir sediment trapping. The consequences in the short, medium and long term of diminished sediment concentrations on the river's morphology, bank stability, flood plain productivity, delta building processes and the productivity of coastal waters need to be fully understood in order that agreement can be reached on a sediment management plan on how best to manage sediments within the system and to mitigate the transboundary impacts of reduced concentrations.

Recommendation (D): Address the need to take urgent action to preserve and protect remaining environmental assets

Whilst there are clearly many environmental issues potentially to deal with, this report highlights two key transboundary issues that are believed to be central to future plans for the LMB. These are:

- ❑ **Wetlands and key river habitats:** This report highlights the enormous historic loss of wetlands in the Mekong Basin, which is continuing unabated today, jeopardising the long-term health of the basin's eco-system. A shared appreciation of the pressures on wetlands and river habitats from alternative land uses, changing flow regimes and climate change is needed as a first step towards identifying and prioritizing areas that may be brought under protection and the necessary trade-offs that this may involve. Thereafter the MRC should facilitate agreement on basin-wide objectives, joint strategies and action plans for protecting and sustainably managing the remaining environmental assets.
- ❑ **Fisheries productivity:** Whilst overall production of capture fisheries appears not to be falling, this report highlights the growing pressures arising not only from human-induced changes to the river systems, but also from changes in fisheries practices. A comprehensive understanding is needed of how fisheries may change in the future with and without further habitat changes, with and without regulation of capture fisheries practices and with future changes in consumption patterns in the light of socio-economic development. Building such an understanding is critical to jointly implement the currently approved strategies (Basin-wide Fisheries Management Strategy, BFMS) with Member Countries and relevant stakeholders to support and maintain the sector in the future.

Recommendation (E): Adopt a more proactive approach to basin planning and the management of trade-offs between sectors and countries

This report highlights the new opportunities and threats arising from changes in flow regime of the mainstream, sediment flows and climate change. The report also demonstrates the Member Countries' willingness to increase cooperation through joint projects and an increased focus on those of basin-wide significance. Given the Member Countries' commitment to optimal and sustainable development, a more proactive stance to basin planning is required as mandated by Art. 24 of the Mekong Agreement. Such an approach would allow the MRC, working as it does with all Member Countries and significant stakeholders, to create platforms to discuss benefit sharing and trade-off between national development plans and thereby to determine the best ways by which to develop the basin given the current circumstances and the legitimate aims and concerns of each Member Country.

The results of this new approach would enable the "Development Opportunities" section of the BDS to proactively provide strategic guidance to national planning for the basin across all water-related sectors in line with the aims of the 1995 Mekong Agreement (see overleaf).

Therefore, it is recommended that the adoption of a more proactive approach to basin planning and management of trade-offs by creating of various platforms for enhancing the discussion and negotiation



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