Biological Indicators

Until recently, physical and chemical information was often the only basis for monitoring the environmental quality of rivers and lakes. Today, with the widespread implementation of biological monitoring programmes, physical and chemical data are complemented by biological information.

Three types of biological metrics of the health of the Mekong aquatic ecosystem were used for each of the four biological groups (benthic diatoms, zooplankton, littoral macroinvertebrates and benthic macroinvertebrates) included in the biomonitoring programme. For each of the groups the biological metrics were abundance, average richness, and ATSPT. A healthy ecosystem is indicated by high abundance, high average richness, or a low average tolerance score (which may signify an abundance of pollution-sensitive species).

Each indicator was calculated for individual samples of each group of organisms. The collection of multiple samples per site enables the assessment of within-site variability of the indicators. It also allows for statistical testing of the significance of differences among sites and within the same site over multiple years.

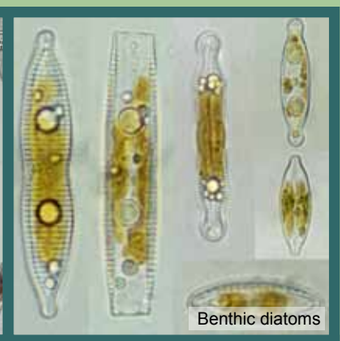
Guidelines for Biological Indicators of Healthy to the Ecosystem

The guidelines of each indicator and biological group were set according to the range of average values obtained at the reference sites.

Biological metrics	Biological indicator groups	Reference site values		Guideline of healthy ecosystem
		10th percentile	90th percentile	
Abundance (mean number of individual organisms per standard sample).	Diatoms	136.22	376.34	Greater than 136.22
	Zooplankton	22.33	174.07	Greater than 22.33
	Littoral macroinvertebrates	46.68	328.56	Greater than 46.68
	Benthic macroinvertebrates	5.37	56.34	Greater than 5.37
Average richness (mean number of taxa per standard sample).	Diatoms	6.54	11.78	Greater than 6.54
	Zooplankton	9.80	20.20	Greater than 9.80
	Littoral macroinvertebrates	5.37	18.48	Greater than 5.37
	Benthic macroinvertebrates	1.84	7.85	Greater than 1.84
Average Tolerance Score per Taxon (ATSPT).	Diatoms	30.85	38.38	Less than 38.38
	Zooplankton	35.54	41.80	Less than 41.80
	Littoral macroinvertebrates	27.80	33.58	Less than 33.58
	Benthic macroinvertebrates	31.57	37.74	Less than 37.74

For further information

- MRC (2008) The Mekong River Report Card on Aquatic Ecological Health (2004-2007).
- MRC (2009) Report on the 2008 biomonitoring survey of the lower Mekong River and selected tributaries. MRC Technical Paper No. 28, Mekong River Commission, Vientiane.



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The Mekong River Report Card on Aquatic Ecological Health 2008

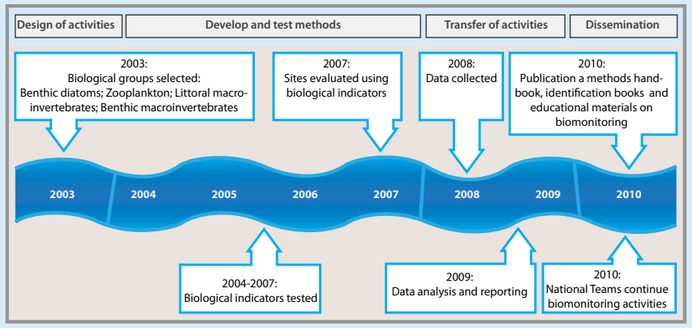
November 2009

The Report Card

This is the second Report Card describing the aquatic ecological health in the Lower Mekong Basin. The assessment is based on the results of the field work and analyses undertaken by a team of biologists and ecologists from the four MRC Member Countries during 2008. The previous Report Card presented the aquatic ecological health in the Lower Mekong Basin from 2004 to 2007 when national experts evaluated the ecology of 51 sites throughout the Basin.

Biomonitoring Activities in the Lower Mekong Basin

The methods used for the biomonitoring sampling and analysis were developed during the studies of 2003 - 2007 when various approaches were tested, modified, and either accepted or rejected. The diagram below illustrates this development process. These initial surveys, together with the information collected in 2008 yielded a large amount of data on the Mekong River and its tributaries. These monitoring results will serve as the baseline information against which future changes in the Basin will be compared.

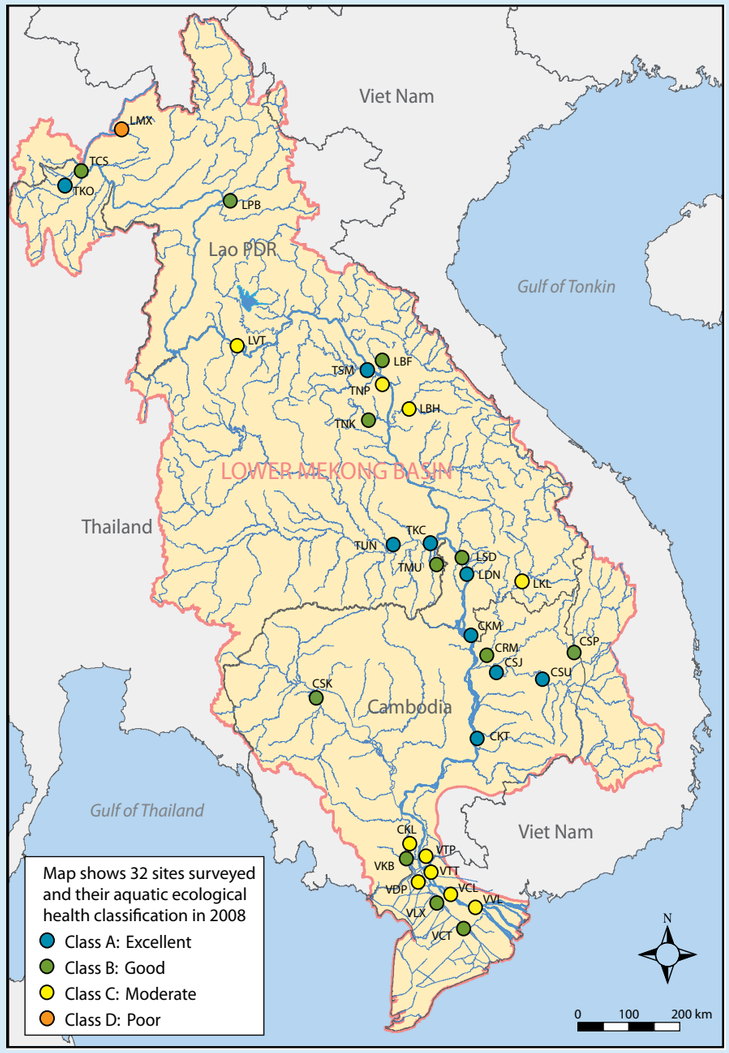


Characteristics of the Classification System

Four biological groups: benthic diatoms, zooplankton, littoral macroinvertebrates and benthic macroinvertebrates were selected for the studies. Three biological metrics namely abundance, average richness and the Average Tolerance Score per Taxon (ATSPT) were measured for each of the biological groups. Thus a total of twelve biological indicators were used to evaluate sites. The sites were classified as one of four groupings:

- Class A (Excellent): 10 - 12 of the 12 indicators meet the guidelines. The biodiversity and ecological capacity to support fish and other freshwater functions are similar to those at the reference sites defined the 2004 – 2007 survey. These reference sites provide a 'baseline' against which other sites can be measured.
- Classes B (Good) 7 - 9 of the 12 indicators meet the guidelines. The biodiversity and ecological capacity are slightly less than that at the reference sites. Human activities may have caused some disturbance.
- Classes C (Moderate) 4 - 6 of the 12 indicators meet the guidelines. The biodiversity and ecological capacity are markedly less than that at the reference sites. Disturbance resulting from human activities is present.
- Class D (Poor) 0 - 3 of the 12 indicators meet the guidelines. The biodiversity and ecological capacity are significantly less than that at the reference sites. Various disturbances from human activities are likely to be present.

Ecological Health Assessment in 2008



During the 2008 biomonitoring survey, eight sampling locations were examined in each country. Some of these were new sites where samples were not collected during the 2004 – 2007 survey. Four of these were in Thailand and five in Viet Nam.

In total the 32 sites assessed were classified into the four class groupings. Of the 2008 sites, nine were in Class A ("excellent ecological health"), 12 in Class B ("good"), 10 in Class C ("moderate") and one in Class D ("poor"). Lower scores may have resulted from increased human activities, and reductions in habitat and water quality.

Temporal Change of Ecological Health During 2004-2008

Site code	Location	Site assessment by year				
		2004	2005	2006	2007	2008
Cambodia						
CKT	Mekong River, Kampi	A		A		A
CMR	Mekong River, Stung Treng Ramsar site		B	A	B	B
CSJ	Se San River, Sesan		A	B	A	A
CKM	Se Kong River, Ramsar site		A	B	B	A
CSP	Sre Pok River, Ratanakiri	A	A	A	A	B
CSU	Se San River, Lum Phat		A	B	B	A
CKL	Bassac River, Koh khel			B		C
CSK	Stoeng Sangke River, Prek Toal			C		B
Lao PDR						
LDN	Mekong River, Done Nguei				A	A
LSD	Se Done River, Ban Hae				B	B
LKL	Se Kong River, Ban Xou		A		C	C
LBH	Se Bang Hieng River, under bridge				A	C
LBF	Se Bang Fai River, under bridge				B	B
LVT	Mekong River, Ban Huayhome	C			B	C
LMX	Mekong River, Ban Xiengkok		C			D
LPB	Mekong River, Done Chor	A	A			B
Thailand						
TNP	Mekong River, Nakorn Panom					C
TSM	Connection between Songkram & Mekong Rivers				C	A
TNK	Nam Kam River, Mukdaharn				C	B
TMU	Nam Mun River, Ubonrachathani	B				B
TKC	Connection between Nam Mun & Mekong Rivers					A
TUN	Nam Mun River, Ubonrachathani					A
TCS	Mekong River, Chiang San, Chiang Rai					B
TKO	Nam Kok River, Chiang Rai	B	A			A
Viet Nam						
VCT	Bassac River, Phu An, Can Tho			C		B
VLX	Bassac River, Long Xuyen, An Giang			C		B
VDP	Bassac River, Da Phuoc, An Giang					C
VKB	Bassac River, Khanh Binh, An Giang					B
VTP	Mekong River, Thuong Phuoc, Dong Thap					C
VTT	Mekong River, Thuong Thoi, Dong Thap					C
VCL	Mekong River, Cao Lanh, Dong Thap			C		C
VVL	Mekong River, My Thuan, Vinh Long					C

The 2008 results are summarised and compared in the above table, together with the previous years' results, in order to illustrate their status and the trend. Stability of site classifications in more than half of the sites and improvement in some sites particularly in the Mekong Delta are positive signs for the health of the Mekong River. Some locations indicate improvement while others show degradation.

On-site observation suggests that the decline seen at some sites has probably been caused by bank erosion during the rainy season. Other sites have changed since 2005 in terms of water flows, water levels and amounts of sand and clay accumulation. These factors could have affected the organisms living in the area and caused the recorded changes.

The degrading trends in isolated locations give a warning of increasing environmental impacts caused by human activities, and degradation of habitats in some portions of the Mekong River. Further investigations of the causes and effects on biological components are needed to identify the necessary remedial actions and possible restoration efforts.